

**AFRICAN ECONOMIC RESEARCH CONSORTIUM
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**COLLABORATIVE MASTERS DEGREE PROGRAMME
(CMAP) IN ECONOMICS FOR SUB-SAHARAN AFRICA**

JOINT FACILITY FOR ELECTIVES



Teaching Module Materials

ECON 541 – Monetary Theory and Practice I

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INTRODUCTION

The purpose of this course is to enable you to acquire sufficient knowledge of monetary theory and policy. The course content is designed to ensure that the state of the art of monetary theory is given sufficient exposition, while at the same time introducing sufficient doses of policy and empirical topics with special reference to developing countries, in particular African countries. The course adequately prepares you for advanced research and practice in the area plus policy analysis and implementation. As the course outline indicates, course is in two parts. Part I deals with issues relating to various aspects of monetary theory including the role of money, money demand, money supply, money and inflation, monetary management, and central banking as well as money in the open economy. Part II covers the economics of financial institutions and financial intermediation, relationship between financial development and economic growth, money in an open economy, international financial institutions, and global economy. As well as providing theoretical frameworks for analyzing banking intermediations and the conduct of monetary policy, the course will also present empirical evidence and policy actions wherever possible to support the theories.

LEARNING OUTCOMES

Upon completion of this course, students should be able to:

Demonstrate an understanding of the subject matter and financial environments.

Narrate the main historical patterns of monetary thought and the diversity of ideas in monetary economics; especially on the effectiveness of monetary policy and the contending schools in monetary theories and policy;

Appreciate the empirical relevance and validity, and intuitive understanding of the effect of money on the aggregate economy;

Discuss the role of money in an economy from the perspective of both Classical and Keynesian changing paradigms;

Appreciate the determination of prices including, inflation, interest rates, exchange rate, and bond and share prices;

Explain theories underpinning demand and supply of money as well as the microfoundations of money;

Explain the theoretical and empirical implications of the conduct of monetary policy on the macroeconomy; and

Demonstrate an understanding of financial markets (such as those for bonds, stocks, and exchange rates) and financial institutions such (banks, insurance companies, mutual funds, etc.)



You should however note that the class notes provided in this course are, by no means, exhaustive. Some additional required readings are provided in the course outline and many more may be incorporated as the course proceeds. Assessment of this course will be based on continuous assessment, practice exercises and final examination at a designated location and date. However, at the end of each section are activities/questions/tasks, which you will be asked to complete to demonstrate your understanding of the subject matter. Students are therefore strongly encouraged to work through the practice exercises at the end of each section.

1.1 INTRODUCTION: ISSUES IN MONETARY ECONOMICS

In this first section in our lecture, we will focus on Money: Functions and Historical Evolution; The Role of Money in the Macroeconomy; Changing Paradigms in Monetary Theory.

1.1.1 Definition; Functions and Evolution of Money

Money is a difficult concept to define in that it fulfills not only one function but several. The definition of money in the literature is grouped into three strands, functional, theoretical or traditional and empirical definitions. In what follows, we discuss each strand in detail.

Functional Definition of Money

The functional definition of money is led by Prof. Coulbourn who defines money as a means of valuation and of payment in terms of the unit of account and exchange¹. This is very wide. It includes cheques, gold, coin, etc., so long as it can perform the functions of valuation and payment. Sir John Hides (1967) says that money is defined by its functions. Anything is money which is used as money, implying in simple terms, Money is what money does.

Some have defined money based on the legal terms. Anything backed by law to be accepted by everyone for payment is called money.

Let's take a minute then to go through some of the primary and secondary functions of money before we discuss the theoretical definition of money.

¹ Coulbourn, *Macroeconomic Theory*, McGraw-Hill, New York, 1963



Primary Functions of Money

The two primary functions of money are to act as a medium of exchange/payment and as a unit of account.

(i) Money as a Medium of Exchange/Payment.

This function was traditionally called the medium of exchange. According to Handa (2009), in a modern context however, in which transactions can be conducted with credit cards, it is better to refer to it as the medium of (final) payments. This is the primary function of money because all the other functions of money are developed from this function. By serving as a medium of payment, money revokes the need for double coincidence of wants and the inconveniences and difficulties associated with barter (which we discuss later in this lecture). As a medium of payment, money acts as an intermediary. It makes exchange possible. It helps production indirectly through specialization and division of labour which, in turn, increase efficiency and output. According to Prof. Walters, money, therefore, serves as a ‘factor of production, enabling output to increase and diversify. Money also facilitates trade. When acting as the intermediary, it helps one good or service to be traded indirectly for others.

(ii) Money as Unit of Account

The second primary function of money is to act as a unit of account. Money is the standard for measuring value just as the yard or meter is the standard for measuring length. The monetary unit measures and expresses the values of all goods and services. In fact, the monetary unit expresses the value of each good or service in terms of price. Money is the common denominator which determines the rate of exchange between goods and services which are priced in terms of the monetary unit. There can be no pricing process without a measure of value. As a matter of fact, measuring the values of goods and services in the monetary unit facilitates the problem of measuring the exchange values of goods in the market. When values are expressed in terms of money, the number of prices is reduced from $n(n-1)$ in barter economy to $(n-1)$ in monetary economy. Money as a unit of account also facilitates accounting. “Assets of all kinds, liabilities of all kinds, income of all kinds, and expenses of all kinds can be stated in terms of common monetary units to be added or subtracted.”



Secondary Functions of Money

Money performs three other secondary functions: as a standard of deferred payments, as a store of value, and a transfer of value. These are discussed below

Money as a Store of Value: Another secondary function of money is to act as a store of value. The commodity chosen as money is always something which can be kept for long periods without deterioration or wastage. It is a form in which wealth can be kept intact from one year to the next. Money is a bridge from the present to the future. It is therefore essential that the money commodity should always be one which can be easily and wisely stored. Obviously, we know money is not the only store of value. This function can be served by any valuable asset. One can store value for the future by holding short-term promissory notes, bonds, mortgages, preferred stocks, household furniture, houses, land, or any other kind of valuable goods. The principal advantages of these other assets as a store of value are that they, unlike money, ordinarily yield an income in the form of interest, profits, rent or usefulness. And they sometimes rise in value in terms of money. On the other hand, they have certain disadvantages as a store of value, among which are the following: (1) They sometimes involve storage costs; (2) they may depreciate in terms of money; and (3) they are “illiquid” in varying degrees, for they are not generally acceptable as money and it may be possible to convert them into money quickly only by suffering a loss of value.”

Money as a Standard of Deferred Payments. The third function of money is to act as a standard of deferred or postponed payments. All debts are taken in money. It was easy under barter to take loans in goats or grains but difficult to make repayments in such perishable commodities in the future. Money has simplified both the taking and repayment of loans because the unit of account is durable.

Contingent Functions of Money

Also called the incidental functions. The contingent functions are based on traditional functions (primary & secondary), made possible by Prof David Kinsley. He outlined the functions as;

1. Money as the most liquid of all assets.

Wealth can be in the form of bonds, debentures, etc. There is an opposite direction- meaning that money can be turned into the other forms of wealth and the other forms of wealth can also be turned into money. Savings can be kept in securities. Money aids the functions of liquidity.

2. Money is the basis of the credit system.

Behind or underneath every credit is money. Credit creation can expand money supply through money multiplier. Whatever credit one receives, one pays/receives it back in money (Cash). Money has helped in the formation of capital or money market. These are based on the fact that money performs the function of unit of account.



3. It brings about the equalization of marginal utility and productivity. Within the indifference curve analysis, where $MU_x = \lambda P_x$, given the P_x and λ marginal utility of good x (MU_x) can be estimated. It also helps in estimating the productivity of a firm and how much to pay for wages, W of labour based on marginal productivity of labour (MPL). i.e. $W = MPL$. But MPL determines the productivity of a labour. Therefore, given wages of the individual, the MPL can be measured in the perfect market.

4. Measurement of National Income

The National income (Y) couldn't have been possible to be calculated in the barter system. But with the use of money, it is easy to estimate the total income, Y of a country to determine the country's welfare. It also helps in calculating the GDP.

5. In the distribution of National Income

Rewards to the factors of production in the form of wages, rent, interest and profit are all determined and paid with money.

Theoretical Definition of Money

In 1962, Prof, Johnson in his book 'Monetary Theory and Policy' gave four different schools of thought with regards to the definition of money.

The traditional definition of money is also known as the view of the currency school. The traditional definition of money defines money as currency and deposits or chequables. That is money is a medium of exchange. Thus almost 100% liquid. Keynes in his General Theory followed the traditional view and defined money as currency and demand deposits. Hicks in his Critical Essays in Monetary Theory points towards a threefold traditional classification of the nature of money: thus to act as a unit of account (or measure of value as Wicksell puts it), as a means of payment and as a store of value. The Banking School criticized the traditional definition of money as arbitrary. This view sees the meaning of money as very narrow because there are other assets which are equally acceptable as media of exchange. These include time deposits of commercial banks, commercial bills of exchange, etc.

Other schools of thought like the banking school said that the definition is narrow because it includes other things that money can do and that there are other assets which are equally acceptable as medium of exchange. Examples include, time deposits, drafts bonds which are sometimes used as money. By ignoring these assets, the traditional view is not in a position to analyze their influence in increasing their velocity. Furthermore, by excluding them from the definition of money, the Keynesians place greater emphasis on the interest elasticity of the



demand function for money. Empirically, they forged a link between the stock of money and output via the rate of interest. We present the detailed position of classical and Keynesian economists below

According to classical economists money is just a medium of exchange and it cannot influence the income and employment of a country. In other words, the money supply which is in circulation just performs the function of exchange of goods and services. People keep money with themselves so that they could transact goods and services. Thus, according to them money is just a token and it has nothing to do with economic activity of a country. They further say that money is like a veil which wraps the goods and services in itself. Money has been accorded as a veil because it has camouflaged the operation of real economic forces. Classical economists do not rule out the act of savings or borrowing. They think the savings, borrowings and lendings take place under the shield of a veil. It means that they have attached the problems of savings, borrowings and lendings with the transactive motive of holding money. Whether any body purchases the goods or services or borrows, both are similar functions. The funds are borrowed or lent with the help of money but they do not influence the economic activity in any way. In this respect, Adam Smith writes:

"Money is like a road which helps in transporting the goods and services produced in a country to the market, but this road does not itself produce any thing".

"Accord money like an agent which expedites the chemical action of any process, but it cannot change the components of chemical action".

Thus, classical economists are of the view, that money facilitates the transaction of goods and services, but it does not influence the quantity of goods and services in any way. It means that money cannot influence the real variables like production, income and employment. It can only influence the monetary variables like monetary wages and prices. In other words, if the supply of money in a country is increased the income and employment will remain unaffected. The increase in supply of money will lead to increase the prices, hence monetary wages. When prices and wages increase in the same proportion real wages will remain the same. As a result, the employment and output will remain the same.

All above discussion shows that the ideology that money cannot influence economy was a corner stone of classical economics. This philosophy remained popular till before and after World War I. But when classical utopia of nonintervention collapsed during 1970's depression the concept of money as a veil disappeared and money was accorded a dynamic element. All the problems which emerged during 1930's were attributed to money. Because of this reason, "Money was accorded Evil Genius". The money which got the importance by putting to an end the problems



of barter system, was later on accorded as veil and finally it was held responsible for inflation and deflation.

According to Keynesian Economists money has another role to play which is as a store of value. They said that due to this role of money a link is established between present and future. And because of this role money can influence the economic activity, level of income and employment. Quite against classical neutrality of money, Keynes thinks that money can alter the level of income and employment of an economy. Classical economists had integrated both the real and monetary sectors of the economy. But Keynes clearly bifurcated the monetary and real sectors of the economy. They said that in monetary sector rate of interest is determined by demand for money and supply of money. However, They stressed upon demand for money while the demand for money rises for two motives: (i) Transactive Demand for Money and (ii) Speculative Demand for Money.

The transaction demand for money depends upon income levels of the people. While speculative demand for money depends upon rate of interest. The speculative demand for money is concerned with money as a store of value. Thus, according to Keynes money is not just demanded for transaction purposes but it is also demanded to take advantage by the liquidity of money. In addition to monetary sector, Keynes also presented their views regarding real sector. They said that equilibrium level of national income is determined where aggregate demand is equal to aggregate supply. They said that it is not necessary that equilibrium level of national income will be determined at the level of full employment. Rather equilibrium level of national income may be at full employment, may be at below full employment and may be at above full employment.

Below full employment represents deflation while above full employment represents inflation. Both inflation and unemployment are undesirable. Therefore, to remove them state will have to interfere with fiscal and monetary policies. All this means that according to Keynes money can be used to change the level of income and employment. In this respect, he establishes a relationship between real and monetary sectors of the economy. As if supply of money is increased the rate of interest will decrease. Hence investment, national income and employment will be boosted up removing unemployment. Moreover, through fiscal action by printing new notes or borrowing from banks govt. can initiate public works program. They will also have the effect of removing the unemployment. All this shows that in Keynes economics money can influence the level of employment.

Turning to the definition of money according to Friedman or Monetarists which has also being described as the modern definition of Money or the Chicago school of thought, the scope of money is much broader than the traditional definitions. In his book “ Employment, growth and



price”, Friedman (1959) defined money literally as the number of dollars people carry around in their pockets as well as the number of dollars they have to their credit at banks in the form of demand deposits and time deposit. In effect, he defines money as currency plus all adjusted deposits in commercial banks. He extended his definition to time deposits-you notify the bank before one can withdraw. Usually time deposit is not included when classifying liquid assets.

However, this definition is criticized as being too narrow since in most empirical studies the definition of money goes beyond time and demand deposits because of sophistications in financial transactions.

Based on this criticism, Friedman reframed his definition of money as “Any asset capable of serving as a temporally abode of purchasing power” or anything that can serve as a purchasing power or a means of buying.

The controversy didn’t end there. Many scholars still criticized this definition and Friedman was compelled to restate that the definition of money shouldn’t be based on theory but how useful it is. The monetarists which are known as modern friends of classical economists have much more similarity regarding different issues. However, they also differ in certain fields. In connection with money monetarists say: *"Money Matters Very Much"*. This means that according to monetarists money in an economy plays a very vital role. They say that aggregate expenditures of the economy are influenced by the changes in the rate of interest. As a result, the level of income and employment can be affected. But it is confined to just short run. In case of long run there is always existing a natural rate of unemployment. It means that whenever through easy fiscal and monetary policies aggregate demand is increased, the level of unemployment will come down. But whenever aggregate demand is controlled prices will be stabilized, but economy will experience the same level of unemployment which the economy faced before increase in aggregate demand.

There are also other well acceptable definitions in the literature such as The Radcliff Definition and The Gurley –Shaw (1960) Definition. The former is actually the outcome of the committees set up to work on the Money system. The report of the committee defined money as notes plus bank deposits. This includes only those assets that are commonly used as a medium of exchange. The bank deposits included demand and time deposits. Even though we can use other things as money, their convertibility requires extra cost. There is a quite different from Radcliff. They regard a substantial volume of liquid assets held by financial intermediaries and the liabilities of non-bank financial intermediaries as close substitutes for money. NBFIs do not perform the functions of bank but rather intermediates.

Evolution of Money

Money dates back several centuries in the era of the Indo-European civilization. Well before the invention of minted coins in the Lydian cities of the Aegean in the 7th century BCE, writings from the Sumerian civilization at Ur in the 3rd millennium BCE refer to documents mentioning silver struck with the head of Ishtar. The mother-goddess and symbol of fertility, Ishtar was also the goddess of death. So from the very outset, money's ambivalence reflects the ambiguity of its social function: an instrument of cohesion and pacification in the community, it is also at the centre of power struggles and a source of violence.

The word "money" is derived from the Latin word "Moneta" which was the surname of the Roman Goddess of Juno in whose temple at Rome, money was coined. The origin of money is seen in ancient times. Even the primitive era man had some sort of money. The type of money in every age depended on the nature of its livelihood, the progress of human civilization at different times and places. In a hunting society, the skins of wild animals were used as money. The pastoral society used livestock, whereas the agricultural society used grains and foodstuffs as money. The Greeks used coins as money. Let's discuss how money has evolved from the barter system to today.

Barter System

At the beginning, there was no money. Before the advent of money, the primitive economy was engaged in exchange and trade but more directly without any medium of exchange. This is known as the Barter system. People engaged in barter, the exchange of merchandise for merchandise, without value equivalence.

Then, a person catching more fish than the necessary for himself and his group, exchanged his excess fish for the surplus of another person who, for instance, had planted and harvested more corn than what he would need. This elementary form of trade prevailed at the beginning of civilization, and may be found today among people of primitive economies, in regions where difficult access makes money scarce and, even in special situations, where people barter items without regard for their





equivalence in value. This is the case, for instance, of a child who exchanges with his friend an expensive toy for another of lesser value, which it treasures.

Goods used in barter are generally in their natural state, in line with the environment conditions and activities developed by the group, corresponding to elementary needs of the group's members. This exchange, however, is not free from difficulties, since there is not a common measure of value among the items bartered.

Difficulties of the Barter System

The barter system as a method of exchange has the following disadvantages:

Lack of Double Coincidence of Wants. For an efficient functioning of the barter system, double coincidence of wants was required on the part of those who wanted to exchange goods or services. To be successful, the barter system involved multilateral transactions which are not possible practically. Consequently, if the double coincidence of wants is not matched exactly, no trade is possible under barter. Thus a barter system is time-consuming and was a great hindrance to the development and expansion of trade.

Lack of a Common Measure of Value. Another difficulty under the barter system was the lack of a common unit in which the value of goods and services should be measured.

Indivisibility of Certain Goods. The barter system was based on the exchange of goods with other goods. It was difficult to fix exchange rates for certain goods which were indivisible. Such indivisible goods pose a real problem under barter trade.

Difficulty in Storing Value. Under the barter system it was difficult to store value. If someone wanted to save real capital over a long period he/she would be faced with the difficulty that during the period of storage, the commodity may become obsolete or deteriorate in value.

Difficulty in Making Deferred Payments. In a barter economy, it was difficult to make future payments. As payments were made in goods and services, debt contracts were not possible due to disagreements on the part of the two parties on the following grounds:

Lack of Specialization. Another difficulty of the barter system was that it was associated with a production system where each person was a jack-of-all-trades. In other words, a high degree of specialization was difficult to achieve under the barter system. Specialization and interdependence in production was only possible in an expanded market system based on the

money economy. In this case no economic progress is possible in a barter economy due to lack of specialization.

As a result of many difficulties and inconveniences in the barter system, around the globe there was a need for accepted medium of exchange. With the passage of time many other types of money emerged for the purpose of exchange. Following are the stages of evolution of money.

Commodity Money

Under commodity money, a large number of goods served as money, however the nature of goods varied from time to time and place to place for example agricultural goods, birds, slaves and animals etc. Some commodities, for their utility, came to be more sought than others are.

Accepted by all, they assumed the role of currency, circulating as an element of exchange for other products and used to assess their value. This was the commodity money.



Cattle, mainly bovine, was one of the mostly used, and had the advantages of moving for itself, reproducing and rendering services, although there was the risk of diseases and death.

Salt was another commodity money, difficult to obtain, mainly in the interior part of continents, also used as a preservative for food. Both cattle and salt left the marks in the Portuguese language of their function as an exchange instrument, as we keep using words such as pecunia (money) and pecúlio (accumulated money) derived from the Latin work pecus (cattle). The word capital (asset) comes from the Latin capita (head). Similarly, the work salário (salary, compensation, normally in money, due by the employer for the services of an





employee) originates from the use of sal [salt], in Rome, for payment of services rendered.



Some African countries used, among other commodity moneys, cowry – brought by Africans –, wood, sugar, cocoa, tobacco and cloth, exchanged in the 17th Century due to the almost complete lack of money, traded in the form of yarn balls, skeins and fabrics.

Later, commodities became inconvenient for commercial trades, due to changes in their values, the fact of being indivisible and easily perishable, therefore checking the accumulation of wealth.



In order to facilitate the exchange of goods, the commodity money also lost its popularity due to the following reasons:

Lack of Storability

Lack of Divisibility

Lack of Durability

Lack of Transportability

Lack of Homogeneity

Lack of General Acceptability

Metal

The commodity money due to the above drawbacks was replaced by metallic money. As metals were available from early times and were durable, portable and easily divisible therefore it got rapid popularity. This was the era of un-coined metals wherein gold, silver, copper and other metals were used as money. The popularity of metallic money is due to lack of homogeneity, scarcity, to secure metals etc.

As soon as man discovered metal, it was used to made utensils and weapons previously made of stone.

For its advantages, as the possibility of treasuring, divisibility, easy of transportation and beauty, metal became the main standard of value. It was exchanged under different forms. At the beginning, metal was used in its natural state, and later under the form of ingots and, still, transformed into objects, from rings to bracelets.



The metal so traded required weight assessment and assaying of its purity at each transaction. Later, metal money gained definite form and weight, receiving a mark indicating its value, indicating also the person responsible for its issue. This measure made transactions faster, as it saved the trouble of weighing it and enabled prompt identification of the quantity of metal offered for trade.

Money in the Form of Objects

Metal items came to be very valued commodities.

As its production required, in addition to knowledge of melting, knowing where the metal could be found in nature, the task was not at the reach of everyone.

The increased value of these objects led to its use as money and the circulation as money of small-scale replicas of metal objects.



This is the case of the knife and key coins found in the East and the talent, a copper or bronze coin with the form of an animal skin that circulated in Greece and Cyprus.

Ancient Coins

In the 7th century B.C. the first coins resembling current ones appeared: they were small metal pieces, with fixed weight and value, and bearing an official seal, that is the mark of who has minted them and also a guaranty of their value.

Gold and silver coins are minted in Greece, and small oval ingots are used in Lydia, made of a gold and silver alloy called electrum.



Coins reflect the mentality of a people and their time. One may find political, economic, technological and cultural aspects in coins. Through the impressions found in coins, we are able to know the effigy of personalities who lived centuries ago. Probably, the first historic character to have his effigy registered in a coin was Alexander the Great, of Macedonia, around the year 330 B.C.

At the beginning, coin pieces were made by hand in a very coarse way, had irregular edges, and were not absolutely equal to one another as today's ones.

Gold, Silver and Copper

The first metals used in coinage were gold and silver. Employment of these metals happened for their rarity, beauty, immunity to corrosion, economic value, and for old religious habits. In primeval civilizations, Babylonian priests, knowledgeable about astronomy, taught to people the close relationship between gold and the sun, silver and the moon. This led to a belief in the magic power of such metals and of objects made with them.



Minting of gold and silver coins was common for many centuries, and pieces were guaranteed by their intrinsic value, that is to say, by the trade value of the metal used in their production. Then, a coin made with twenty grams of gold was exchanged for goods of even value.

For many centuries, countries minted their most highly valued coins in gold, using silver and copper for lesser value coins. This system was kept up to the end of the last century, when cupronickel, and later other metallic alloys, became used, and coins came to circulate for their extrinsic value, that is to say, for their face value, which is independent from their metal content.

With the appearance of paper money, minting of metal coins was restricted to lower values, necessary as change. In this new role, durability became the most requested quality for coins.



Large quantities of modern alloys appeared, produced to support the high circulation of change money.

Standardized Coinage

To make the process of exchange easier, the concept of standard coinage was adopted. Government took control over all the coins. Coins were stamped with a logo, with uniform weight and the value was guaranteed. These coins were standard as both their face and intrinsic (value in themselves) were equal. Standardized coinage was unable to catch the minds due to

Too much time in extraction of metals from mines

Scarcity of Metals

Mobility

Paper Money

The emergence of paper money is a significant milestone in the evolution of money. In the Middle Ages, the keeping of values with goldsmiths, persons trading with gold and silver items, was common. The goldsmith, as a guaranty, delivered a receipt. With time, these receipts came to be used to make payments, circulating from hand to hand, giving origin to paper money.

Some of had its value written by hand, as we today do with our checks.



With time, in the same form it happened with coins, the government came to conduct the issue of notes, controlling counterfeits and securing the power to pay.

Currently, all countries have their central bank in charge of issuing coins and notes.

Paper money experienced an evolution regarding the technique used in their printing. Today, the printing of notes uses especially prepared paper and several printing processes, which are complementary to each other, assuring to the final product a great margin of security and durability conditions.



Different Shapes

Money has greatly changed its physical aspect along the centuries.



Coins had already very small sizes, as the stater, which circulated in Aradus, Phenicia, and some reached large sizes, such as the thaler, a 17th century Swedish copper piece.

Although today the circular form is used in almost the whole world, there had been oval, square, polygonal and other shapes for coins. They were also minted in different non-metallic materials, such as wood, leather and even porcelain. Porcelain coins circulated, in this century, in Germany, when the country was under the economic hardships caused by the war.

Bank notes were generally of rectangular lengthwise format, although with great variety of sizes. There are, still, square notes and those with inscriptions written in the vertical.

Bank notes depict the culture of the issuing country, and we may see in them characteristic and interesting motifs as landscapes, human types, fauna and flora, monuments of ancient and contemporary architecture, political leaders, historical scenes, etc.

Bank notes bear, in addition, inscriptions, generally in the country's official language, although several also bear the same inscriptions in other idioms. The inscriptions, frequently in English, aim at permitting the piece to be read by a larger number of people.

Different banks practiced it at different times such as in England up to 1694 and Scottish banks until 1850. First the Private commercial banks issued paper money afterward the system was centralized as the bank of England was granted the authority to monopolize the issuance of currency after 1694, the Federal Reserve Bank in USA was granted the same authority in 1913. In the beginning all kinds of paper currency were convertible into gold or silver (Before 1914). This conversion was abolished after 1914 in England and after 1933 in America. Now all currency notes issued from the central banks are inconvertible or Fiat money. By fiat money we mean that money for which the central bank does not promise to convert it in the equivalent amount of gold or silver and it does not possess any intrinsic value rather it is backed by the government's order in which it is declared as legal tender money and the people are bound to accept to.

Monetary System

The set of coins and bank notes used by a country form its monetary system. The system is regulated by appropriate legislation and organized from a monetary unit, its base value.

Currently almost all countries use a monetary system of centesimal basis, in which the coinage dividing the unit represents one hundredth of its value.



Normally, higher values are expressed in notes while smaller values are represented by coins. The current world trend is that daily expenses be paid with coins. Modern metallic alloys enable coins to be more durable than notes, making them more appropriate to the intense use of money as change.

The countries, through their central banks, control and guarantee the issue of money. The set of notes and coins in circulation, the so called monetary mass, is constantly renewed through the process of sanitation, substitution of worn out and torn notes

Near Money: Cheques

As coins and notes ceased to be convertible into precious metal, money became more dematerialized and assumed abstract forms.

One of these forms is the cheque that, for simplicity of use and security offered, is being adopted by an increasing number of people in their day-by-day activities.

This document, by which one orders payment of a certain amount to its bearer or to a person mentioned in it, aims mainly at transactions with bank deposits.





Cheque is basically a representation of a particular amount and hence cannot be treated as legal tender or high-powered money.

The important role played today in the economy by this form of payment is due to the innumerable advantages offered by it, speeding transactions with large sums, avoiding hoarding and diminishing the need of change by being a document completed by hand in the necessary amount.

Money, whatever the form it has, is not valuable for itself, but for the goods and services it may purchase. It is a sort of security giving its bearer the faculty of being creditor of society and take advantage, through his or her purchasing power, of all conquests of modern man.

Money was not, hence, invented by a stroke of genius, but stemmed from a need, and its evolution reflects, at each time, the willingness of man to harmonize its monetary instrument to the reality of its economy.

Near Money

The next stage in the evolution of money has been the use of bills of exchange, treasury bills, bonds, debentures, savings certificates, etc. They are known as “near money.” They are close substitutes for money and are liquid assets. Thus, in the final stage of its evolution money has become intangible. Its ownership is now transferable simply by book entry.

Electronic Money

Until now it is the last stage of evolution of money, this is the age of computer, now-a-days people avoid using cash and even cheques in their financial matters. Besides the credit money, they have now the facility of transferring money electronically which is quite effective in the context of time saving and safety. The introduction of electric payments technology as a means of transacting business has not only substituted for cheques but also for cash as well in the form of electronic money (e-money). E-money is the form of money that exists in electronic form. All kinds of debt cards, credit cards, ATM cards and smart cards are the examples of electronic money. Electronic money is not legal tender money.

In most advanced countries the use of debit and credit cards are becoming more popular than the use of cash in transacting a business. The ATM card is an example of a credit card that enables the customer of a bank to withdraw money from his account without going to the bank itself. The smart card (for example, the e-zwich in Ghana) is a type of store- value card that contains a computer chip at allows it to be loaded with digital cash from the owner’s bank account whenever needed. Smart cards can be loaded from ATM machines, personal computers with a smart card reader or special type of phones. The e-cash is another form of electronic money used on the internet to make purchases of goods and services. This process of making transfers online and paying bills online is termed as internet banking.



Some of the things that are required for widening the use of e-cards include:

Electricity

Telecommunication infrastructure, for example internet facilities

A literate population in ICT-population that can use the internet

Efficient ICT support system capable of preventing internet fraud

Easy access to computers

Other forms of e-money that have emerged in recent times are money are mobile money and digital currency

Mobile Money

Mobile money is an electronic wallet service or a movement of value that is made from a mobile wallet, accrues to a mobile wallet, and/or is initiated using a mobile phone. Mobile payment on the other hand is a movement of value that is made from a mobile wallet, accrues to a mobile wallet, and/or is initiated using a mobile phone. Sometimes, the term mobile payment is used to describe only transfers to pay for goods or services, either at the point of sale (retail) or remotely (bill payments). Mobile wallet is an account that is primarily accessed using a mobile phone.

This is available in many countries and allows users to store, send, and receive money using their mobile phone. The safe and easy electronic payments make. Mobile money a popular alternative to bank accounts. It can be used on both smartphones and basic feature phones.

Digital Currency

Digital currency (digital money, electronic money or electronic currency) is a balance or a record stored in a [distributed database](#) on the [Internet](#), in an electronic [computer database](#), within [digital files](#) or within a [stored-value card](#).^[1] Examples of digital currencies include [cryptocurrencies](#), [virtual currencies](#), [central bank digital currencies](#) and [e-Cash](#).

Digital currencies exhibit properties similar to other currencies, but do not have a physical form of banknotes and coins. Not having a physical form, they allow for nearly instantaneous transactions. Usually not issued by a governmental body, virtual currencies are not considered a [legal tender](#) and they enable [ownership](#) transfer across governmental [borders](#)



You can do almost anything online, including paying others with digital currency, currency that's not held in physical form. Some hold no real value except within a certain community such as the coins used in the game FarmVille. Others, such as the Bitcoin, do have real world value. As of fall 2017, 1 Bitcoin is worth about \$4800 US dollars.



Digital currency is code with monetary value and is backed by software

Forms

There are two major forms of digital currency.

Virtual currency is digital currency that is used within a specific community. For example, all FarmVille players have access to the in-game virtual currency coins with which they can purchase items for their farm. Virtual currency though is only valid within the specified community. You can't take your FarmVille coins and use them to buy a hamburger from McDonald's, therefore, it has no real world value.

Cryptocurrency, on the other hand, is digital currency that does have real world value, like Bitcoin. This type of digital currency is based on mathematical algorithms with tokens being transferred electronically over the internet via peer-to-peer networking.

A benefit to cryptocurrency is that it is not tied into the economy of any one country. This form is decentralized and does not rely on any one regulatory agency. This means that if the economy of one country crashes, your digital currency will remain the same.

With no regulatory agencies to go through, cryptocurrency makes it easier to conduct international transactions. It can also be exchanged for any type of physical currency. And it is completely private. Though transactions are digitally confirmed, they are anonymous. Your personal details are never attached to your transactions, so there is no money trail as there is with some physical currency.



Transactions are also irreversible. You know how if you deposit a fake check, the bank will then reverse that transaction and take that money back out of your account? This can't happen in cryptocurrency. There is little room for mistakes as all transactions are conducted via complex algorithms that transfer tokens from one person to another.

Though all this privacy is usually considered a good thing, cryptocurrency has also been used for illegal transactions such as money laundering and purchasing illegal drugs. It has also been connected with ransomware, which is when a virus hijacks your computer and demands payment in cryptocurrency to release your data.

Types

While there are only two forms of digital currency, there are actually many types.

There are as many types of virtual currencies as there are communities that have them. Virtual currencies typically cannot be traded or exchanged with each other. You can't trade or exchange FarmVille currency for Diner Dash currency. Each is only valid in its own gaming community or app. There are many different cryptocurrencies to choose from as well. Some are accepted at more places than others, but the most popular is currently Bitcoin. Right now, you can use your Bitcoins to make purchases at Overstock.com, Expedia, eBay, Shopify, Etsy, DISH Network, and Microsoft.

When you shop with Bitcoins, you'll actually be spending satoshis, which is the smallest fraction of Bitcoin (at least for now). 1 Bitcoin is equal to 100,000,000 satoshis.

In addition to Bitcoins, Overstock also accepts all major alt-coins, other cryptocurrencies created after the Bitcoin. The Bitcoin is still number 1 as far as cryptocurrencies are concerned. The other major cryptocurrencies include Litecoin (launched in 2011), Ripple (launched in 2012), Dash (launched in 2014), Monero (launched in 2014), and Ethereum (launched in 2015).

Mobile Digital Wallets

A number of electronic money systems use [contactless payment](#) transfer in order to facilitate easy payment and give the payee more confidence in not letting go of their electronic wallet during the transaction.

In 1994 [Mondex](#) and [National Westminster Bank](#) provided an "electronic purse" to residents of [Swindon](#)

In about 2005 [Telefónica](#) and [BBVA Bank](#) launched a payment system in [Spain](#) called Mobipay, which used simple [short message service](#) facilities of [feature phones](#) intended for pay-as-you-go services including taxis and pre-pay phone recharges via a BBVA current bank account debit.



In January 2010, [Venmo](#) launched as a mobile payment system through SMS, which transformed into a social app where friends can pay each other for minor expenses like a cup of coffee, rent and pay a share of the restaurant bill when one has forgotten their wallet. It is popular with college students, but has some security issues. It can be linked to a bank account, credit/debit card or have a loaded value to limit the amount of loss in case of a security breach. Credit cards and non-major debit cards incur a 3% processing fee.

On 19 September 2011, [Google Wallet](#) released in the United States to make it easy to carry all one's credit/debit cards on a phone.

In 2012 [Ireland's O2](#) (owned by [Telefónica](#)) launched Easytrip to pay [road tolls](#) which were charged to the mobile phone account or prepaid credit.

The UK's [O2](#) invented O2 Wallet^[27] at about the same time. The wallet can be charged with regular bank accounts or cards and discharged by participating retailers using a technique known as 'money messages'. The service closed in 2014.

On 9 September 2014, [Apple Pay](#) was announced at the [iPhone 6](#) event. In October 2014 it was released as an update to work on [iPhone 6](#) and [Apple Watch](#). It is very similar to [Google Wallet](#), but for Apple devices only.

Empirical and Econometric Developments on the Definition of Money

This section is based on Handa (2009) where we trace the historical definition and classification of money. Numerous theoretical and empirical studies in the 1950s and 1960s pointed out the development of close substitutes for money as a feature of the financial evolution of economies. By the 1960s, these developments led to a realignment of the functional definition of money to stress its store of value aspect, in this case as an asset relative to other assets, rather than medium of payments aspect. The result of this shift in focus was to further stress the closeness of substitution between the liabilities of banks and those of other financial intermediaries. Such shifts in the definition of money were supported both by shifts in the analysis of the demand for money, suited to the stress on the store-of-value function, and by a large number of empirical studies. However, in the presence of a variety of assets performing the functions of money to varying degrees, purely theoretical analysis did not prove to be a clear guide to the empirical definition or measurement of money. As a result, research on measuring the money stock for empirical and policy purposes took a variety of routes after the 1960s. Several broad routes may be distinguished in this empirical work. Two of these were:

One of the routes was to measure money as the sum of M1 and those assets that are close



substitutes for demand deposits. Closeness of substitution was determined on the basis of the price and cross-price elasticities in the money-demand functions or of the elasticities of substitution between M1 and various non-money assets. Such studies, generally reported relatively high degrees of substitution among M1, savings deposits in commercial banks, and deposits in near-bank financial intermediaries and therefore supported a definition of money that is broader than M1 and in many studies even broader than M2.

The second major mode of defining money was to examine its appropriateness in a macroeconomic framework. In this approach, the definition of money was specified as that which would “best” explain or predict the course of nominal national income and of other relevant macroeconomic variables over time. But there proved to be little agreement on what these other relevant variables should be. The quantity theory tradition (in the work of Milton Friedman, most of his associates and many other economists) took nominal national income as the only relevant variable. For the 1950s and 1960s, this approach found that the “best” definition of money, as shown by examining the correlation coefficients between various definitions of money and nominal national income, was currency in the hands of the public plus deposits (including time) in the commercial banks. This was the Friedman definition of money and was widely used in the 1960s. However, it should be obvious that the appropriate definition of money under Friedman’s procedure could vary between periods and countries, as it did in the 1970s and 1980s.

Further, in the disputes on this issue in the 1960s, many researchers in the Keynesian tradition took the appropriate macroeconomic variables related to money as being nominal national income and an interest rate, and defined money much more broadly than M2 to include deposits in several types of non-bank financial intermediaries and various types of Treasury bills and government bonds. Up to the 1970s, empirical work along the above lines brought out an array of results, conflicting in detail though often in agreement that M2 or a still wider definition of money performs better in explaining the relevant macroeconomic variables than money narrowly defined. This consensus vanished in the 1970s and 1980s in the face of increasing empirical evidence that none of the simple-sum aggregates of money – whether M1, M2 or a still broader one – had a stable relationship with nominal national income. Research on the 1970s and 1980s data showed that (a) the demand functions for the various simple-sum monetary aggregates were unstable, and (b) they did not possess a stable relationship with nominal income.

The above findings for the simple sum aggregates prompted the espousal of several new functional forms for the definition of money. The search for stability of the money-demand function also led to refinement of econometric techniques, resulting in cointegration analysis and error-correction



modeling of non-stationary time series data, and the derivation of separate long-run and short-run demand functions for money. Further, the continuing empirical instability of the demand functions for M2 and still broader definitions of money since the 1980s led to an increased preference for some form of M1 over broader aggregates for policy formulation and estimation, thereby reversing the shift towards M2 and other broad monetary aggregates which had occurred in the 1950s and 1960s. Further, the empirical instability of money-demand functions led to a marked decrease after the 1980s in both analytical and empirical studies on the definition of money. In addition, after the 1980s, at the monetary policy and macroeconomic level, many central banks and researchers have chosen to focus on the interest rate as the appropriate monetary policy instrument – thereby relegating money supply and demand to the sidelines of macroeconomic reasoning.

Practical Definitions of Money and Related Concepts

We have already referred to several definitions of money. These definitions are fairly, though not completely, standardized across countries for M1 and M2 but tend to differ for broader designations. The generic definitions of these monetary variables can be taken to be as follows:

- M1= Currency in the hands of the public + checkable deposits in commercial banks;
- M2= M1 + savings deposits in commercial banks.

These generic definitions are modified to suit the context of different countries and their central banks. Further, in general, with increases in the substitutability of different monetary assets, the definitions of each of the aggregates have broadened over time. Often, the variations in the definition of M1 are accommodated by using terms such as M1, M1+, M1++, etc.



Practical Definitions of Money and Related Concepts

Measurement	Description
M1 =	Currency in the hands of the public plus checkable deposits in Commercial banks
M2=	M1 + Savings deposit in Commercial banks.
M1= (Major Monetary Aggregate in the USA)	Currency in circulation among the public(i.e., excluding the Fed, the US Treasury and commercial banks)+ demand deposits in commercial banks(excluding interbank and US government deposits and those of foreign banks)+other checkable deposits including negotiable orders of withdrawal(NOW)+ credit union (Such as savings and Loan Associations) Share drafts accounts + demand deposits at thrift institutions(such as Mutual Savings Banks)-cash items in the process of collection and Federal Reserve float;
M2 =	M1 + savings deposits, including money market deposit accounts + small time deposits under \$100,000+ balances in retail money market mutual funds;
M3 =	M2 + Time deposits over \$100,000 +Eurodollars held by US residents at foreign branches of US banks and at all banks in the UK and Canada + Money market mutual funds held by institutions
M1 = (Monetary Aggregates for Canada)	Currency in the hands of the public and Demand deposits in the Chartered banks;
M1+ =	M1+ PERSONAL CHECKABLE DEPOSITS+ non-personal checkable notice deposits at Chartered banks, mortgage loan companies and credit union
M2=	M1 plus personal savings deposit and non-personal notice deposits at chartered banks;
M2+ =	M2 Plus deposits at trust and mortgage loan companies and credit unions(including caisses populaires) Adjusted M2+ = M2+ plus Canada Savings Bonds and mutual funds at financial institutions;

1.1.2 The Role of Money in Macroeconomy

Money plays a vital role in macroeconomic management. It is crucial for growth and development. Money and for that matter finance is said to be a lubricant that oils the engine of economic growth; too little of it inside the engine will slow the pace of growth; too much of it will have the same effect. Even if the quantity is right but the quality is bad, it can still slow the engine of growth considerably. If any of this is not managed or overlooked for a period of time, it can lead to a complete damage of the engine of growth. Therefore, without a well-managed, stable and a well-functioning monetary and banking system that channels finance to the right places in the right form and quality, macroeconomic management will be illusive. Money has implication for inflation, interest rate, exchange rate and economic growth and so if it is not properly controlled the management of these key macroeconomic variables will be a herculean task. The literature documents that the right management of money that ensures a stable financial system is capable of efficiently allocating resources, assessing and managing financial risks, maintaining



employment levels close to the economy's natural rate, and eliminating relative price movements of real or financial assets that will affect monetary stability, or economic growth and employment levels (Beck et al., 2007 and World Bank 2016).

Fundamentally, there are 2 main forms in which the role of money can be classified- Static role and Dynamic role.

Static role: This role emerges from the traditional functions of money, which we have discussed previously.

Dynamic role: In its dynamic role, Money plays an important part in the lives of people and in the economic system as a whole.

a) Role of money to the consumer. It makes the consumer sovereign because the consumer has the power to choose. It also ensures effective demand. It brings about postponement of consumption. The consumer's income is in the form of money.

b) To the producer. It helps in calculating revenue, cost, and profit. It also aids in planning, forecasting and budgeting. It brought about specialization and division of labour and how much to pay each skills according to the marginal product (MP).

c) It brought about capital formation by transferring saving into investment. Money has made it possible for people to save usually for a long time and earn interest on their savings. Investment is also linked closely with the growth of the economy. Increasing investment increases the income base of the economy just because money goes around in the economy.

d) As an index of economic growth, National income, income per capita and GDP are all measured in terms of money. When the value of money falls, prices increase and this may arise from too much money in the economy. Money is the index of an economy. If the value of money increases, it means the economy is getting well the general price levels.

e) It has helped in solving the central problems in economic system- what to produce, how to produce and to whom to produce. When the producer knows the MC, supply which is positively linked with prices (money) gives incentive to the producer to produce where the prices are high



($P > MC$). Feasibility studies help in identifying the income levels of the people in that community, how to produce? to whom to produce? who is the target?, what transport system to use?, whether the market is based on a centralized government or market forces?, the Cost Benefit Analysis (CBA) of the labour or capital intensive used, and whether distribution is dependent on equity or on the survival of the fittest.

f) Facilitates the collection of taxes and subsidies as well as fostering income distribution.

It facilitates exchange of goods and services and helps in carrying on trade smoothly. The present highly complicated economic system will not exist without money.

g) Money helps in maximizing consumers' satisfaction and producers' profit. It helps and promotes saving.

Other Things Money Does are as Follows:

Money promotes specialization which increases productivity and efficiency.

It facilitates planning of both production and consumption.

Money can be utilized in reviving the economy from depression.

Money enables production to take place in advance of consumption.

It is the institution of money which has proved a valuable social instrument of promoting economic welfare. The whole economic science is based on money; economic motives and activities are measured by money.

Defects of Money

The classical regard money as a veil or wrapper without performing any function. It is simply a tool of convenience to facilitate the exchange of goods and services but it is not a determinant of the quantities produced. It does not bring any increase in output. Here are some of the defects of money.

1. Money brings about instability in the value of money. E.g. excess supply of money wouldn't be too much of importance to the economy. Too much of it reduces its value.



When the value of money falls, it means the general price level of the economy increases. This is what is called inflation. When inflation increases, money is less effective to perform its function as a store of value. Investment also falls because inflation distorts the price level. An investor will hold on with the investment because of the instable nature of the value of money.

The real value of goods and services might be falling because of inflation. If investors are uncertain about the economy and the price level, they will not invest. These brings about unequal distribution of income. Inflation or fall in the value of money causes direct and immediate damage to creditors and consumers. On the contrary deflation or rise in the value of money brings down the level of output, employment and income. If prices fall, production also falls (depression). The effect of it is laying off some workers who lose their labour income, employment rate increases, effective demand falls and price also falls. However, production actually increases in the stable economy, but the two extreme ends (inflation and deflation) are not good for the economy.

2. Money spreads monopoly.

Too much money leads to concentrating of capital in the hands of few capitalists who practice monopoly and exploits both consumers and workers.

3. Wastage of resources

Because money is the basis of credit, too much credit to the individuals who might give to a productive sector will create over capitalization, over production and this wastes output in the system. If the individual decides not to give it to the production sector but to the unproductive sector, it is in itself wastage of resources. Especially, where there is political patronage without easily assessing the use of money.

4. Black Money

Money being the store of value usually causes people to hand it. This happens when people conceal money in order to evade tax. This works through money laundry where money does not perform any activity. It creates an underground economy or black marketing where tax evasion is rife. When you conceal money and refuse to pay tax on that money for a log time, it creates black money. Transferring the black money is called money laundering and this leads to underground or parallel economy.



5. Money creates a class economy which brings about conflict and distinguishes the rich from the poor.

6. Cyclical fluctuation in money brings about over production where the economic activities increase. This increases demand.

The defects of money discussed above are economic in nature. But there are some defects which are non-economic. One non-economic defect of money is increase in crime rate. “The love of money is the root of most evil”. In most cases, the moral, social and political fibers of the society are brought down because of money. The resultant effects are corruption, political bankruptcy, political instability, prostitution, strike actions, artificiality in religion which breeds fake pastors. People deceive and betray their fellow human beings, take or give bribe to temper justice just because of money. It is not getting the money which is not good but the attitude towards money.

Money is the lubricant for the smooth functioning of the economy. But the attitude of the various economic agents (government, firms, individuals) is what is worrying.

1.1.3 Changing Paradigms in Monetary Theory

Broadly, there are two main school of thought of investigating monetary issues: Classical and Keynesian group of models.

Classical group of models: This group of models argue the neutrality of money in the economy. The main arguments are premised on perfect competition and market clearances.

Keynesian group of models: Here, they believe in non-neutrality of money at least in the short-run. They argue that the economy is embedded with some rigidities that brings about market distortions. The Keynesian paradigm recognizes that the economy may sometimes have equilibrium in all markets, but does not assert that this occurs always or most of the time. They believe that even if there is equilibrium, it may not be the competitive equilibrium. These characteristics make money non-neutral.



Classical Models

Traditional Classical ideas: These include models that existed prior to Keynes's publication of *The General Theory* in 1936. The relevant theories are the quantity theory of money for the determination of prices and the loanable funds theory for the determination of interest rates, Say's Law.

Neoclassical model Here, classical ideas are re-branded in the post-General Theory period in a new compact into the IS-LM framework. The re-branding included the elucidation of some nuances of the traditional classical ideas, such as the wealth/Pigou and real balance effects, and addition of new elements such as the speculative demand for money and the explicit analysis of the commodity market at the macroeconomic level. Also, elements such as the quantity theory, the loanable funds theory, Say's law were discarded in this framework.

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.

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.

Keynesian Models

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

Neo-Keynesian Models

Just as [Keynes](#) posited his theory in response to gaps in classical economic analysis, Neo-Keynesianism derives from observed differences between Keynes's theoretical postulations and real economic phenomena. The Neo-Keynesian theory was articulated and developed mainly in the U.S. during the post-war period. Neo-Keynesians did not place as heavy an emphasis on the concept of full employment but instead focused on [economic growth](#) and stability.

The reasons the Neo-Keynesians identified that the market was not self-regulating were manifold. First, [monopolies](#) may exist, which means the market is not competitive in a pure sense. This also means that certain companies have discretionary powers to set prices and may not wish to lower or raise prices during periods of fluctuations to meet demands from the public.

[Labor markets](#) are also imperfect. Second, trade unions and other companies may act according to individual circumstances, resulting in a [stagnation](#) in wages that does not reflect the actual conditions of the economy. Third, real interest rates may depart from natural interest rates as monetary authorities adjust the rates to avoid temporary instability in the macroeconomy.

The two major areas of microeconomics by Neo-Keynesians are price rigidity and wage rigidity.

In the 1960s, Neo-Keynesianism began to examine the microeconomic foundations that the macroeconomy depended on more closely. This led to a more integrated examination of the dynamic relationship between microeconomics and macroeconomics, which are two separate but interdependent strands of analysis.

The two major areas of microeconomics, which may significantly impact the macroeconomy as identified by Neo-Keynesians, are price rigidity and wage rigidity. Both of these concepts intertwine with social theory negating the pure theoretical models of classical Keynesianism.

For instance, in the case of wage rigidity, as well as influence from [trade unions](#) (which have varying degrees of success), managers may find it difficult to convince workers to take wage cuts on the basis that it will minimize unemployment, as workers may be more concerned about their own economic circumstances than more abstract principles. Lowering wages may also reduce productivity and morale, leading to overall lower output.

New Keynesian economics is a school of contemporary [macroeconomics](#) that strives to provide [microeconomic foundations](#) for [Keynesian economics](#). It developed partly as a response to criticisms of Keynesian macroeconomics by adherents of [new classical macroeconomics](#).



Two main assumptions define the New Keynesian approach to macroeconomics. Like the New Classical approach, New Keynesian macroeconomic analysis usually assumes that households and firms have [rational expectations](#). However, the two schools differ in that New Keynesian analysis usually assumes a variety of [market failures](#). In particular, New Keynesians assume that there is [imperfect competition\[1\]](#) in price and wage setting to help explain why prices and wages can become "[sticky](#)", which means they do not adjust instantaneously to changes in economic conditions.

Wage and price stickiness, and the other market failures present in New Keynesian [models](#), imply that the economy may fail to attain [full employment](#). Therefore, New Keynesians argue that macroeconomic stabilization by the government (using [fiscal policy](#)) and the [central bank](#) (using [monetary policy](#)) can lead to a more [efficient](#) macroeconomic outcome than a [laissez faire](#) policy would.

Activity 1.1: Review and discussion questions

If money lubricates the wheels of the economy, does it mean that money is always good?

“Our first step must be to elucidate more clearly the functions of money. ... Money, it is well known, serves two principal purposes. By acting as a money of account, it facilitates exchanges without its being necessary that it should ever itself come into the picture as a substantive object. In this respect it is a convenience which is devoid of significance or real influence. In the second place, it is a store of wealth. So we are told, without a smile on the face. But in the world of classical economy, what an insane use to which to put it! For it is recognized characteristically of money as a store of wealth that it is barren: whereas practically every other form of storing wealth yields some interest or profit. Why should anyone outside a lunatic asylum wish to use money as a store of wealth?” (Quarterly Journal of Economics, February 1937, pp.215-216).

Critically evaluate the above passage within the frameworks of Keynesian and Classical Theorists of money functions.

What are the different ways of defining money in your economy? Compare these with

the monetary aggregates commonly used in another selected country. Explain their differences and the reasons for such differentiation.



What are the underlying themes (or theme, if only one) of the classical paradigm? How are they represented in the different models within this paradigm?

Explain the various models within the classical approach and compare them. Which would you accept for your economy?

“The modern classical approach does not assume full employment. In fact, it allows for the deviations of employment from its full-employment level.” Discuss these statements. If you agree with them, what is the nature of such deviations? Compare their nature with the nature of deviations from full employment that can occur in the traditional classical and neoclassical approaches and in the 1970s monetarist doctrines.

What are the underlying themes of the Keynesian paradigm? Do they justify the study of just one model, one variety of models, or several different varieties of models? Why?

“The 1970s monetarism was a hybrid between the classical and the Keynesian paradigms.” Discuss.

“Under the modern classical approach, there is no sensible role for demand management policies in both the short-run and the long-run.” Why not? Discuss.



1.2 THE DEMAND FOR MONEY

Introduction

In this section, you will learn about the theory of demand for money, focusing on classical and Keynes theories and the demand for money theories that followed. We will also focus on microfoundations of money (representative agent models) including money in utility function, cash-in-advance and overlapping generation models. Demand for money is a prominent issue in macroeconomics due to the important role that money plays in the determination of the price level, interest income. But first we should know the meaning of demand for money. In general, the demand for money refers to how much assets individuals wish to hold in the form of money (as opposed to illiquid physical assets.) It is sometimes referred to as liquidity preference. The demand for money is related to income, interest rates and whether people prefer to hold cash(money) or illiquid assets like money.

Further, demand for money arises from two important functions of money. The first is that money acts as a medium of exchange and the second is a store of value. Thus, individuals and businessman wish to hold money partly in cash and partly in the form of assets. Theoretically, speaks, various schools of thought in economics define differently the demand for money. In-fact, people's demand for money is not for nominal money holdings but real money balances, because if people are merely concerned with nominal money holdings irrespective of the price level, they said to suffer from money illusion.

In the theory, till recently, there were three approaches to demand for money, namely, transactions approach or Fisher's quantity theory of money, cash balances approach or Cambridge equation and, Keynes theory of liquidity preference. However, in recent years Baumol, Tobin and Friedman also have put forward new theories of demand for money.

Learning Outcome

By the end of this lecture, you should be able to

explain and discuss the difference between the Classical (Fischerian Approach) and Keynes approach to demand for money

analyze and differentiate the Transaction approach from the Cambridge approach to money demand.



analyze the main determinants of the speculative motive of holding money.

explain Baumol and Tobin-Markowitz Models of demand for money.

Discuss the four main propositions of the Monetarist system and the Friedman's Restatement of the Quantity Theory of Money.

Compare and contrast the role of money in the Monetarist and Keynesian systems.

Explain the microfoundations of money and clearly discuss the following models:

The Demand for Money vis- a- viz the Demand for other Commodities

Money in the utility functions

Shopping-Time Models

Cash-in-Advance Models (Clower Constraint)

Overlapping Generation Model

Appreciate empirical studies of the demand for money with emphasis on Africa

1.2.1 Classical Approach to Demand for Money or Fisher's Equation

The classical economists did not explicitly formulate demand for money theory, but their views are inherent in the quantity theory of money. They considered only the medium of exchange function of money as an important one i.e., money as a means of purchasing of goods & services. The cash transactions approach was popularized by Irving Fisher of the USA in 1911, in his book 'Purchasing Power of Money'. Through his equation of exchange he made an attempt to determine price level and value of money.

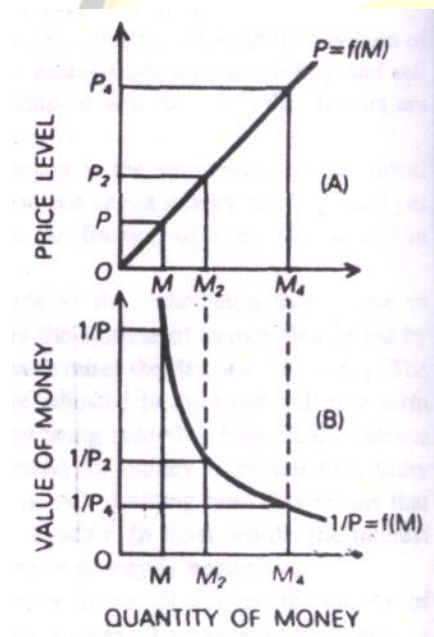
Symbolically, Fisher's equation of exchange is written as under

$$M'V' + MV = PT \dots\dots\dots(1)$$

Where M is the total quantity of money, M' is the credit money, V & V' is its velocity of circulation of money and credit, 'P' is the price level and, 'T' is the total amount of goods and services exchanged for money. This equation equates the demand for money (PT) to supply of money (MV). As mentioned earlier, he made an attempt to determine price level and value of money. Value of money is meant by purchasing power of money. In order to find out the effect of the quantity of money on the price level or the value of money we write the equation as:

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

As per the equation, price is positively associated and negatively influenced by the changes in T and value of money is also determined by the same variables but it has negative association with M and the direct relation with T. In other words, if the quantity of money is doubled the price level will also double and the value of money will be one half. On the other hand, if one half reduces the quantity of money, one half will also reduce the price level and the value of money will be twice. The same theory is explained with the help of fig.



Panel A of fig shows the positive effect of the quantity of money on the price level and in panel B, the inverse relation between the quantity of money and the value of money is presented.

However, by taking some assumptions about the variables V & T Fisher transformed the quantity theory equation into a theory of demand for money.

According to Fisher, the nominal quantity of money is fixed by the central bank and is therefore, treated as an exogenous variable which is assumed to be a given quantity in a particular period of time. Further, the number of transactions in a period is a function of national income. Since, Fisher assumed full employment of resources prevailed in the economy, the level of national income is determined by the amount of the fully employed resources. Thus, with this assumption, the volume of transactions T is fixed in short run. Fisher made most important assumption which makes his



equation as a theory of demand for money is that, velocity of circulation (V) remains constant and is independent of M, P and T. this is because he thought that velocity of circulation of money (V) is determined by institutional & technological factors involved in the transaction process.

If we want to be in equilibrium, nominal quantity of money supply must be equal to the nominal quantity of money demand. So that,

$$M_s = M_d = M \dots\dots\dots(2)$$

Where M is fixed by Central Bank.

With the above assumptions Fishers equation can be rewritten as

$$MD = \frac{PT}{V} \text{ or } MD = \frac{1.PT}{V} \dots\dots\dots(3)$$

Therefore, according to Fisher, demand for money is depends on the following three factors: 1) The number of Transactions 2) The average price transfers 3) The velocity of circulation of money.

This approach is faced some serious difficulties in empirical research 1) in this approach transactions are not only purchase of goods and services but also purchase of capital assets, so that when there is a scope for frequent changes in capital assets, it is not appropriate to assume that T will remain constant even if Y is taken to be constant due to full employment assumption 2) it is difficult to define and determine a general price level that covers not only current goods and services but also capital assets.

The Cambridge Quantity Theory:

Cambridge cash balance theory of demand for money was put forward by Cambridge economists, Marshall, Pigou, and Robertson. It places emphasis on the function of money as a store of value or wealth instead of Fisher's emphasis on the use of money as a medium of exchange. Marshall, Pigou and Robertson focused their analysis on the factors that determine individual demand for holding cash balances. Although, they recognized that current interest rate, wealth owned by the individuals, expectations of future prices and future rate of interest determine the demand for money, they however believed that changes in these factors remain constant or they are proportional to changes in individual's income. Thus, they put forward a view that individual's demand for cash balances is proportional to the nominal income. Thus, according to their approach, aggregate demand for money can be expressed as

$$M_d = kPY \dots\dots\dots 1)$$



Where Y = real national income; P = average price level of currently produced goods and services; PY = nominal income; k = proportion of nominal income (PY) that people want to hold as cash balances

Demand for money in this equation is a linear function of nominal income. The slope of the function is equal to k , that is, $k = M_d/PY$, thus important feature of cash balance approach is that it makes the demand for money as function of money income alone. A merit of this formulation is that it makes the relation between demand for money and income as behavioural in sharp contrast to Fisher's approach in which demand for money was related to total transactions in a mechanized manner.

We can observe the Cambridge approach even by the equations of individual economists. Marshall's formula is as follows:

$$M = kY \dots \dots \dots 2)$$

Where M is the quantity of money, Y is the total money income and K is the co-efficient whole function is to bring the two sides into balance.

Pigou expresses the form of an equation as:

$$P = \frac{KR}{M} \text{ or } \frac{M}{KR} \dots \dots \dots 3)$$

Where P stands for the value of money or its inverse the price level (M/KR), M represents the supply of money, R the total national income and K represents that fraction of R for which people wish to keep cash.

Pigou presents the equation in an extended form by dividing cash into two parts: cash with the public and, deposits which the people consider as cash, therefore:

$$P = \frac{KR}{M\{C + h(1 - c)\}} \dots \dots \dots 4)$$

Where, C denotes cash with the public ($1-c$) stands for bank deposits and H denotes the percentage of cash reserve against bank deposits. If we assume the total amount of money in the community as 1, the public as cash holds the public holds part of it and balance as deposits in banks. Banks do not keep the entire deposits as cash only a portion or a part of it is kept as cash and is denoted by



'h'. Therefore, $C+h(1-c)$ shows the amount of money in the economy at any time denoting the proportion of cash and $h(1-c)$ denoting its proportion of bank deposits.

Prof D H Robertson's equation is similar to that of Prof Pigou's with a little difference. Robertson's equation is:

$$M = PKT \text{ or } P = \frac{M}{KT}$$

Where P is the price level, T is the total amount of goods and services K represents the fraction of T for which people wish to keep cash. Robertson's equation is considered better than that of Pigou as it is more comparable with that of Fisher. It is the best of all the Cambridge equations, as it is the easiest.

Glax writes, 'Cambridge approach is conceptually richer than the transactions approach, the former is incomplete because it does not formally incorporate the influence of economic variables must mentioned on the demand for cash balances, Keynes attempted to eliminate this shortcoming.

Another important feature of Cambridge demand for money function is that the demand for money is proportional function of nominal income. Thus, it is proportional function of both price level and real income. This implies two things, first income elasticity of demand for money is unity and secondly price elasticity of demand for money is also equal to unity so that any change in the price level causes equal proportionate changes in the demand for money.

Policy implications of the quantity equation for persistently high rates of inflation

Rewrite the quantity equation in terms of growth rates as:

$$M'' + V'' \equiv P'' + y''$$

where '' 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'' . This identity asserts that the rate of inflation is always equal to the rate of money growth plus the growth rate of velocity less the growth rate of output. Ceteris paribus, the higher the money growth rate, the higher will be the inflation rate, whereas the higher the output growth rate is, the lower will be the inflation rate. Note that velocity also changes over time and can contribute to inflation if it increases, or reduce inflation when it falls. In normal circumstances in the economy, velocity changes during a year but not by more than a few percentage points. Similarly, for most economies, real output growth rate is usually only a few percentage points. For the quantity equation, we need only consider the difference

$(V'' - y'')$ between them.

In the normal case, both velocity and output increase over time but the difference in their growth rates is likely to be quite small, usually in low single digits. Adding this information to the quantity equation implies that high (high single digits or higher numbers) and persistent (i.e. for several years) rates of inflation can only stem from high and persistent money growth rates. This is particularly true of hyperinflation in which the annual inflation rate may be in double (10 percent or more) or triple (100 percent or more) digits or even higher. Empirically, even at low inflation rates, the correlation between money supply growth and inflation rates over long periods is close to unity.

To reiterate, the source of inflation over long periods is usually money supply growth and the source of persistently high inflation over even short periods is high and persistent money growth rates. Therefore, if the monetary authorities wish to drastically reduce inflation rates to low levels, they must pursue a policy that achieves an appropriate reduction in money supply growth.

Keynes Liquidity Preference Approach

Keynes propounded a theory of demand for money in his general theory which occupies an important place in his monetary theory. In other words, his demand for money is called liquidity preference. How much of income or resources will a person hold in money and how much will a person part with or lend. Liquidity preference means the demand for money to hold or the desire of the public to hold cash.

The term liquidity preference was first used by Keynes for to refer to the demand for money. Keynes identified three reasons/motives for holding money in every economy. These motives are:



- (1) The transactions motive for holding money;
- (2) The precautionary motive; and
- (3) The speculative demand.

The Transactions Demand for Money

The transactions demand for money arises from the medium of exchange function of money. This motive for holding money stems from the need to money for the current transactions of personal and business exchange. To the individual, this motive relates to the need to hold money to serve as a connection between the time of receipt of income and making of expenditures. Similarly, to the businessman the motive is meant to bridge the gap between the time of incurring business costs and the time of receipt of revenue from sales. If the time between the making of expenditure and receipt of income is short then less money balances will be held by the people for current transactions. If on the other hand, if the time between the incurring of expenditure and receipt of income is long, more cash will be held by the people for day to day transactions.

Changes may however occur in the transactions demand for money and may arise from changes in individual and business expectations. Expectations in turn depend upon the level of income, interest rates, the business turnover, the normal period between the receipt and disbursement of income, etc. Given these factors, the transactions demand for money is a direct proportional and positive function of the level of income, and is expressed as:

$$L_T = kY$$

where

L_T is the transactions demand for money (liquidity preference)

K is the proportion of income which is kept for transactions purposes, and

Y is income level.

Interest Rate and Transactions Demand

In recent years two renowned post-Keynesian economists, William J. Baumol and James Tobin' have shown that there is some linkage between the transaction demand for money and the rate of interest (we will treat this in detail in the subsequent section). They also demonstrated that this



relationship between transactions demand for money and income is not linear and proportional as Keynes argued. Rather, changes in income lead to proportionately smaller changes in transactions demand. This is because incomes received at the beginning of the month is not spent on the same day so that a portion of that money meant for transactions purposes can be spent on short-term interest –yielding bonds or securities. The higher the interest rate, the larger will be the fraction of any given amount of transactions balances that can be profitably diverted into securities. One should however be mindful of the cost involved in buying and selling this asset.

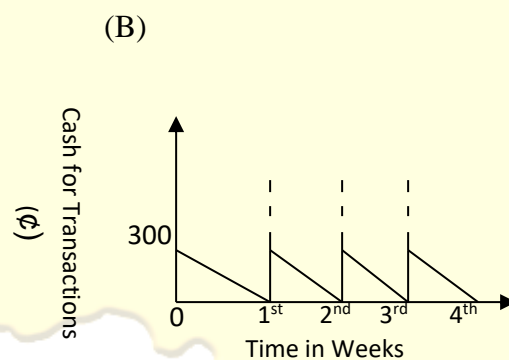
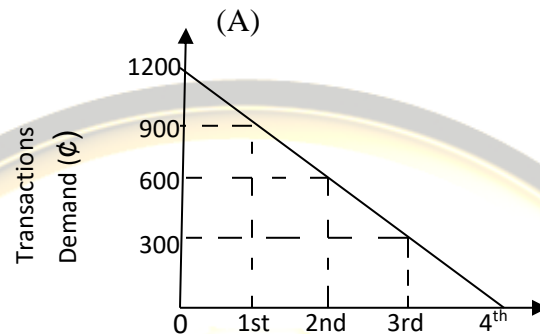
The structure of cash and short-term bond holdings is shown in Figure 2.1 (A), (B) and (C). Suppose an individual receives ₦1200 as income on the first of every month and spends it evenly over the month. The month has four weeks. Assume also that he saves nothing, thus his saving is zero. Accordingly, his transactions demand for money in each week is ₦300. So he has ₦ 900 idle money in the first week, ₦ 600 in the second week, and ₦ 300 in the third week. He will, therefore, transfer this idle money into interest bearing bonds, as illustrated in diagram (B) and (C) of Figure 2.1. He keeps and spends ₦300 during the first week (shown in diagram B), and invests ₦900 in interest-bearing bonds (shown in diagram C). On the first day of the second week, he sells bonds worth ₦300 to cover cash transactions of the second week, and his bond holdings are reduced to ₦600. Similarly, he will sell bonds worth ₦300 in the beginning of the third and keep the remaining bonds amounting to ₦300 which he will sell on the first day of the fourth week to meet his expenses for the last week of the month. The amount of cash held for transactions purpose by the individual during each week are shown in diagram B), and the bond holdings in each week are shown in diagram (C) of Figure 2.1.

The modern view is that the transactions demand for money is a function of both income and interest rates which is also expressed as:

$$LT = f(Y,r).....(a)$$



Figure 2.1



(C)

The Precautionary Demand for Money

According to Keynes the precautionary motive is concerned with the desire to hold money to meet unforeseen events requiring sudden spending and for “unforeseen opportunities of advantageous purchases.” Both individuals and businessmen keep money to meet unexpected needs. For example, individuals hold some money to provide for illness, accidents, and unexpected visits from relatives, unemployment and other unforeseen contingencies. In the same vein, businessmen reserve cash take advantages of gains from unexpected deals or to overcome unfavourable conditions.



The precautionary demand for money depends upon the level of income, and business activity, opportunities for unexpected profitable deals, availability of cash, the cost of holding liquid assets in bank reserves, etc. Keynes believed that the precautionary demand for money, like transactions demand, was a function of the level of income. But the post-Keynesian economists believe that like transactions demand, it is inversely a function of income and interest rate. Thus precautionary demand has the same determinants as the transactions demand. The demand for money for these two purposes can therefore be represented by a single equation $LT = f(Y,r)$ ”.

The Speculative Demand for Money

Keynes believed that wealth could be held in a form of money which does not earn any rate of return and in the form of bonds which do. So then after keeping enough money balances for transactions and precautionary purposes, of what value will the excess money be? Keynes argued that such extra funds will be used in making speculative gains by investing in financial instruments like bonds. Specifically, speculative (or asset or liquidity preference) demand according to Keynes is desire to hold money for “securing profit from knowing better than the market what the future will bring forth.” It arises because of uncertainty surrounding future interest rate and is based on regressive expectation. Money held for speculative purposes is a liquid store of value which can be invested at an opportune moment in interest-bearing bonds or securities.

A bond holder has expected returns on the bond from two sources, namely, the bond yield, that is, the interest payment he receives – and a potential capital gain/loss-an increase/decrease in the price of the bond from the time he buys it and the time it is sold. The bond’s yield Y is usually stated as the face value of the bond. The market rate of return on the bond r is the ratio of the yield to the price of the bond P_b . For example, if a hundred-cedi bond has a yield of ₵5, the percentage yield is 5%. If the price of the bond rises to ₵125, the ₵5 yield corresponds to a market rate of 4 %, that is ₵5/₵125. Thus the market rate is given as:

$$r = \frac{Y}{P_b} \quad (1)$$

.(You remember bond prices and the rate of interest are inversely related to each other? Such that the lower the bond prices the higher the interest rates, and vice versa?)

But the yield is a fixed amount stated as a percentage of the bond’s face value, so then the market price of the bond is represented as:

$$P_b = \frac{Y}{r} \quad (2)$$

The expected percentage capital gain g is the percentage increase in price from the purchase price P_b to the expected sale price P_b^e . Thus the expression for the percentage capital gain is $g = (P_b^e - P_b)/P_b$. From equations (1) and (2), with a fixed Y on the bond, an expected price P_b^e corresponds to an expected interest rate, $r = Y/P_b^e$. Thus in terms of expected and current interest rates, the capital gain can be written

as:

$$g = \frac{\frac{Y}{r^e} - \frac{Y}{r}}{\frac{Y}{r}} \quad (3)$$

Cancelling the Y terms and multiplying both the numerator and denominator by r gives:

$$g = \frac{r}{r^e} - 1 \quad (4)$$

Equation 6 represents the expected capital gains in terms of current and expected interest rates. For example, if the current rate of interest is 5% and the buyer of the bond expects the rate to decline to 4%, his expected capital gain would be:

$$g = \frac{0.05}{r^e 0.04} - 1 = 1.25 - 1 = 0.25 \%$$

The total percentage return on a bond, that is total earnings e , will be the sum of the market rate of interest at the time of the purchase and the capital gains. That is $e = r + g$. By substituting for g from equation (4), the expression for the total percentage return will be presented as:

$$e = r + \frac{r}{r^e} - 1 \quad (5)$$

Individuals demand for money

Given the expected return on bonds as e , and with a zero return on holding cash, the asset holding will be expected to buy more bonds if he expects the return e to be greater than zero. If the return on bonds is expected to be less than zero, the asset holder will put his liquid wealth in money.

Keynes argued that each person is assumed to have an expected interest rate r^e that corresponds to some normal/critical long run average rate. If rates rise above this long-run expectation, he expects them to fall, and vice versa. The asset holder's expected interest rate r^e , together with the observable market rate r , determines his expected rate percentage return e . With this information we can compute a critical level of the market rate r , that is r_c , which will give the investor a net zero return on bonds, that is, the value of r that makes $e = 0$. Whenever $r > r_c$, we would expect the investor to hold all of his liquid wealth in bonds and when $r < r_c$, he moves entirely into money. To find the critical value of r , r_c , we set the total return equation as shown in equation (5) to zero:

$$0 = r + \frac{r}{r^e} - 1 \quad (6)$$

Simplifying 6 gives

$$r(1 + r^e) = r^e \quad (7)$$

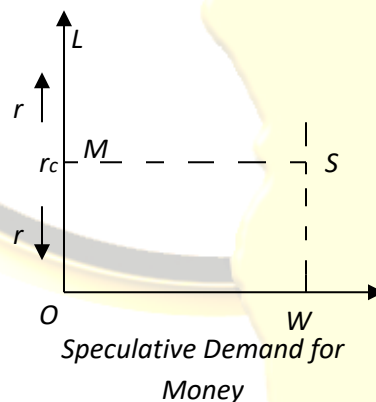
Making r the subject of (9) we have,

$$r = \frac{r^e}{1+r^e} = r_c \quad (8)$$

In equation (8) r_c represents the value of the market interest rate is r that make $e=0$ and is given by $r^e / (1 + r^e)$.

The relationship between an individual's demand for real balances and the interest rate is shown in figure 2.2 where the horizontal axis shows the individual's demand for money for speculative purposes and the current and critical interest rates on the vertical axis. The figure shows that when r is greater than r_1 , the asset holder puts all his cash balances in bonds and his demand for money is zero. This is illustrated by the LM portion of the vertical axis. When r falls below r_1 , the individual expects more capital losses on bonds as against the interest yield. He, therefore, converts his entire holdings into money, as shown by OW in the figure. This relationship between an individual asset holder's demand for money and the current rate of interest gives the discontinuous step demand for money curve $LMSW$.

Figure 2.2



For the economy as a whole and the individual demand curve can be aggregated on this presumption that individual asset-holders differ in their critical rates r_1 . It is a smooth curve which slopes downwards from left to right, as shown in Figure 2.3

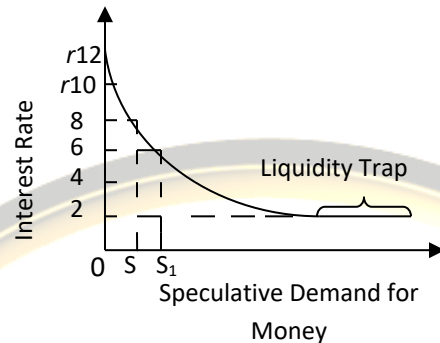


Figure 2.3

Thus the speculative demand for money is a decreasing function of the rate of interest. The higher the rate of interest, the lower the speculative demand for money and vice versa.

Liquidity Trap

Keynes conceptualized a situation in which the speculative demand for money is perfectly elastic such that changes in the quantity of money would be fully absorbed into speculative balances. This is what Keynes referred to as the liquidity trap as shown in figure above. In this case, changes in the quantity of money have no effects at all on prices or income. According to Keynes, such a situation may occur when the market interest rate is very low so that the yields on bonds, equities and other securities will also be low. At such a low rate, investors prefer to keep their wealth in the form of money rather than bonds because purchasing bonds will lead to capital losses.

The Total Demand for Money

We have considered the three motives for holding money according to the Keynesian system. By putting these three together we derive the total demand for money function. The transactions and precautionary motives were seen to vary positively with the level of income and negatively with the interest rate. The speculative demand for money was negatively related to the rate of interest.



Thus the total demand for money is a function of both income and the interest rate which be presented as:

$$M_d = f(Y,r)$$

Where M_d represents the total demand for money, Y , income and r is the interest rate. A rise in income increases money demand; a rise in the interest rate leads to a fall in money demand. The money demand function can be represented in a linear form as:

$$M_d = c_0 + C_1Y - C_2r \quad C_1 > 0, \quad C_2 < 0$$

Thus the total demand for money can be derived by the lateral summation of the demand function for transactions and precautionary purposes and the demand function for speculative purposes.

Criticisms of Keynes' Theory:

James Tobin found two main weaknesses of the Keynesian theory of the speculative demand for money:

(i) All-or-nothing choice:

In Keynes' theory investors are assumed to hold all their wealth in bonds (other than the amount of money held for transaction purposes) as long as the rate of interest exceeded the 'critical rate' — a rate below which the expected capital loss on bonds outweighed the interest earnings on bonds. If, on the contrary, the interest rate fell below the critical level, investors would hold no bonds, i.e., they would hold their entire wealth in money. So Keynes' theory cannot explain why and how an individual investor diversifies his portfolio by holding both money and bonds as stores of wealth.

(ii) Changes in the normal rate of interest:

Keynes assumed that investors hold money as an asset so long as the interest rate is low. The reason is that they expect the interest rate to rise and return to 'normal' level. According to Keynes there exists a fixed or a slowly changing normal level for the interest rate, around which the actual rate of interest gravitates.

So the normal rate is taken as a benchmark against which to judge the possibility of interest rate changes which determine the amount of money held for speculative purposes.



According to Tobin the normal level itself keeps on changing over time — as has been shown by the experience of the 1950s. This explains why portfolio diversification takes place. An individual's portfolio choice, i.e., his decision to diversify does not depend on Keynes' restrictive assumption about investor expectations of a return of the interest rate to a normal level. It is against this backdrop that we study Tobin's portfolio theory of demand for money.

In short, Keynes' followers such as James Tobin have not been satisfied with his theory of speculative demand for money which seeks to explain the inverse relationship between the interest rate and money demand. They have identified other reasons for the dependence of demand for money on the interest rate.

W. J. Baumol and Tobin have also extended Keynes' analysis of the transactions demand for money. We may now discuss these two extensions of Keynes' theory one by one.

On the other hand non-Keynesians — called monetarists — have refined and modified the classical quantity theory of money. This is another notable development in the area of monetary economics. Friedman's analysis treats the demand for money in the same way as the demand for an ordinary commodity. It can be viewed as a producer's good; businesses hold cash balances to improve efficiency in their financial transactions and are willing to pay, in terms of forgone interest income, for this efficiency. Money can also be viewed as a consumer's good; it yields utility to the consumer in terms of smoothing out timing differences between the expenditure and income streams and also in terms of reducing risk.

1.2.2 Theories of Demand of Money: Baumol and Tobin-Markowitz Model

Introduction

In this lecture, we discuss the Post-Keynesian theories of demand for money put forward by Tobin, Baumol and Friedman.

By introducing speculative demand for money, Keynes made a significant departure from the classical theory of money demand which emphasized only the transactions demand for money. However, as seen above, Keynes' theory of speculative demand for money has been challenged. The main drawback of Keynes' speculative demand for money is that it visualizes that people hold their assets in either all money or all bonds. This seems quite unrealistic as individuals hold their financial wealth in some combination of both money and bonds.

This gave rise to portfolio approach to demand for money put forward by Tobin, Baumol and Friedman. The portfolio of wealth consists of money, interest-bearing bonds, shares, physical assets etc. Further, while according to Keynes' theory, demand for money for transaction purposes



is insensitive to interest rate, the modern theories of money demand put forward by Baumol and Tobin show that money held for transaction purposes is interest elastic.

1. Tobin's Portfolio Approach to Demand for Money

An American economist James Tobin, in his important contribution explained that rational behaviour on the part of the individuals is that they should keep a portfolio of assets which consists of both bonds and money. In his analysis he makes a valid assumption that people prefer more wealth to less.

According to him, an investor is faced with a problem of what proportion of his portfolio of financial assets he should keep in the form of money (which earns no interest) and interest-bearing bonds. The portfolio of individuals may also consist of more risky assets such as shares.

According to Tobin, faced with various safe and risky assets, individuals diversify their portfolio by holding a balanced combination of safe and risky assets.

According to Tobin, individual's behaviour shows risk aversion. That is, they prefer less risk to more risk at a given rate of return. In the Keynes' analysis an individual holds his wealth in either all money or all bonds depending upon his estimate of the future rate of interest.

But, according to Tobin, individuals are uncertain about future rate of interest. If a wealth holder chooses to hold a greater proportion of risky assets such as bonds in his portfolio, he will be earning a high average return but will bear a higher degree of risk. Tobin argues that a risk averter will not opt for such a portfolio with all risky bonds or a greater proportion of them.

On the other hand, a person who, in his portfolio of wealth, holds only safe and riskless assets such as money (in the form of currency and demand deposits in banks) he will be taking almost zero risk but will also be having no return and as a result there will be no growth of his wealth. Therefore, people generally prefer a mixed diversified portfolio of money, bonds and shares, with each person opting for a little different balance between riskiness and return.

It is important to note that a person will be unwilling to hold all risky assets such as bonds unless he obtains a higher average return on them. In view of the desire of individuals to have both safety and reasonable return, they strike a balance between them and hold a mixed and balanced portfolio consisting of money (which is a safe and riskless asset) and risky assets such as bonds and shares though this balance or mix varies between various individuals depending on their attitude towards risk and hence their trade-off between risk and return.

Tobin's Liquidity Preference Function:

Tobin derived his liquidity preference function depicting relationship between rate of interest and demand for money (that is, preference for holding wealth in money form which is a safe and

“riskless” asset. He argues that with the increase in the rate of interest (i.e. rate of return on bonds), wealth holders will be generally attracted to hold a greater fraction of their wealth in bonds and thus reduce their holding of money.

That is, at a higher rate of interest, their demand for holding money (i.e., liquidity) will be less and therefore they will hold more bonds in their portfolio. On the other hand, at a lower rate of interest they will hold more money and less bonds in their portfolio.

This means, like the Keynes’s speculative demand for money, in Tobin’s portfolio approach demand function for money as an asset (i.e. his liquidity preference function curve) slopes downwards as is shown in Figure. 2.5, where on the horizontal axis asset demand for money is shown. This downward-sloping liquidity preference function curve shows that the asset demand for money in the portfolio increases as the rate of interest on bonds falls.

In this way Tobin derives the aggregate liquidity preference curve by determining the effects of changes in interest rate on the asset demand for money in the portfolio of individuals. Tobin’s liquidity preference theory has been found to be true by the empirical studies conducted to measure interest elasticity of the demand for money.

As shown by Tobin through his portfolio approach, these empirical studies reveal that aggregate liquidity preference curve is negatively sloped. This means that most of the people in the economy have liquidity preference function similar to the one shown by curve M_d in Fig. 2.5.

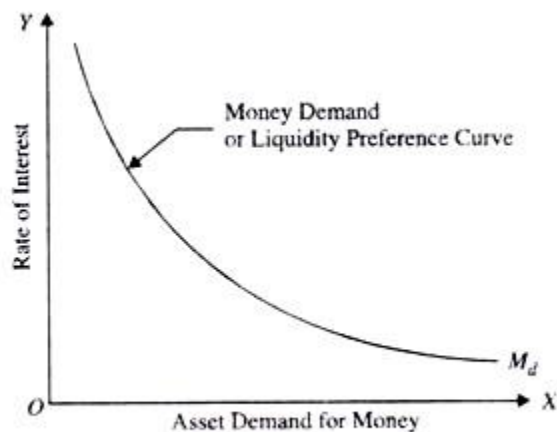


Figure 2.5 | Tobin's Liquidity Preference Curve

Tobin’s approach has done away with the limitation of Keynes’ theory of liquidity preference for speculative motive, namely, individuals hold their wealth in either all money or all bonds. Thus, Tobin’s approach, according to which individuals simultaneously hold both money and bonds but in different proportion at different rates of interest yields a continuous liquidity preference curve.



Further, Tobin's analysis of simultaneous holding of money and bonds is not based on the erroneous Keynes's assumption that interest rate will move only in one direction but on a simple fact that individuals do not know with certainty which way the interest rate will change.

It is worth mentioning that Tobin's portfolio approach, according to which liquidity preference (i.e. demand for money) is determined by the individual's attitude towards risk, can be extended to the problem of asset choice when there are several alternative assets, not just two, of money and bonds.

2. Baumol's Inventory Approach to Transactions Demand for Money:

Instead of Keynes's speculative demand for money, Baumol concentrated on transactions demand for money and put forward a new approach to explain it. Baumol explains the transaction demand for money from the viewpoint of the inventory control or inventory management similar to the inventory management of goods and materials by business firms.

As businessmen keep inventories of goods and materials to facilitate transactions or exchange in the context of changes in demand for them, Baumol asserts that individuals also hold inventory of money because this facilitates transactions (i.e. purchases) of goods and services.

In view of the cost incurred on holding inventories of goods there is need for keeping optimal inventory of goods to reduce cost. Similarly, individuals have to keep optimum inventory of money for transaction purposes. Individuals also incur cost when they hold inventories of money for transactions purposes.

They incur cost on these inventories as they have to foregone interest which they could have earned if they had kept their wealth in saving deposits or fixed deposits or invested in bonds. This interest income forgone is the cost of holding money for transactions purposes. In this way Baumol and Tobin emphasized that transaction demand for money is not independent of the rate of interest.

It may be noted that by money we mean currency and demand deposits which are quite safe and riskless but carry no interest. On the other hand, bonds yield interest or return but are risky and may involve capital loss if wealth holders invest in them.

However, saving deposits in banks, according to Baumol, are quite free from risk and also yield some interest. Therefore, Baumol asks the question why an individual holds money (i.e. currency and demand deposits) instead of keeping his wealth in saving deposits which are quite safe and earn some interest as well.

According to him, it is for convenience and capability of it being easily used for transactions of goods that people hold money with them in preference to the saving deposits. Unlike Keynes both Baumol and Tobin argue that transactions demand for money depends on the rate of interest.



People hold money for transaction purposes “to bridge the gap between the receipt of income and its spending.” As interest rate on saving deposits goes up people will tend to shift a part of their money holdings to the interest-bearing saving deposits.

Individuals compare the costs and benefits of funds in the form of money with the interest-bearing saving deposits. According to Baumol, the cost which people incur when they hold funds in money is the opportunity cost of these funds, that is, interest income forgone by not putting them in saving deposits.

Tobin’s Portfolio Balance Approach (With Diagram) | Demand for Money

Let us make an in-depth study of the Tobin’s Portfolio Balance Approach.

The main problem with Keynesian approach to the demand for money is that it suggests that individuals should, at any given time, hold all their liquid assets either in money or in bonds, but not some of each. This is obviously not true in reality. The second approach — Tobin’s model of liquidity preference — deals with this problem by showing that if the return on bonds is uncertain, that is, bonds are risky, then the investor worrying about both risk and return is likely to do best by holding both bonds and money.

Portfolio theories like the one presented by Tobin emphasizes the role of money as a store of value. According to these theories, people hold money as part of their portfolio of assets. The reason for this is that money offers a different combination of risk and return than other assets which are less liquid than money — such as bonds. To be more specific, money offers a safe (nominal) return, whereas the prices of stocks and bonds may rise or fall. Thus Tobin has suggested that households choose to hold money as part of their optimal portfolio.

Portfolio theories predict that the demand for money depends on the risk and return associated with money holding as also on various other assets households can hold instead of money. Furthermore, the demand for money should depend on real wealth, because wealth measures the size of the portfolio to be allocated among money and the alternative assets.

For instance, the money demand function may be expressed as:

$$(M/P)_d = f(rs, r_b, \pi_e, W)$$

where r_s = the expected real return on stock, r_b = the expected real return on bonds, π_e = the expected inflation rate and W = real wealth. An increase in r_s or r_b reduces money demand, because other assets become more attractive. An increase in π_e also reduces money demand, because money becomes less attractive. An increase in W raises money demand, because higher wealth means a larger portfolio.

It is against this backdrop that we study the portfolio theory of money demand.

Speculative Demand for Money as Behaviour toward Risk:

Tobin ignored the determination of the transactions demand for money and considered only the demand for money as a store of wealth. The focus is on an individual's portfolio allocation between money-holding and bondholding, subject to the wealth constraint, i.e., $W = M + B$, where W is the total fixed wealth, M is money and B is bond.

In Tobin's theory there is no such thing as fixed normal level to which interest rates are always expected to return as has been postulated by Keynes. Following Tobin, we can assume that the expected capital gain is zero. This is because the individual investor expects capital gains and losses to be equally likely.

The best expectation of the return on bonds is simply the prevailing market rate of interest (r). But this is just the expected return on bonds. The actual return also includes some capital gain or loss, since the interest rate does not generally remain fixed. Thus, bonds pay an expected return of interest, but they are a risky asset. Their actual return is uncertain due to the fact that the market rate of interest fluctuates even in the short run.

In contrast, money is a safe asset because it yields no return at all. At the same time money is a safe asset since no capital gain or loss is made by holding money. In Tobin's view an individual will hold some proportion of wealth in money for reducing the overall riskiness of his portfolio. If only bonds are held, returns would be maximum no doubt but the risk to which the investor is exposed will also be maximum. A risk-averse investor would voluntarily sacrifice some return for a reduction in risk. Tobin argues that money as an asset is demanded as an aversion to risk.

Tobin's theory is explained in Figure 2.6. On the vertical axis of the upper quadrant we measure the expected return to the portfolio; on the horizontal axis we measure the riskiness of the portfolio. The expected return on the portfolio is the interest that can be earned on bonds.

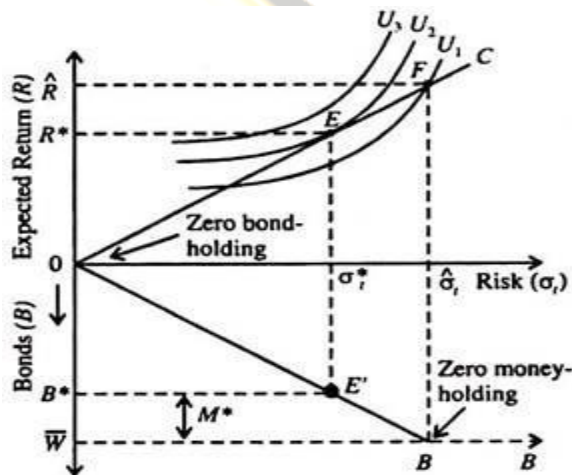


Fig. 19.4 Determination of Optimal Portfolio Figure 2.6



This depends on two things: (i) the interest rate and (ii) the proportion of the portfolio held in bonds. The total risk to which an individual is exposed depends on (i) the uncertainty concerning bond prices — that is, the uncertainty concerning future movements in market rate of interest, and (ii) the proportion of the portfolio held in bonds.

Let us denote the expected total return by R and the total risk of the portfolio as σ . If an individual holds all his wealth (W) in money and none in bonds, i.e., $W = M + 0$, both R and σ will be zero, as shown by the origin (point 0) in Figure 1. With an increase in the proportion of bonds, i.e., $W = M + B$; as M falls and B increases, R and σ , will both rise.

The opportunity line C is a locus of points showing the terms on which the individual investor can increase R at the cost of increasing σ . A movement along C from left to right shows that the investor increases his bond holding only by reducing his money holding.

The lower quadrant of Figure 2.6 shows alternative portfolio allocations, resulting in different combinations of R and σ . The vertical axis measures bond holding. The amount of bonds (B) held in W increases as the investor moves down the vertical axis to a maximum of W .

The difference between W and B is the asset demand for money (M). The line OB in the lower part of the diagram shows the relationship between σ , and B . As the proportion of B in W increases, σ also increases. This means that as the proportion of bonds in the portfolio increases, the total risk of the portfolio increases, too.

Preference of the Investor: Risk-Aversion:

The optimal portfolio allocation depends on the preferences of the investor. Here we assume that the investor is risk-averse. He wants the best of both the worlds — a high return on the portfolio by avoiding risk. He will accept more risk if he is compensated by an increase in expected return. Let us assume that the utility function of the investor is $U = f(R, \sigma) \dots(9)$

where an increase in R increases utility (U) and an increase in σ reduces U . In Fig. 19.4 we show three indifference curves of the investor for three levels of utility U_1 , U_2 and U_3 . Each indifference curve shows the risk-return trade-off, i.e., the terms on which the investor is desirous of taking more risk if compensated by a higher expected return.

All the points on any such indifference curve yield the same fixed level of utility.

Any movement from U_1 to U_2 and from U_2 to U_3 implies higher level of utility, i.e., higher levels of R and the same or even lower levels of σ . The indifference curves are upward sloping because the investor is risk-averse. He will take more risk only if compensated by a higher return. Moreover, the curves become steeper as the investor moves to the right, implying increasing risk aversion.



If we make this assumption, then the more risk the individual has already taken on, the greater will be the increase in expected return required for the investor to be exposed to a greater degree of risk. We may now determine the optimal portfolio allocation of a risk averse investor.

Optimal Portfolio Allocation:

A risk-averse investor will move to that point along the line C which enables him to reach the highest attainable indifference curve. At that point he ends up choosing that portfolio which he intends to choose and, thus, maximizes his utility. The reason is obvious. At the

tangency point E, with $R = R^*$ and $\sigma = \sigma^*$, the terms on which the investor is able to increase expected return on the portfolio by taking more risk, shown by the slope of the line C, is equated to the terms on which he (she) is willing to make the trade-off, as is measured by the slope of the indifference curve.

From the lower part we see that this risk-return combination is achieved by holding an amount of bonds equal to B^* , and by holding the remainder of wealth ($\bar{W} - B^* = M^*$) in the form of money.

The demand for money thus shows the investor's 'behaviour towards risk', i.e., the result of seeking to reduce risk below what it would be if $\bar{W} = B$ and $M = 0$. In Fig. 19.4 such an all-bonds-portfolio would be associated with risk of σ and the expected return of R , as shown by point F in the upper part of the diagram.

This portfolio yields a lower level of utility than that represented by bond holdings of B^* and money holdings of M^* .

The reason is that as the investor moves to the right of point E along the line OC, the additional return expected from the portfolio by holding more bonds (and less money) is not adequate to compensate the investor for the additional risk (the slope of the line OC is less than that of the indifference curve U2). The movement to point F takes the investor to a lower indifference curve, U1.

Interest Rate Changes and the Speculative Demand for Money:

In Tobin's theory the amount of money held as an asset depends on the level of the interest rate. Figure 2 shows the relationship between interest rate and asset demand for money. An increase in the rate of interest from r_0 to r_1 and then to r_2 will improve the terms on which the expected return on the portfolio can be increased by taking more risk.

So the line OC becomes steeper. It rotates anticlockwise from $C(r_0)$ to $C(r_1)$ and then to $C(r_2)$.

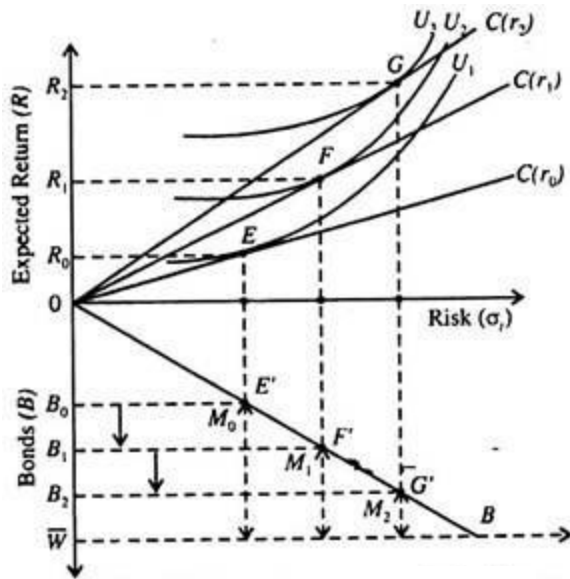


Fig. 19.5 Speculative | Figure 2.7
and the Rate of Interest

The investor responds by taking more risk and earning higher expected returns by moving from E to F and then to G. It may be noted that each point is one of portfolio optimization. In this case his holdings of bonds (risky asset) increase (from B_0 to B_1 , and then to B_2) and money holdings fall (from M_0 to M_1 , then M_2).

In short, as the interest rate rises, a given increase in risk, which corresponds to a given increase in the amount of bonds in the portfolio, will result in a greater increase in expected return on the portfolio. The box below presents a formal derivation of Tobin's mean-variance model of bond demand.

Box: Formal Derivation of Tobin's mean-variance model of bond demand

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

$$RB = i + g$$

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

Tobin also assumes that the expected capital gain is zero⁵ and that its variance is δ_g^2

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

$$\text{Var}(g) = E[g - E(g)]^2 = E(g^2) = \delta_g^2$$

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:

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

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

$$\mu = E(R) = E(ARB) = AE(RB) = Ai$$

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

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

yields:
$$A = \frac{1}{\sigma_g} \sigma \quad (2)$$

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

$$\mu = \frac{i}{\sigma_g} \sigma \quad (3)$$

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 $\frac{i}{\sigma_g}$.

It is drawn in the top half of Figure 3, along with the indifference curves which shows *returns on bonds and risk* (μ and σ) that satisfies the individual.

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 $\frac{i}{\sigma_g}$. 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.

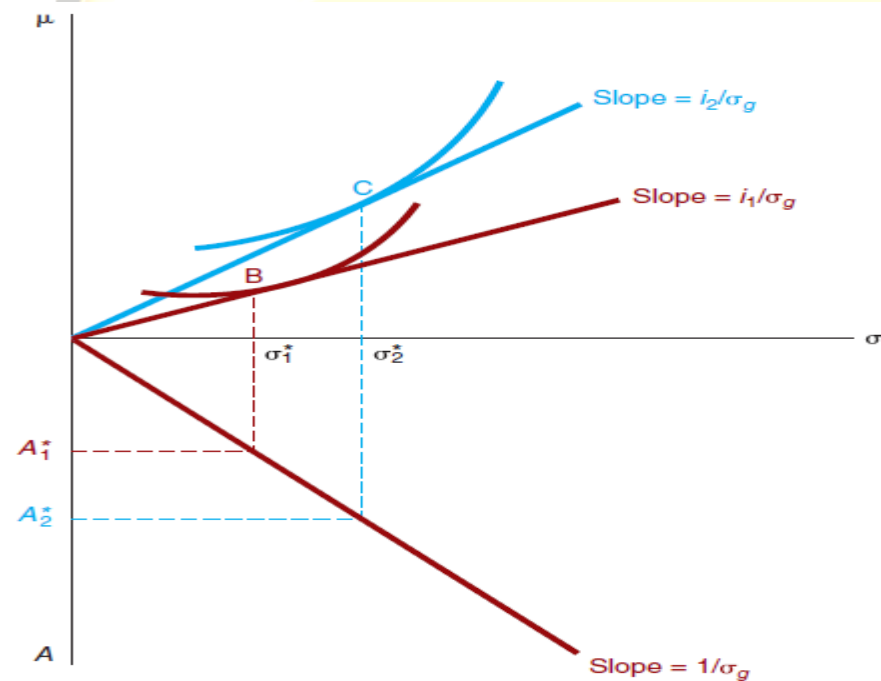
Now what happens when the interest rate falls from i_2 to i_1 .

This situation is shown in the Figure below. 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 decrease as i decreases.

Thus, the opportunity locus rotates down and we move from point C to point B at the tangency of the new opportunity locus and the indifference curve.

As is shown it is shown in the graph. the optimal level of risk decreases from σ_2^* to σ_1^* , and the optimal fraction of the portfolio held in bonds falls from A_2^* to A_1^* .

The result is that as the interest rate on bonds falls, the demand for money increase; that is, $1 - A$, the fraction of the portfolio held as money, increases.





2. Baumol's Analysis of Transactions Demand:

This section presents Baumol's (1952) version of the inventory analysis of the transactions demand for money. This analysis considers the choice between two assets, "money" and "bonds," whose discriminating characteristic is that money serves as the medium for payments in the purchase of commodities whereas bonds do not; hence, commodities trade against money, not against bonds. There is no uncertainty in the model, so the yield on bonds is known with certainty. The real-world counterpart of such bonds is interest-paying savings deposits or such riskless short-term financial assets as Treasury bills. Longer-term bonds whose yield is uncertain are not really considered in Baumol's analysis. Baumol's other assumptions are:

Money holdings do not pay 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. Bonds can be savings deposits or other financial assets.

There is no uncertainty even in the timing or amount of the individual's receipts and expenditures.

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. Since money is the medium of payments in the model, all payments are made in money.

The individual intends to cash bonds in lots of $\$W$ spaced evenly through the period.

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 from bonds. The overall cost per withdrawal of $\$W$ is $\$(B_0 + B_1W)$.

Since the individual starts with $\$Y$ and spends it in a continuous even stream over the period, 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 $\frac{1}{2}W$. These propositions are shown in Figures 1 and 2. In Figure 1, for expenditures over one period, the triangle OY_1 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.



Figure 2.8

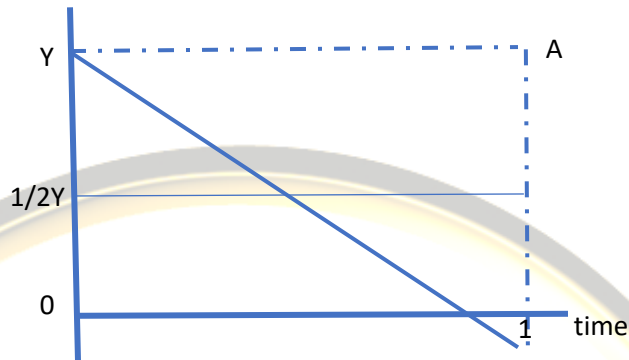
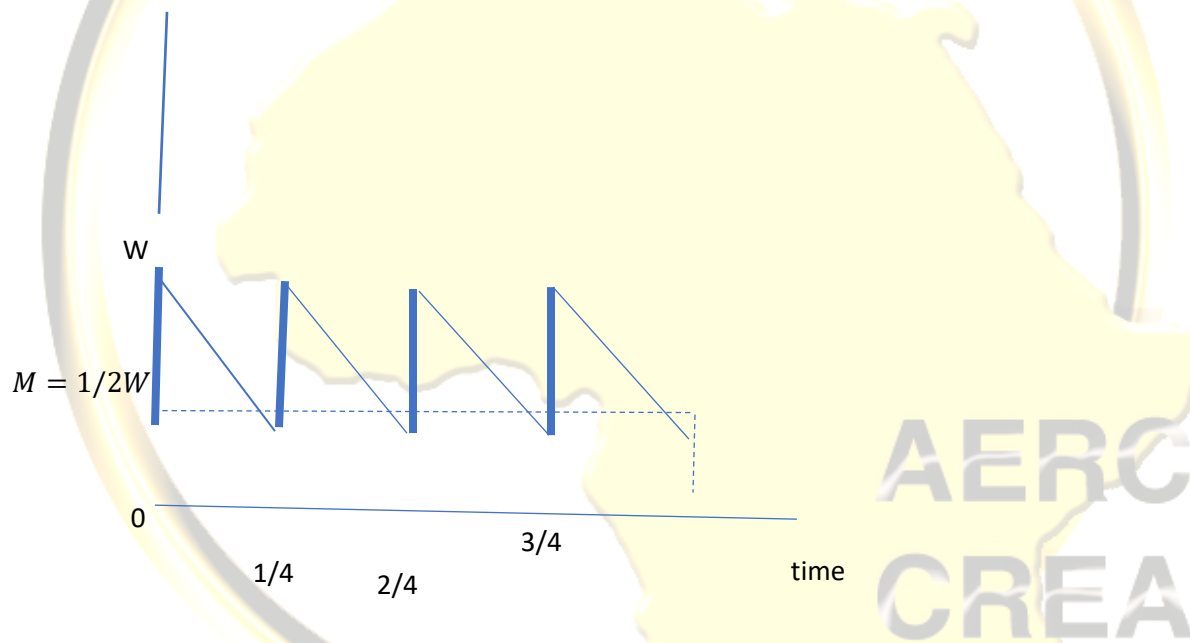


Figure 2.9



Over the period $0Y1$ equals $\frac{1}{2}Y$ and would be held in either money or bonds. Figure 2.9 focuses on money holdings. To illustrate, assuming that the period is divided into 4 weeks, the amount $\$W$ is withdrawn at the beginning of each week and spent evenly through the week. The average money balances over the period are only $\frac{1}{2}W$, and, from Figures 2.8 and 2.9, the average bond holdings over the period are $(\frac{1}{2}Y - \frac{1}{2}W)$.

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 $[(B_0 + B_1W)n]$. In addition, the interest foregone



by holding money rather than bonds is RM . Since $M = \frac{1}{2}W$, this interest cost equals $RW/2$.

The total opportunity cost C of financing Y of expenditures in this manner is the sum of the cost of withdrawing Y from investments and the interest foregone in holding average money balances of $(W/2)$. Hence,

$$\begin{aligned} C &= RM + (B_0 + B_1)n \\ &= RW/2 + B_0 \cdot Y / W + B_1 Y \end{aligned} \quad (1)$$

If the individual acts rationally in trying to meet his payments Y at minimum cost, he will minimize the cost C of holding transactions balances. To do so, set the derivative of (1) with respect to W equal to zero. This yields:

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

so that:

$$W = [2B_0 \cdot Y / R]^{1/2} \quad (3)$$

and

$$M^{tr} = \frac{1}{2}W = (\frac{1}{2}B_0)^{1/2} Y^{1/2} R^{-1/2} \quad (4)$$

where we have inserted the superscript tr to emphasize that (4) specifies only the transactions demand for money and does not include the money demand that would arise for speculative and other motives. (4) is called the square root formula in inventory analysis and has the easily identifiable form of a Cobb–Douglas function. In the present analysis, it specifies the

demand for transactions balances for a cost-minimizing individual. The preceding demand function is clearly different from Keynes's demand function for transactions balances and, among other things, indicates that the demand for transactions balances depends upon the nominal rate of interest. The properties of this demand function, showing its response to changes in the real levels

of expenditures, interest rates and prices, are discussed below. Brokerage costs are the prices charged for brokerage services, which are commodities (i.e. “goods and services”), so that:

let $B_0 = P.b_0$ and $B_1 = P.b_1$, where b_0 and b_1 are the elements of the brokerage charge in real terms,

whereas B_0 and B_1 were nominal brokerage charges, and P is the price level. The reason for expressing brokerage costs in this way is that the brokerage services related to money withdrawals from earning assets are themselves commodities and, from a rigorous viewpoint, if the prices of all commodities double, the brokerage cost must also double. Hence, both B_0 and B_1 must be taken to increase in the same proportion as the commodity price level P .

Therefore, equation (4) can be rewritten as:

$$M_{tr,d} = (\frac{1}{2}b_0)^{\frac{1}{2}} P y^{\frac{1}{2}} R^{-\frac{1}{2}} \quad (5)$$

and

$$M_{tr,d}/P = m_{tr} = (\frac{1}{2}b_0)^{\frac{1}{2}} y^{\frac{1}{2}} R^{-\frac{1}{2}}$$

Therefore, the elasticities of the transactions demand for money with respect to y , R and P , are:

$$E_{m,y} = \frac{1}{2}; E_{m,R} = -\frac{1}{2}; E_{m,P} = 1; E_{m,P} = 0$$

The profitability of Holding Money and Bonds for Transactions

Based on the Baumol-Tobin model of the transaction demand for money, assume that a person has income/expenditure $\$Y$, Bond savings B which earns interest R , money holdings M and cash bonds cash bonds in lots of $\$W$ spaced evenly through the period. If 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, derive an expression for the optimal number of trips (n^*) that minimizes the total cost.



The average nominal holdings B of bonds are equal to $(\frac{1}{2}Y - M)$, where, as before, M equals $\frac{1}{2}W$. 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 π from using the combinations of money and bonds is given by:

$$\begin{aligned} \pi &= \text{interest income from bonds} - \text{brokerage expenses} \\ &= R \cdot B - (B_0 + B_1 W)^n \\ &= R \left\{ \frac{1}{2}Y - M \right\} - \left\{ \frac{1}{2}B_0 Y / M + B_1 Y \right\} \dots\dots\dots(1) \end{aligned}$$

Maximizing (1) with respect to M yields the first-order maximizing condition as:

$$\frac{\partial \pi}{\partial M} = -R + \frac{1}{2}B_0 Y / M^2 = 0 \dots\dots\dots(2)$$

Hence, as in,

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

Further,

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

where the superscript tr on B emphasizes that this demand for bonds is only for transactions purposes. Hence, from (1),

$$\begin{aligned} \pi &= R \left\{ \frac{1}{2}Y - ((\frac{1}{2}B_0)^{\frac{1}{2}} Y^{\frac{1}{2}} R^{-\frac{1}{2}}) \right\} - \left\{ (\frac{1}{2}B_0) Y / [((\frac{1}{2}B_0)^{\frac{1}{2}} Y^{\frac{1}{2}} R^{-\frac{1}{2}}) + B_1 Y] \right\} \dots\dots\dots(3) \\ &= \frac{1}{2}RY - ((\frac{1}{2}B_0)^{\frac{1}{2}} Y^{\frac{1}{2}} R^{\frac{1}{2}}) - \left\{ ((\frac{1}{2}B_0)^{\frac{1}{2}} Y^{\frac{1}{2}} R^{\frac{1}{2}}) \right\} - B_1 Y \\ &= \frac{1}{2}RY - 2((\frac{1}{2}B_0)^{\frac{1}{2}} Y^{\frac{1}{2}} R^{\frac{1}{2}}) - B_1 Y \end{aligned}$$

Simplifying, we get:

$$\begin{aligned} \pi &= \frac{1}{2}RY - 2RM - B_1 Y \\ &= (\frac{1}{2}R - B_1)Y - 2RM \dots\dots\dots(4) \end{aligned}$$

ii) Equation (4) derived from the profit function above implies the following:

- 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. Further, 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 $R > 2B_1$.

-In equation (4), π is non-positive if $R = 0$ or if the total brokerage charges exceed the income from holding bonds. The latter would occur if the brokerage costs are relatively high. Note in this regard that the brokerage costs include both the charges explicitly levied by financial institutions and any other costs of conversion from bonds to money. The latter include the time and inconvenience, etc. – sometimes referred to as the “shoe-leather costs”

1.2.3 Friedman's Restatement of the Quantity Theory of Money

A noted monetarist economist Friedman put forward demand for money function which plays an important role in his restatement of the quantity theory of money and prices. Friedman believes that money demand function is most important stable function of macroeconomics. He treats money as one type of asset in which wealth holders can keep a part of their wealth. Business firms view money as a capital good or a factor of production which they combine with the services of other productive assets or labour to produce goods and services. Thus, according to Friedman, individuals hold money for the services it provides to them. It may be noted that the service rendered by money is that it serves as a general purchasing power so that it can be conveniently used for buying goods and services.

His approach to demand for money does not consider any motives for holding money, nor does it distinguish between speculative and transactions demand for money. Friedman considers the demand for money merely as an application of a general theory of demand for capital assets. Like other capital assets, money also yields return and provides services. He analyses the various factors that determine the demand for money and from this analysis derives demand for money function. Note that the value of goods and services which money can buy represents the real yield on money. Obviously, this real yield of money in terms of goods and services which it can purchase will depend on the price level of goods and services.

Besides money, bonds are another type of asset in which people can hold their wealth. Bonds are securities which yield a stream of interest income, fixed in nominal terms. Yield on bond is the coupon rate of interest and also anticipated capital gain or loss due to expected changes in the market rate of interest.

Equities or Shares are another form of asset in which wealth can be held. The yield from equity is determined by the dividend rate, expected capital gain or loss and expected changes in the price level. The fourth form in which people can hold their wealth is the stock of producer and durable consumer commodities.



These commodities also yield a stream of income but in kind rather than in money. Thus, the basic yield from commodities is implicit one. However, Friedman also considers an explicit yield from commodities in the form of expected rate of change in their price per unit of time.

Friedman's nominal demand function (M_d) for money can be written as

$$M_d = f(W, h, r_m, r_b, r_e, P, \Delta P/P, U)$$

As demand for real money balances is nominal demand for money divided by the price level, demand for real money balances can be written as

$$M_d/P = f(W, h, r_m, r_b, r_e, P, \Delta P/P, U)$$

Where M_d stands for nominal demand for money and M_d/P for demand for real money balances, W stands for wealth of the individuals, h for the proportion of human wealth to the total wealth held by the individuals, r_m for rate of return or interest on money, r_b for rate of interest on bonds, r_e for rate of return on equities, P for the price level, $\Delta P/P$ for the change in price level {i.e. rate of inflation), and U for the institutional factors.

1. Wealth (W):

The major factor determining the demand for money is the wealth of the individual (W) In wealth Friedman includes not only non-human wealth such as bonds, shares, money which yield various rates of return but also human wealth or human capital. By human wealth Friedman means the value of an individual's present and future earnings.

Whereas non-human wealth can be easily converted into money, that is, can be made liquid. Such substitution of human wealth is not easily possible. Thus human wealth represents illiquid component of wealth and, therefore, the proportion of human wealth to the non-human wealth has been included in the demand for money function as an independent variable. Individual's demand for money directly depends on his total wealth. Indeed, the total wealth of an individual represents an upper limit of holding money by an individual and is similar to the budget constraint of the consumer in the theory of demand.

The greater the wealth of an individual, the more money he will demand for transactions and other purposes. As a country, becomes richer, its demand for money for transaction and other purposes will increase. Since as compared to non- human wealth, human wealth is much less liquid, Friedman has argued that as the proportion of human wealth in the total wealth increases, there will be a greater demand for money to make up for the illiquidity of human wealth.

2. Rates of Interest or Return (r_m, r_b, r_e):



Friedman considers three rates of interest, namely, r_b , r_e and r_m , which determine the demand for money, r_m is the own rate of interest on money. Note that money kept in the form of currency and demand deposits does not earn any interest.

But money held as saving deposits and fixed deposits earns certain rates of interest and it is this rate of interest which is designated by r_m in the money demand function. Given the other rates of interest or return, the higher the own rate of interest, the greater the demand for money.

In deciding how large a part of his wealth to hold in the form of money the individual will compare the rate of interest on money with rates of interest (or return) on bonds and other assets. As mentioned earlier, the opportunity cost of holding money is the interest or return given up by not holding these other forms of assets.

As rates of return on bond (r_b) and equities (r_e) rise, the opportunity cost of holding money will increase which will reduce the demand for money holdings. Thus, the demand for money is negatively related to the rate of interest (or return) on bonds, equities and other such non-money assets.

3. Price Level (P):

Price level also determines the demand for money balances. A higher price level means people will require a larger nominal money balances in order to do the same amount of transactions, that is, to purchase the same amount of goods and services.

If income (Y) is used as proxy for wealth (W) which, as stated above, is the most important determinant of demand for money, then nominal income is given by $Y.P$ which becomes a crucial determinant of demand for money.

Here Y stands for real income (i.e. in terms of goods and services) and P for price level. As the price level goes up, the demand for money will rise and, on the other hand, if price level falls, the demand for money will decline. As a matter of fact, people adjust the nominal money balances (M) to achieve their desired level of real money balances (M/P).

4. The Expected Rate of Inflation ($\Delta P/P$):

If people expect a higher rate of inflation, they will reduce their demand for money holdings. This is because inflation reduces the value of their money balances in terms of its power to purchase goods and services.

If the rate of inflation exceeds the nominal rate of interest, there will be negative rate of return on money. Therefore, when people expect a higher rate of inflation they will tend to convert their money holdings into goods or other assets which are not affected by inflation.



On the other hand, if people expect a fall in the price level, their demand for money holdings will increase.

5. Institutional Factors (U):

Institutional factors such as mode of wage payments and bill payments also affect the demand for money. Several other factors which influence the overall economic environment affect the demand for money. For example, if recession or war is anticipated, the demand for money balances will increase.

Besides, instability in capital markets, which erodes the confidence of the people in making profits from investment in bonds and equity shares will also raise the demand for money. Even political instability in the country influences the demand for money. To account for these institutional factors Friedman includes the variable U in his demand for money function.

Simplifying Friedman's Demand for Money Function:

A major problem faced in using Friedman's demand for money function has been that due to the non-existence of reliable data about the value of wealth (W), it is difficult to estimate the demand for money. To overcome this difficulty Friedman suggested that since the present value of wealth or $W = Y_p/r$ (where Y_p is the permanent income and r is the rate of interest on money.), permanent income Y_p can be used as a proxy variable for wealth.

Incorporating this in Friedman's demand for money function we have:

$$M_d = (Y_p, h, r_m, r_b, r_e, \Delta P/P, U)$$

If, we assume that no price change is anticipated and institutional factors such as h and U remain fixed in the short run and also all the three rates of interest return are clubbed into one, Friedman's demand for money function is simplified to

$$M_d = f(Y_p, r)$$

Since the demand function is derived from the consumer's utility function, which represents the individual's tastes, shifts in these tastes will shift the demand function. Friedman sought to take account of such shifts by incorporating a variable u for "tastes/preferences" in the demand function. Substituting y_p for w , taking r to be proxied by the various interest rates and adding the new variable u for tastes/preferences, in the manner of Friedman's article, the demand function for real balances becomes:



$$m_d = M_d/P = m_d(r_1, \dots, r_n, \pi, y_p, HW/NHW, u)$$

Note that this demand for money is essentially derived from the notion of money as an asset – that is, a store of value – and that permanent income appears in it as a proxy for wealth. Note also that HW/NHW is the same as h i.e., ratio of human to non-human wealth

The role of velocity

Since the velocity of circulation V equals Y/M , and M in equilibrium equals M_d , we have:

$$v = \frac{y}{m_d(r_1, \dots, r_n, \pi, Y_p, \frac{HW}{NHW}, u)}$$

where both the numerator and the denominator on the right-hand side of the equation are real variables, so that their ratio is also a real variable. The preceding equation implies that, for Friedman, velocity was not a constant but a real variable, which depended upon the real yields on alternative assets and other variables. Except for the introduction of permanent income instead of current income as a determinant on the right side, (24) was consistent with the Keynesian tradition. The essential difference between Friedman and Keynes was on the stability of the velocity function: Friedman asserted that velocity was a function of a few variables and the velocity function was stable, whereas, for Keynes, the velocity function possessed, by virtue of the volatile nature of the subjective probabilities on bond returns, the potential for being unstable and its shifts unpredictable.

What then are the main differences between the Keynes' and Friedman's Money Demand Theory

The difference between the Keynes' and Friedman's money demand theory are captured in the following points discussed below:



While the Keynes believed that the demand for money was unstable because of changing investor confidence, the Monetarists on the other hand believed that the demand for money was stable, implicitly because the increase in one kind of rate of return would tend to be matched by a decrease in another. For example, if the rate of return on shares goes up, individuals will buy more shares and as a result the rate of returns on bonds will decrease causing them to reduce their bonds purchases.

Keynes stated that there were different types of demand for money: transactional, precautionary and speculative. The Monetarists on the other hand believe that, people demand money for its usefulness as an asset and that difference in the types of demand were not material.

To Keynes, wealth was composed of cash and a homogenous category of interest earning assets called bonds, but to the Monetarists, there were different rates of return for different financial assets, e.g. bonds, equities and durable goods. You will recognize that Keynes' definition for wealth is narrow since he concentrated only on bonds and money but Friedman focused on other interest earning assets individuals hold. This implies that when there is excess supply of money asset holder will like to buy bonds, shares or durables.

In the nutshell we can say that, Friedman's demand for money theory differs from Keynes' in three ways: First, Friedman views the money demand function as stable. Second, Friedman does not segment money demand into components representing transactions balances, speculative demand and precautionary demand. Third, Friedman does not lump all assets under one category, i.e., bonds. Rather, he focuses on separate yields for bonds, equities, and durable goods. Thus, from this point on we do not have to be restricted to bonds vs. money.

Restating the Cambridge equation, the Monetarist theory of money demand becomes:

$$M^d = k(r_B, r_E, r_D)PY \dots\dots\dots(8)$$

where k is no longer a constant as in the classical model but rather a variable dependent on different rates of return. An increase in any of the rate of return will cause k to fall but on balance it remains stable because changes in other components of k will offset the initial change in k, so it remains relatively stable. From Friedman's view every quantity theorist must believe that the money demand function is stable and this function plays an important role in determining economic activity, and that the quantity of money is strongly affected by money supply factors.

For equilibrium in the money market, demand for money equals supply of money:

$$M^s = M^d = k(r_B, r_E, r_D)PY \dots\dots\dots(9)$$

Given the Monetarist assumption that the demand for money was stable an increase in the money supply would require either that nominal income (PY) rise or that rB, rE, rD fall causing k to



rise. But if k does not change, then we would expect the direction of change in nominal income (PY) to be the same as the change in the money supply. This would confirm the proposition that the quantity of money is important in determining nominal income.

As we saw under the Cambridge equation with k as a constant and money supply (M_s) fixed by the monetary authorities a theory of nominal income results with:

$PY = (1/k) M_s$, i.e., nominal income (PY) is equal to one over k times the money supply.

1.2.4 Microfoundations of Money: The Representative Agents (Households and Firms)

Introduction

In this section we will look at microfoundations of money and ways of introducing money into a neoclassical model and how these methods can be developed in an effort to try and explain certain facts. As in previous lectures, we shall find that while we can develop models to improve our understanding of the business cycle we still remain some distance from a reliable model. While we introduce money in ways which break the neoclassical dichotomy, the models we look at are still partly neoclassical in nature.

The first problem with any neoclassical general equilibrium approach to business cycles when it comes to modelling monetary phenomena is how to explain why consumers need to hold money. Without a justification of why there is a demand for money it is obviously impossible to model the impact that variations in money supply will have on the economy. There are three broad approaches:

Money in the Utility Function - if utility depends upon real money balances then money is like any other good and will be demanded by consumers. However, most people are reluctant to start with this assumption as it is rather ad hoc. It is a far better modelling strategy to try and point to a reason why money is held by consumers other than it is a direct source of utility. However, that said it is well known that under certain conditions there exists an equivalence between putting money in the utility function or specifying a transactions technology which involves money.

Cash in Advance Models - this is the route which has been most thoroughly explored in the literature the assumption here is that 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



Transactions Cost (Shopping Time Technology) - in these models consumers have a choice (unlike in

They can obtain goods on credit or barter or they can purchase goods with cash. However, purchasing goods consumes resources and the more cash that an individual holds the lower these shopping costs are (e.g. they can avoid very costly bartering processes). By holding money, consumers lose any interest they would otherwise have gained on their savings, but they economize on their transactions costs.

In this lecture, I review the recent development of a microfoundations of money. To explain what a microfoundations of money about and why it is necessary, let me list the main issues in monetary economics as follows. (I) Existence and essentiality of fiat money. (II) Why would intrinsically worthless money have value? (III) Is money a good or not?

In [economics](#), the microfoundations are the [microeconomic](#) behavior of individual [agents](#), such as households or firms, that underpins an economic theory. Most early macroeconomic models, including early [Keynesian](#) models, were based on hypotheses about relationships between aggregate quantities, such as aggregate [output](#), [employment](#), [consumption](#), and [investment](#). Critics and proponents of these models disagreed as to whether these aggregate relationships were consistent with the principles of microeconomics. Therefore, in recent decades macroeconomists have attempted to combine microeconomic models of household and firm behavior to derive the relationships between macroeconomic variables. Today, many macroeconomic models, representing different theoretical points of view, are [derived by aggregating microeconomic models](#) allowing economists to test them both with macroeconomic and microeconomic data.

Three terms need to be defined —fiat money, the essentiality of money and a microfoundations of money. Fiat money is an object that circulates in the market and that has two characteristics emphasized by Wallace (1980). One is intrinsically uselessness in the sense that fiat money does not yield direct utility or facilitate production; the other is that fiat money is not backed or expected to be backed by any government policy such as taxes. According to this definition, fiat monies have been rare. Commodity monies, such as gold, silver or even seashells, have intrinsic value. Paper monies have very little intrinsic value, but they are occasionally defended by the authorities that issue them, especially in episodes of currency crises. Despite this reality, I would argue that monetary theory should not be built upon the intrinsic value of money or government intervention. Any such theory would fail to account for the additional value that money has in the market over and beyond its intrinsic value and government intervention, and hence the theory would fail to uncover the critical differences between money and other assets. On the other hand, a theory that focuses on fiat money can be extended easily to incorporate the intrinsic value that money might have, or the government intervention to which money might be exposed. Thus, fiat money should



be the primary object to be studied in monetary economics. Money is essential if it improves the efficiency of resource allocations relative to an economy without money. In this lecture, I will often use a social welfare function to measure efficiency, but sometimes Pareto efficiency will also be used. Essentiality is not a vacuous concept.

In many models, money can have a positive value in a particular equilibrium, while the equilibrium is inferior to a non-monetary equilibrium. Essentiality of money is a property to be sought for two reasons. One is that we want to know how much better money can do relative to non-monetary methods of exchange. The other is that a monetary equilibrium which is inferior to a non-monetary equilibrium could not have survived the test of time. A microfoundations of monetary economics is a theoretical framework that endogenizes the value and essentiality of fiat money by explicitly specifying the frictions that impede the functioning of markets. Such a framework must be able to trace all potential changes in the role of money to changes in the underlying environment and policy. A large class of models in monetary economics, some of which are popular for policy analysis, fail to qualify as the microfoundations of monetary economics. When a model cannot resolve fundamental issues such as existence and essentiality, one cannot give much confidence to the answers that the model gives to other questions listed above.

The quest for the microfoundations of money started formally when Kareken and Wallace (1980) edited their volume. There, Kareken and Wallace identified fiat money as the main object to be studied in monetary economics. The volume contained three specifications of monetary models that have been widely used since then. The first specification is the overlapping generations model of money originated from Samuelson (1958). Lucas' (1972) pioneering work on the neutrality of money stirred interest in this model for macroeconomists. Although Lucas focused on the positive implications of the model, he did specify the physical environment explicitly to support a role of money. The main friction in the overlapping generations model is that markets between currently alive agents and future generations do not exist. Money is a device used to trade between generations. A few papers in the Kareken-Wallace volume formally explored when this friction could give rise to a monetary equilibrium and how money affected efficiency. One drawback of the overlapping generations model of money is that the role of money is so tied to the generational structure that it can be superseded by other means of intergenerational transfers, such as social security.

Another drawback is that money has the same rate of return as other assets, unless additional ad hoc assumptions are imposed to give money a special role.



The second specification is Townsend's (1980) models of spatial separation. In these models, agents differ in the timing of receiving endowments and in the (exogenous) itineraries by which they travel across spatially separated markets. Spatial separation serves as a metaphor for the difficulties of communicating between markets and enforcing contracts. Townsend constructed three models of this kind. One model endogenously delivers a cash-in-advance constraint; the second model has a structure of overlapping generations, with agents being born at different dates but living forever; the third model allows privately issued debt to exist in the equilibrium. Because agents are differently situated, these models are suitable for studying the redistributive role of monetary policy. The main drawback of these models is that the itineraries assumed for agents are very rigid.

The third specification is the model by Bewley (1980). In that model, each agent faces idiosyncratic shocks to preferences and/or endowments. Although agents can barter perfectly within each period, they cannot enforce intertemporal contracts and, in particular, cannot enforce insurance contracts. Money serves as a device to self-insure against unfavourable shocks. However, Bewley did not model why it is difficult to enforce insurance contracts. Later developments have explained this difficulty by introducing private information regarding tastes or actions (see Green, 1987, for a non-monetary example). These models, under the label "dynamic contracts", have been widely used for examining the distribution of wealth and the redistributive consequences of policy (see Lucas, 1992). However, the efficient contracts in these models can often induce better allocations than a monetary equilibrium; that is, money is not essential.

1.2.5 The Demand for Money vis- a- viz the Demand for other Commodities

Money and Other Goods in the Economy

To consider whether money is a good or not, we need a definition of "goods." From the analysis of the behavior of individuals or households, we define a good as something of which an individual desires more rather than less, or less rather than more, *ceteris paribus*. A particular good may or may not be marketed; thus silence may be a good in the midst of overwhelming noise and yet may not be marketed.¹ From the point of view of the relevance to a market economy, only those goods that are marketed at some price or other need to be considered. Further, note that economic analysis does not ask why more of a good is desired to less of it. Therefore, it does not need to consider whether the good is in some sense beneficial or injurious for the individual, or whether there is something innate to the individual as a biological entity or something in the social or physical



environment, or any other factor, which affects the individual's desire for its acquisition. To take some odd examples, diamonds, cigarettes, drugs, labor time spent in a criminal activity, guns and bombs, etc., are all treated as goods (or "bads") in microeconomic analysis. So is money, though it is not "directly consumed" and even though its components (such as the currency of the particular country and the demand deposits in it) only constitute money by virtue of the social and economic environment that make them acceptable as a medium of payments. Note that this is also so for diamonds, as for many other commodities, whose demand arises not because they or their services are "directly used in consumption or production" but because of the social and economic environment which creates utility for them or their services. The desire of an individual to hold diamonds or real balances constitutes adequate reason for treating them as goods in his utility function. The fact that money can only be held and used at a cost only adds confirmation to the treatment of money as a good for individuals but is strictly not necessary to this treatment. From the point of view of a firm, an input (which is a type of good) is anything of which more rather than less increases (or decreases) its production. Economic theory does not ask why it does so and, therefore, does not consider whether a good "directly" enters production or whether more or less of it increases production by virtue of the environment in which the firm functions. The desire of firms to hold real balances constitutes an adequate reason for treating money as an input to their production, so that it constitutes a good for them.

Money as a Durable Good

Financial assets are durable goods in an economic sense. The concept of the economic durability of money can be quite confusing and needs clarification. The demand for money is taken to be a demand for the average money balances held by the individual in a period and is often designated as the demand for nominal balances to hold. This demand differs from the amounts that the individual would hold at various points in time during the period but is a weighted average of the latter amounts, with the weights being the duration a particular amount is held.

However, an individual may or may not hold a durable good for its transactions services. He may instead use it as a means of transferring his wealth or real purchasing power from one week to the next. Such a usage would be one of a store of value.⁵ For convenience, monetary theory has generally treated the demand for money as a medium of payments under the category of the transactions demand for money and the demand for money as a store of value (relative to other assets) as the speculative or portfolio demand for money. But any particular unit of money balances can be used for either function, and the division into the transactions and speculative balances must be taken to be an analytical division and not necessarily applicable to the real world. This chapter confines itself to general propositions on the total demand for money.

1.2.6 Money in the Utility Functions

In this section I present the basis for including money in the utility function and the formal derivation for the demand for money function. The neoclassical growth model by Ramsey (1928) and Solow (1956) provides the basic framework for modern macroeconomics. But these are models of nonmonetary economies. In order to explain monetary policy we have to introduce a monetary policy instrument. Sidrauski (1967) introduced money into the neoclassical growth model. At this time money was considered the monetary policy instrument. The model derives from Ramsey (1928): utility maximization by the representative agent

How can we introduce money?

- find explicit role for money (e.g. money is necessary to make transactions - Cash in Advance (CIA) approach, Clower (1967))
- assume money yields utility (Money in the Utility Function (MIU) - Sidrauski (1967))- MIU is simple though not very appealing. Can be rationalized by transaction demand for money. The model allows us studying:
 - impact of money (i.e. monetary policy) on the real economy,
 - impact of money on prices,
 - optimal rate of inflation.

Derivation follows (approximately) Handa (2009 and Walsh (2003);

Deriving MIUF

This subsection presents the axiomatic basis for including money in the utility function. Individuals differ in their tastes or preferences over goods and in their income or wealth. Microeconomic theory defines the “rational” individual as one whose preferences are consistent and transitive. The definitions of these terms are specified by the following

axioms of utility theory:

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. To these two axioms in the theory of the demand for commodities, monetary theory usually adds the following one:

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.

The axioms of consistency and transitivity ensure that the individual’s preferences among goods can be ordered monotonically and represented by a utility or preference function. Axiom (iii) ensures that financial assets, when considered as goods in such a utility function, should be measured in terms of their purchasing power and not their nominal quantity.

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:

$$U(.) = U(x_1, \dots, x_K, n, mh) \dots\dots\dots 1)$$

where:



x_k = quantity of the k th commodity, $k = 1, \dots, K$

n = labor supplied, in hours

m_h = average amount of real balances held by the individual or household for their liquidity services.

Note that (1) has $K+2$ goods, consisting of K commodities, labor and real balances.

Axioms (1) to (3) only specify $U(\cdot)$, an ordinal utility function. $U_k = \partial U / \partial x_k > 0$, all k , $U_n = \partial U / \partial n < 0$, $U_m = \partial U / \partial m_h > 0$. All second-order partial derivatives of $U(\cdot)$ 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.

Derivation of the demand and supply functions

To derive the individual's demand and supply functions for all goods, maximize:

$$U(\cdot) = U(x_1, \dots, x_K, n, m_h) \dots\dots\dots 2)$$

subject to:

$$\sum_k p_k x_k + (R - R_m) P m_h = A_0 + W_n, k = 1, \dots, K \dots\dots\dots 3)$$

where:

p_k = price of k th commodity

P = price level



W = nominal wage rate

A_0 = nominal value of initial endowments of commodities and financial assets.

Maximizing (2) subject to (3) gives the first-order maximizing conditions as:

$$U_k - \lambda p_k = 0, k = 1, \dots, K \dots \dots \dots (4)$$

$$U_n - \lambda W = 0 \dots \dots \dots (5)$$

$$U_m - \lambda(R - R_m)P = 0 \dots \dots \dots (6)$$

$$\sum_k p_k x_k + (R - R_m)Pm^h = A_0 + W_n \dots \dots \dots (7)$$

where λ is the Lagrangian multiplier. Equations (4) to (7) constitute a system of $K+3$ equations in the $K+3$ endogenous variables x_1, \dots, x_K, n, m^h and λ . The exogenous variables are: $p_1, \dots, p_K, W, R, R_m$ and P .

Assuming that a unique solution exists for the set of equations (4) to (7) and that the sufficiency conditions for a maximum are satisfied, the solution for the $K+3$ endogenous variables will have the general form:



$$x_k^{dh} = x_k^{dh}(p_1, \dots, p_k, W, (R - R_m)P, A_0) \quad k = 1, \dots, K \dots \dots \dots 8)$$

$$n^s = n^s(P_1 \dots \dots, p_k, W, (R - R_m)P, A_0) \dots \dots \dots 9)$$

$$m^{dh} = m^{dh}(P_1 \dots \dots, p_k, W, (R - R_m)P, A_0) \dots \dots \dots 10$$

where the superscripts d and s stand for the demand and supply functions respectively and the superscript h stands for households.

1.2.7 Shopping-Time Models

Let us now turn our attention to a situation where money enters the utility function indirectly. This is known as the Shopping-Time Model. 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. A model that leaves real balances out of the direct utility function but embodies their usage for facilitating purchases and sales of commodities is briefly specified in this subsection.

For this model, assume that only consumer goods and leisure directly yield utility. Hence, the one-period utility function $U(.)$ is:

$$\text{The one-period utility function } U(.) \text{ is: } U(.) = U(c,L) \tag{1}$$

where: c = consumption L = leisure.

Assume that $U_c, U_L > 0, U_{cc}, U_{LL} < 0$.

Note that 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.

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.

These two clearly take time. In a monetary economy, over all his purchases, 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 less than 100 percent 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. The time used for this purpose is a nuisance, would have negative marginal utility and can be labeled as “payments time” – that is, the time needed to effect the payments for the commodities bought. It is also often labeled as “shopping time”

or “transactions time.”

Leisure equals the time remaining in the day after deducting the time spent on a job and the payments time. Hence, $L = h_0 - n - nT$ (2)

where:

h_0 = maximum available time for leisure, work and transactions

n = time spent working

nT = 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:

$$nT = nT(mh, c) \quad (3)$$

where $\partial nT / \partial c > 0$ and $\partial nT / \partial mh \leq 0$.



From (2) and (3), $\partial U/\partial nT = (\partial U/\partial L)(\partial L/\partial nT) < 0$.

That is, an increase in payments time decreases leisure and therefore decreases utility. But, since an increase in the amount held and utilized of real balances decreases payments time,

$$\partial U/\partial mh = (\partial U/\partial nT)(\partial nT/\partial mh) > 0.$$

A proportional form of the payments time function is:

$$nT/c = \varphi(mh/c) \quad (4)$$

where $-\infty < \varphi \leq 0$, with φ_* as the first-order derivative of φ with respect to mh/c . Satiation in real balances occurs as $\varphi_* \rightarrow 0$. (3) implies that $\partial \varphi/\partial mh \leq 0$. Incorporating this payments time function into the utility function above (1), we have:

$$U(.) = U(c, h_0 - n - c\varphi(m/c)) \quad (5)$$

Equation (5) can be rewritten as the indirect utility function: $V(.) = V(c, n, mh)$

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

According to Handa (2009), the generic form and properties of the indirect utility function, which has real balances as a variable, are similar to those of the direct one used earlier in this. Therefore, economists who prefer its payments time justification for putting money in the utility function substitute this justification for the one given earlier for the direct MIUF, which was simply that money is in the utility function because the individual prefers more of it to less, ceteris paribus, in the environment of a monetary economy. Both justifications are acceptable. However, given the similarity of the direct and the indirect utility functions, and the relative simplicity of using the former, we revert for convenience to the direct utility function.

1.2.8 Cash-in-Advance Models (Clower 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



In what follows we shall focus entirely on cash in advance models. The basic cash in advance model is due to Lucas. 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, $P_t c_t \leq m_t$. 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 P_{t-1}/P_t , so if there is inflation money earns a negative return (it loses value).

Consumers choose their consumption, assets and money balances once they observe the state of the world (i.e. after seeing what today's money supply growth is, what the value of the current productivity shock is, etc.). 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. $P_t c_t = m_t$. This has a rather unfortunate consequence 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, the velocity of money shows considerable variation and depends in particular on the interest rate. These are features which the basic cash in advance (CIA) model cannot account for.

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 reasons.

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.

Let us now consider the following problem. Suppose that consumption or purchase can only be made in cash so that Cash-in-advance (CIA) constraint applies only on consumption good. The preference of the representative agent is

given by

$$U = \sum_{t=0}^{\infty} \beta^t \ln c_t$$

The purchase of consumption good at time t is subject to the CIA constraint

$$p_t c_t \leq m_t + w_t$$

where P_t is the price of consumption good, Q_t is the price of bonds, m_t is nominal money balance that the household carried from the previous period and w_t lump-sum-transfer equal to at the beginning of period t .

The budget constraint for the household in any period t is

$$c_t + \frac{m_{t+1}}{P_t} + \frac{Q_t B_{t+1}}{P_t} \leq \frac{m_t}{P_t} + w_t + \frac{B_t}{P_t}$$

where B_{t+1} is the total units of nominal bond demanded at time t .

Find the representative agents' optimization problem for $(c_t; m_{t+1}; B_{t+1})$ in order to maximize his inter-temporal utility function above subject to the CIA constraint and the wealth constraint.



Show that Q_t is constant that is expressed in λ_{1t} and λ_{2t}

Solution

The representative agent's problem is to choose the sequence of $(c_t; m_{t+1}; B_{t+1})$ in order to maximize his inter-temporal utility subject to CIA constraint, and the wealth/ budget constraint. Students should specify the problem as below and determine the First Order Conditions (FOCs)

$$\max_{c_t, m_{t+1}, B_{t+1}} \sum_{t=0}^{\infty} \beta^t \ln c_t$$

Subject to

$$\sum_{t=0}^{\infty} \beta^t \left[\lambda_{ct} \left(\frac{m_t + w_t}{P_t} - c_t \right) + \lambda_{mt} \left(\frac{m_t + w_t}{P_t} + \frac{B_t}{P_t} - c_t - \frac{m_{t+1}}{P_t} - \frac{Q_t B_{t+1}}{P_t} \right) \right]$$

This is then specified as:

$$\max_{c_t, m_{t+1}, B_{t+1}} \sum_{t=0}^{\infty} \beta^t \left[\ln c_t + \lambda_{ct} \left(\frac{m_t + w_t}{P_t} - c_t \right) + \lambda_{mt} \left(\frac{m_t + w_t}{P_t} + \frac{B_t}{P_t} - c_t - \frac{m_{t+1}}{P_t} - \frac{Q_t B_{t+1}}{P_t} \right) \right]$$

F.O.C

$$c_t: \frac{1}{c_t} = \lambda_{ct} + \lambda_{mt} \quad 1)$$

$$m_{t+1}: \frac{\lambda_{mt}}{P_t} = \frac{\beta}{P_{t+1}} [\lambda_{ct+1} + \lambda_{mt+1}] \quad 2)$$

$$B_{t+1}: \beta \frac{\lambda_{mt+1}}{P_{t+1}} = Q_t \frac{\lambda_{mt}}{P_t} \quad 3)$$

Combining (1) and (2) we get

$$\lambda_{mt} = \beta \frac{P_t}{P_{t+1} c_{t+1}} \quad 4)$$

From (3)

$$Q_t = \beta \frac{P_t \lambda_{mt+1}}{P_{t+1} \lambda_{mt}} \quad 5)$$



Combining (5), (4) and (2), and rewriting (1) as $c_{t+1} = \frac{1}{\lambda_{mt+1} + \lambda_{ct+1}}$

$$Q_t = \frac{\lambda_{mt+1}}{\lambda_{mt+1} + \lambda_{ct+1}}$$

1.2.9 Overlapping Generation Model

Overlapping generations (OLG) models of money, which was first introduced by Samuelson (1958), and later with major extensions by Wallace (1980, 1981) have been proposed by some economists as an alternative to the money in the MIUF). However, other economists do not consider the OLG models of money in their standard form to be valid or useful for modeling the actual role of money in the economy.

Basing our presentation on Handa (2009) and the work of Wallace (1980, 1981), we assume the standard version of the OLG model assumes that the individuals in the economy live for two periods only – or for two life-stages, “young” and “old,” with each life-stage lasting one period – and that in each period the economy has two generations of individuals. One of these is the old generation of individuals who were born in the preceding period and the other is the young generation born at the beginning of the current period. The old of one generation and the young of the next one overlap in every period, so that the name given to the models using this framework is the overlapping generations models.

The OLG framework is a substitute for a timeless or an infinite one, with the representative agent having an infinite horizon. It does not by itself provide a model, but has to be combined with other assumptions in order to yield a meaningful model.

The essential assumptions and implications of the OLG models with fiat money

The assumptions of the standard OLG models with money are:

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.

Fiat money is preferable to commodities – and any other assets – as the medium for carrying forward saving to the following period.

There is net (positive) saving in the first lifestage.



Future periods will not renounce the use of fiat money or pursue policies such that fiat money will become valueless.

The OLG model's economy has an infinite horizon, even though the individuals in it have a finite (two-period) horizon.

Given these assumptions, the OLG models of fiat money explore the value of money for various growth rates of money versus commodities, growth of population, open market operations, etc. Among the attractive features claimed for OLG models is that, along certain paths, they establish a positive value for an intrinsically worthless fiat money¹⁰ which is not required by law to be convertible into commodities, and that time and the distinctiveness of the earning pattern over a lifetime are incorporated in an “essential” manner.¹¹ Further, they allow for economic agents who are identical at birth – thus permitting the study of stationary states – while allowing for a degree of heterogeneity among the economic agents alive at any time in the economy, and also allow – indeed require – the economy to continue indefinitely into the future.

As pointed out already, 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. This is a characteristic of bootstrap or bubble paths, which are paths along which the values of the variables depend upon expected values, even if arbitrary ones, in the future and change if the latter change. The numerous equilibria of this kind are among the tenuous kind, meaning by this that they are not based on the fundamentals of the system. However, the usual focus of OLG models is not on such bootstrap or bubble paths. Rather, their implications are normally analyzed only for the stationary states of the economy, with expectations assumed to be identical with the stationary values or with those implied by the rational expectations hypothesis (REH)

The Basic OLG Model

In the standard version of the OLG framework, individuals live for two periods – that is, go through two life-stages – only. They are often labeled “young” in their first lifestage and “old” in their second lifestage. This book uses the superscripts y and o to indicate the individual's respective life-stages.



For the economy, the periods are $t+i$, $i = 0, 1, 2, \dots$. 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 $0, 1, 2, \dots$, 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, for the basic OLG model of this chapter, 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. The next chapter deviates from this assumption to examine the case where the seigniorage from money creation is used to buy up commodities that are then destroyed, resulting in a net decrease in the commodities left for consumption in the economy.

The number of individuals born in period t is N_t . In the early parts of the analysis of this section, 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 W^y in the young life-stage and w^o in the old life-stage. W^y and w^o are in units of the single consumption good, assumed in the basic model to be non-storable (perishable). Some of the versions of the OLG models assume that w^o is zero, but such an assumption is not essential to the OLG framework.

However, 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. His budget constraint for the first/young life-stage is:

$$p_t c_t^y + m_t^y = p_t w_t^y \quad c_t^y < w_t^y$$



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

$$p_{t+1}c_{t+1}^0 = p_{t+1}w_{t+1}^0 + m_{t+1}^0$$

where the money balances purchased when young, m_{yt} , become the inheritance of the old as m_{t+1} , so that $m_{yt} = m_{t+1} = m_t$.

It is noteworthy that there is no explicit interest rate in this model since the commodity is perishable and there are no interest (or coupon) paying assets in the model. The only asset 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),

$$m_t^0 = p_{t+1}c_{t+1}^0 - p_{t+1}w_{t+1}^0$$

Noting that $m_{t+1} = m_{yt}$, substitution of (2') in (1) gives the individual's lifetime budget constraint as:

$$p_t c_t^y + p_{t+1} c_{t+1}^0 = p_t w_t^y + p_{t+1} w_{t+1}^0$$

Define the individual's real lifetime wealth W_t as:

$$W_t = w_t^y + (p_{t+1}/p_t)w_{t+1}^0$$

The symbols used so far and their definitions are:



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

Since $C_t^y < W_t^y$ by assumption, the young want to transfer commodities to themselves in the future but the non-storable commodity assumption of the model prevents them doing so directly – as it were, through barter (via storage) between themselves when young and when old. Further, the auctioneer and other costless clearing mechanisms of the general Walrasian equilibrium models are excluded from the OLG models. So are state-enforced compulsory exchanges between generations, as through a government pension or social security system. Similarly excluded are private intergenerational mechanisms for transfers of commodities between generations through a private pension plan or an extended family system. The OLG models only allow the transfer of commodities over generations through trade, with the intermediation of money.

Utility Maximization by the Young

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

$$U(c_t^y, c_{t+1}^o)$$

Where $U(\cdot)$ 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:

$$\text{Maximize } U(c_t^y, c_{t+1}^o) \quad (4)$$

$$\text{subject to: } p_t c_t^y + p_{t+1} c_{t+1}^o = p_t w_t^y + p_{t+1} w_{t+1}^o \quad (3)$$

Implying the optimal consumption amounts c_t^y , c_{t+1}^o as:

$$c_t^y = c_t^y(p_{t+1}/p_t, w_t^y, w_{t+1}^o)$$

$$c_{t+1}^o = c_{t+1}^o(p_{t+1}/p_t, w_t^y, w_{t+1}^o)$$

By assumption, with $w_t^y > w_{t+1}^o$,

$$c_t^y < w_t^y$$

$$c_{t+1}^o > w_{t+1}^o$$

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_t^y in period t is given by:

$$s_t^y = w_t^y - c_t^y$$

$$= s_t^y(p_{t+1}/p_t, w_t^y, w_{t+1}^o)$$

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

$$m_t^y = p_t s_t^y = p_t s_t^y(p_{t+1}/p_t, w_t^y, w_{t+1}^o)$$

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 consumption 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

There are only two goods, the commodity and money, in this OLG model, so that the macroeconomic analysis has to take account of only the markets for money and the commodity. Further, by Walras's law, equilibrium in one of these markets ensures equilibrium in the other one, so that we need to present the analysis of one market only. We choose to focus explicitly on the money market for further analysis.

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:



$$M_t^d = N_t[p_t(w_t^y - c_t^y)] \quad (10)$$

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:

$$M_t = N_{t-1}[m_t^o] \quad (11)$$

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

$$N_t[p_t(w_t^y - c_t^y)] = M_t \quad (12)$$



$$p_t = M_t/[N_t(w_t^y - c_t^y)] \quad (13)$$

From (5), c_t^y on the right side of (12) depends on p_{t+1}/p_t , w_t^y and w_{t+1}^o , so that:

$$p_t = M_t/[N_t(w_t^y - c_t^y(p_{t+1}/p_t, w_t^y, w_{t+1}^o))] \quad (13')$$

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:

$$\begin{aligned} v_t &= [(w_t^y - c_t^y)N_t]/(N_{t-1}m_t^o) \\ &= [(w_t^y - c_t^y)N_t]/M_t \end{aligned} \quad (14)$$

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

1.2.10 Currency Substitution

Thus far, we have been looking at the demand for money in a close economy. Let's now tend our attention to demand for money in an open economy and consider the concept of currency substitution. As you may know, economies are becoming increasingly open to flows of commodities and financial assets, so that a special topic in the money demand literature deals with money demand in the open economy, in which economic units have access not only to domestic



financial assets but also to foreign ones. For portfolio investments in open economies, the financial alternatives to holding domestic money include the currencies and bonds of foreign countries, in addition to domestic bonds, so that the determinants of the domestic money demand should include not only the rates of return on domestic assets but also those on foreign assets. Since these assets include foreign money holdings, money demand studies for open economies need to pay special attention to substitution between domestic and foreign monies. This determination is especially relevant for open economies in which foreign currencies are extensively traded and foreign monies are part of the domestic media of payments. Note that the relevant literature on substitution between domestic and foreign money in the open economy uses the word “currency” for money. In what follows, we follow this usage.

Definition for Currency Substitutions

Currency substitution (CS) can be defined as substitution between domestic and foreign currencies, which is “currency–currency substitution.” Substitution can also exist between domestic currency and foreign bonds, and between domestic currency and domestic bonds, which are “currency–bond substitutions.” Designating, respectively, the nominal values of domestic money, foreign money, domestic bonds and foreign bonds by M , M^* , B and B^* , CS can be measured by $\frac{\partial M}{\partial M^*}$, while the various currency–bond substitutions would be measured by $\frac{\partial M}{\partial B}$, $\frac{\partial M}{\partial B^*}$, $\frac{\partial M^*}{\partial B}$ and $\frac{\partial M^*}{\partial B^*}$, or by their corresponding elasticities.

Theories of currency substitution

The magnitude of CS will depend both on portfolio selection considerations – since both M and M^* are assets in a portfolio²⁶ – and on substitution between them as media of payments in the domestic economy. Therefore, the relevant approaches to the degree of CS are the portfolio/asset approach and the transactions approach.

For the asset/portfolio approach, the relevant theory would be the theory of portfolio selection, which would treat M and M^* among the assets in the portfolio. This theory would determine substitution between currencies on the basis of their expected yield and risk. Two currencies would therefore be perfect substitutes if they had identical returns. They would be poor substitutes if, with identical risk, the return on one dominated that on the other. This identity of risk dominance does not in general apply in practice. Note that if some types of bonds were riskless, then, with a higher return, bonds would dominate over money, so that there would be zero portfolio demand for currency.

For the transactions approach to the demand for media of payments, it is the general acceptance in daily exchanges and payments that would determine the degree of substitution

between the alternative assets. If the foreign currencies do serve as a medium of payments in the domestic economy, the classic demand analysis for the total of the media of payments, i.e. for the sum of M and M^* , is the Baumol–Tobin inventory analysis presented in an earlier section. Under this approach, since domestic and foreign bonds do not serve as media of payments they would have a relatively low substitutability with the domestic currency, while that between M and M^* could be much higher. Further, the demand for $(M + M^*/\rho)$ would be a function of the domestic expenditures or GDP to be financed.

For a given amount of transactions or expenditures to be financed, an increase in one medium of payments implies a decrease in the other, so that transactions demand analysis implies that $\partial M/\partial(M^*/\rho) < 0$. That is, in economies in which both M and M^* do act as media of payments, $\partial M/\partial(M^*/\rho)$ would be negative and significant. In the limit, if domestic residents are indifferent whether they receive payments in the domestic money or in the foreign one, $EM, M^* = -1$, where $EM, M^* = (M^*/M)(\partial M/\partial(M^*/\rho))$.

This elasticity would be very much smaller in absolute magnitude, or non-existent, in open economies in which the usage of foreign currency for domestic payments involves significant additional costs to those for payments in the local currency. If this cost is sufficiently high,

$EM, M^* = 0$.

Therefore, the magnitude of EM, M^* is clearly likely to vary between economies which do not extensively use foreign monies in domestic payments for goods²⁸ and those economies in which the foreign money is extensively used as a medium of payments, alongside (or in preference to) the domestic money.



“Partially dollarized economies” – defined as ones in which the domestic currency and the foreign one circulate side by side, with buyers and sellers indifferent between their use in settling transactions – are especially ones in which EM, M^* tends to -1

Handa (2009) argued that economic agents in even very open economies but without effective dollarization tend to use the domestic currency as the preferred medium of payments and do not easily switch to the use of foreign currencies for payments because of the transactions costs³⁰ imposed on retail payments. He therefore designated the domestic currency as being the “preferred habitat” for the domestic medium of payments. Under this hypothesis, the degree of substitutability between the domestic currency and a given foreign one would depend on the latter’s acceptance for payments in the domestic economy or the cost and ease of conversion from the latter into the former. In general, there would be a very significant transactions cost in conversion of foreign currencies into the domestic currency. These costs lie in the spread between the purchase and sale conversion rates and in banks’ commissions, and are usually quite significant for the size of the transactions of the representative household in the economy. Further, in retail transactions, payment in a foreign currency is usually at an unfavorable exchange rate set by the retailer.

Consequently, the general presumption under the preferred habitat approach would be that foreign currencies will have low elasticities of substitution with the domestic currency, except possibly in special cases where a particular foreign currency is generally accepted in payments at par in the domestic economy. To illustrate, while sellers in Canada often accept US dollars, their offer by buyers is not all that common, because there is a greater cost to paying in the US dollar than is specified by the bank exchange conversion rate. Hence, under the transactions approach, the degree of substitution between the US dollar and the Canadian dollar need not be high and could be quite low. The Canadian dollar finds almost no acceptance in the United States, so they are poor substitutes in the US economy. Further, in the Canadian economy, even if the Canadian and US dollars proved to be good substitutes, British currency is not generally accepted and would be a poor substitute for the Canadian dollar. Most open economies tend to be of this type, so that, except for special cases, the preferred habitat hypothesis implies that we should expect even quite open economies (open but without extensive usage of foreign currencies in domestic retail payments) to have EM, M^* close to zero or with a small negative value.

Among the special cases of possibly high CS was the historical use of the local currency and the imperial one in colonies during the colonial era. Another special case is the use of the US dollar as a second medium of payments in domestic transactions in partially dollarized economies. For such economies, the transactions demand for the media of payments implies that, for a given



amount of transactions and GDP to be financed in economies in which both M and M^* act as media of payments, a decrease in one would have to be offset by an equivalent increase in the other. Hence, partially dollarized economies are especially likely to have EM, M^* equal to -1 , and an infinite elasticity of substitution, while non-dollarized economies will have significantly lower elasticities of substitution.

Two broad approaches to CS: weak substitutability between monies and bonds

It is an implicit assumption of the CS literature that weak separability exists between the four financial assets (domestic money, foreign money, domestic bonds and foreign bonds) and other goods, which include commodities and leisure, so that the demand functions for these four assets can be estimated by using only the returns on the four financial assets and the amount to be allocated among them. Proceeding further, the literature allows two possibilities:

A). Preferences over the domestic and foreign monies are not weakly separable from domestic and foreign bonds. That is, $U(M^*, M^*/\rho, B, B^*)$ is not weakly separable into a sub-function with M^* and M^*/ρ . Estimations related to this hypothesis have been labeled in the CS literature the “unrestricted approach.” As is discussed later, this approach is more suited to the portfolio approach than to the transactions one. In this approach, the demand function for domestic money will include the returns on all four assets, in addition to other variables, such as a scale variable.

B) Preferences over domestic and foreign monies are weakly separable from domestic and foreign bonds. That is,

$U(M^*, M/\rho, B, B^*)$ is weakly separable into a sub-function with M^* and M^*/ρ , so that:

$$U(M^*, M^*/\rho, B, B^*) = U(f(M, M^*/\rho), B, B^*).$$

Estimations related to this hypothesis have been labeled the “restricted approach” in the CS literature. This approach is appropriate for the demand for the two monies as domestic media of payments. It allows the possibility that domestic money and foreign money may act as media of payments in the domestic economy, but bonds do not. If this is so, the demand functions for M and



M^* can be estimated as a function of ρ , the returns on M and M^* and the amount to be allocated between them. Such estimation is said to be “restricted,” since it is independent of the returns on bonds.

1.2.11 Empirical Studies of the Demand for Money with emphasis on Africa

The empirical relationship which has received most attention in the modelling of private sector financial behaviour is the demand for money function. Over the years, there has been a plethora of studies on the aggregate demand for money functions of African countries, and it is arguably the most estimated relationship in the whole of empirical macroeconomics. The majority of these studies have not been primarily concerned with testing, at the aggregate level, the empirical validity of the alternative micro theories of money demand. This is partly because total money holdings are not readily separable into their different transactions, precautionary and risk-return elements, a degree of disaggregation which is required for the satisfactory testing of most of these theories. Also, variables such as the risk attached to bond holding, the level of brokerage costs and the variance of net receipts, which are crucial to the testing of particular theories, are by their very nature, difficult to measure in any satisfactory way for empirical purposes. These data limitations have meant that most empirical studies have been concerned with finding a stable aggregate time-series relationship, between money holdings and a few key determining variables, such as the rate of interest and the level of income or wealth.

The following empirical studies will be reviewed:

Group	Article Title	Reference
1	Empirical Analysis of Money Demand Stability in Nigeria	Osmond N. Okonkwo ^{1*} Emmanuel I. Ajudua Sunny T. Alozie Journal of Economics and Sustainable Development Vol.5, No.14, 2014
2	Stability Of Money Demand In A Developing Economy: Empirical Evidence From South Africa	Ferdinand Niyimbanira and International Business & Economics Research Journal

Group	Article Title	Reference
		– May 2013 Volume 12, Number 5
3	Some Empirical Evidence on the Stability of Money Demand in Kenya	Moses C. Kiptui International Journal of Economics and Financial Issues Vol. 4, No. 4, 2014, pp.849-858
4	The Stability of the Demand for Money in Monetary Unions: Some Empirical Evidence from WAEMU	Pierre Canac , Hassan Shirvani & Barry Wilbratte International Economic Journal Vol. 23, No. 4, 617–628, December 2009
5	On the Stability of Money Demand in Ghana: A Bounds Testing Approach	Jihad Dagher and Arto Kovanen IMF Working Paper, WP/11/273
6	Comparative Analysis of the Stability of Money Demand between Côte d’Ivoire And Ghana: An Application of ARDLModel	Yao Kouadio Ange-Patrick1& Drama Bédi Guy Hervé International Journal of Economics and Finance; Vol. 9, No. 11; 2017



Discussions and Review Questions

Differentiate between the relationship between the rate of interest and the demand for money within the Keynesian theory of money demand and the classical quantity theory of money demand?

Discuss the inventory theoretic approach to the transactions demand for money. In which way(s) is it an improvement over Keynes's Liquidity Preference model?

Based on the Baumol-Tobin model of the transaction demand for money, assume that a person has income/expenditure \$Y, Bond savings B which earns interest R, money holdings M and cash bonds cash bonds in lots of \$W spaced evenly through the period.

If every withdrawal, he incurs a "brokerage (bonds-money transfer) cost" that has two components: a fixed cost of \$B₀ and a variable cost of B₁ per dollar withdrawn, derive an expression for the optimal number of trips (n*) that minimizes the total cost.

Derive the real money demand (the average money holding) function.

With the aid of a diagram show the effect of a fall in interest rate on optimal number of trips (n*) and average money holding.

Assuming the individual's objective is to maximize the lifetime utility function:

$$V = U(C_t^Y) + \left(\frac{1}{1+\rho}\right)U(C_{t+1}^O), \quad \theta \leq 0, \quad u_j(\cdot) > 0, \quad u_{jj}(\cdot) < 0.$$
$$\ln C_{1t} + \frac{1}{1+\rho} \ln C_{2t+1}$$

If the first stage budget constraint is given as:

$$C_t^Y + S_t = W_t$$



And the second stage budget constraint is given as:

$$C^o_{t+1} = (1 + r_{t+1}) \cdot S_t;$$

Where

C_t^Y designates the second period consumption of the same generation

C^o_{t+1} designates the second period consumption of the same generation;

S_t designates the savings of the young generation in period t ;

W_t designates the wages received by the young generation in t .

ρ = discount factor.

Maximize the individual utility subject to the intertemporal budget constraint and.

Show that that the ratio of the marginal utility of the two goods C_t^Y and C^o_{t+1} (MRS) is a positive function of interest r_t

Suppose that consumption or purchase can only be made in cash so that Cash-in-advance (CIA) constraint applies only on consumption good. The preference of the representative agent is given by

$$U = \sum_{t=0}^{\infty} \beta^t \ln c_t$$

The purchase of consumption good at time t is subject to the CIA constraint

$$p_t c_t \leq m_t + w_t$$

where P_t is the price of consumption good, Q_t is the price of bonds, m_t is nominal money balance that the household carried from the previous period and w_t lump-sum-transfer equal to at the beginning of period t .

The budget constraint for the household in any period t is

$$m_{t+1} + Q_t B_{t+1} \leq (m_t + w_t - p_t c_t) + B_t$$

where B_{t+1} is the total units of nominal bond demanded at time t .



Find the representative agents' optimization problem for $(c_t; m_{t+1}; B_{t+1})$ in order to maximize his inter-temporal utility function above subject to the CIA constraint and the wealth constraint.

Show that Q_t is constant that is expressed in λ_{1t} and λ_{2t}

Consider a standard two period OLG model, where the preference function of a household is given as: $U(C_t^y, C_{t+1}^o) = \ln(C_t^y) + \beta \ln(C_{t+1}^o)$

The budget constraints are $W_t = C_t^y + S_t$ and $C_{t+1}^o = (1 + r_{t+1}) \cdot S_t$;

Where

C_t^y designates the second period consumption of the same generation

C_{t+1}^o designates the second period consumption of the same generation;

S_t designates the savings of the young generation in period t ;

W_t designates the wages received by the young generation in t .

Derive the optimal consumption path, C_t^y and C_{t+1}^o , for the individual.

Derive the saving functions for the individual.

Define currency substitution and distinguish it from capital mobility, as well as from substitution between domestic and foreign bonds. How are the returns on foreign monies and foreign bonds determined?



1.3 THE SUPPLY OF MONEY

Introduction

In this lecture we are going to explore how changes in the quantity of money occur. Note that changes or growth of money supply is an important factor not only for acceleration of the process of economic development but also for the achievement of price stability in the economy. There must be controlled expansion of money supply if the objective of development with stability is to be achieved. A healthy growth of an economy requires that there should be neither inflation nor deflation. Inflation is the greatest headache of a developing economy. A mild inflation arising out of the creation of money by deficit financing may stimulate investment by raising profit expectations and extracting forced savings. But a runaway inflation is highly detrimental to economic growth. The developing economies have to face the problem of inadequacy of resources in initial stages of development and it can make up this deficiency by deficit financing. But it has to be kept strictly within safe limits. Thus, increase in money supply affects vitally the rate of economic growth. In fact, it is now regarded as a legitimate instrument of economic growth. Kept within proper limits it can accelerate economic growth but exceeding of the limits will retard it. Thus, management of money supply is essential in the interest of steady economic growth.

In most countries today, a central bank or other monetary authority is charged with controlling the stock of money or issuing domestic currency. That is an important charge because the supply of money greatly influences interest and inflation rates and, ultimately, aggregate output, as noted earlier. If the central bank's monetary policy is good, if it creates just the right amount of money, the economy will hum, and interest and inflation rates will be low. If it creates too much money too quickly, prices will increase rapidly and wipe out people's savings until even the poorest people are nominal billionaires (as in Zimbabwe recently). If it creates too little money too slowly, prices will fall, wiping out debtors and making it nearly impossible to earn profits in business (as in the Great Depression). But even less extreme errors can have serious negative consequences for the economy and hence your wallets, careers, and dreams. This section is a little involved, but it is worth thoroughly understanding the money supply process and money multipliers if you want you and yours to be healthy and happy.

By the end of this section, students should be able to:

Explain Money Supply/Stock (including the effects of Financial Innovations)

Describe Endogenous Money Supply: Credit Creation Process

Explain the Monetary Base Model of Money Supply

Explain and distinguish between the Flow of Funds Approach and the Base Multiplier approaches to Money Supply

Describe the relationship between Fiscal Balance and the Money Supply Process

Describe how empirical studies of money supply are carried out



1.3.1 Money Supply/Stock (including the effects of Financial Innovations)

Money is a good, which, just like other goods, is demanded and supplied by economic agents in the economy (Handa 2009). There are a number of determinants of the demand and supply of money. The most important of the determinants of money demand are national income, the price level and interest rates, while that of money supply is the behavior of the central bank of the country which is given the power to control the money supply and bring about changes in it. The equilibrium amount in the market for money specifies the money stock, as opposed to the money supply, which is a behavioral function specifying the amount that would be supplied at various interest rates and income levels. The equilibrium amount of money is the amount for which money demand and money supply are equal.

The money supply and the money stock are identical in the case where the money supply is exogenously determined, usually by the policies of the central bank. In such a case, it is independent of the interest rate and other economic variables, though it may influence them. Much of the monetary and macroeconomic reasoning of a theoretical nature assumes this case, so that the terms “money stock” and “money supply” are used synonymously. One has to judge from the context whether the two concepts are being used as distinct or as identical ones. The control of the money supply rests with the monetary authorities. Their policy with respect to changes in the money supply is known as monetary policy.

What is relationship between nominal and the real value of money stock?

The nominal value of money is in terms of money itself as the measuring unit. The real value of money is in terms of its purchasing power over commodities. Thus, the nominal value of a \$1 note is 1 – and that of a \$20 note is 20. The real value of money is the amount of goods and services one unit of money can buy and is the reciprocal of the price level of commodities traded in the economy. It equals $1/P$ where P is the average price level in the economy. The real value of money is what we usually mean when we use the term “the value of money.”

Let's also discuss money and bond markets in monetary macroeconomics. The “money market” in monetary and macroeconomics is defined as the market in which the demand and supply of money interact, with equilibrium representing its clearance. However, the common English-language usage of this term refers to the market for short-term bonds, especially that of Treasury bills. To illustrate this common usage, this definition is embodied in the term “money market mutual funds,” which are mutual funds with holdings of short-term bonds. It is important to note that our usage of the term “the money market” in this book will follow that of macroeconomics. To reiterate, we will mean by it the market for money, not the market for short-term bonds. The usual custom in monetary and macroeconomics is to define “bonds” to cover all nonmonetary financial assets, including loans and shares, so that the words “bonds,” “credit” and “loans” are treated as synonymous. Given this usage, the “bond/credit/loan market” is defined as the market for all non-monetary financial assets.

Money supply and Financial innovations

Financial innovation has been extremely rapid since the 1960s. It has included technical changes in the servicing of various kinds of deposits, such as the introduction of automatic teller machines,



telephone banking, on-line banking through the use of computers, etc. It has also included the creation of new assets such as Money Market Mutual Funds, etc., which are often sold by banks and can be easily converted into cash. There has also been the spread first of credit cards, then of debit or bank cards, followed still more recently by the attempts to create and market “electronic money” cards – sometimes also known as electronic purses or smart cards. Further, competition among the different types of financial intermediaries in the provision of liabilities that are close to demand deposits or are readily convertible into the latter, increasingly by telephone and online banking, has increased considerably in recent decades. Many of these innovations have further blurred the distinction between demand and savings deposits to the point of its being only in name rather than in effect, and also blurred the distinction between banks and some of the other types of financial intermediaries as providers of liquid liabilities. This process of innovation, and the evolution of financial institutions into an overlapping pattern in the provision of financial services, are continuing.

Credit cards allow a payer to pay for a purchase while simultaneously acquiring a debt owed to the credit card company. Because of the latter, most economists choose not to include credit card usage or their authorized limits in the definition of money. Nor are credit cards near-monies. However, their usage reduces the need for the purchaser to hold money and reduces the demand for money. Debit cards are used to pay for purchases by an electronic transfer from the buyer’s bank account, often a demand deposit account with a bank. They replace the need to make payments in currency or by issuing a check. Therefore, they reduce currency holdings. They also reduce payments by checks. However, they do not obviate the need to hold sufficient balances in the bank account on which the debit is made. They are expected to have a very limited impact on the holding of deposits, which could increase or decrease.

Electronic transfers are on-line transfers made over the Internet. They reduce the need to use checks for making payments. However, electronic transfers may not affect deposits in banks, or do so marginally due to better money-management practices afforded by on-line banking. Smart cards embody a certain cash value and can be used to make payments at the point of purchase. Given the increasing prevalence of online banking and debit cards, smart cards are likely to be mainly used for small payments, as in the case of telephone cards, library photo-copying cards, etc. Smart cards reduce the need to hold currency and reduce its demand. Therefore, financial innovations in the form of debit and smart cards reduce currency holdings rather than demand deposits. Financial innovations in the form of online transfers facilitate the investment of spare balances, which at one time may have been held in savings deposits, in higher-interest money market funds, etc., thereby reducing the demand for savings deposits.

In recent decades, the reduction in brokerage fees for transfers between money and nonmonetary financial assets (bonds and stocks) and the Internet revolution in electronic banking have meant a reduction in the demand for money. Part of this is due to a reduction in the demand for precautionary balances held against unexpected consumption expenditures. This reduction has taken place because individuals can more easily and at lower cost accommodate unexpected expenditure needs by switching out of other assets into money.



1.3.2 Endogenous Money Supply: Credit Creation Process

Before we begin the money supply or credit creation process, let me take a moment to walk you through the fundamentals of the central bank balance sheet and the key players involved in the money supply process. The money supply is determined by the interaction of four groups: commercial banks and other depositories, depositors, borrowers, and the central bank. Like any bank, the central bank's balance sheet is composed of assets and liabilities. Its assets are similar to those of common banks and include government securities. The central bank's liabilities, however, differ fundamentally from those of common banks.

Its most important liabilities are currency in circulation and reserves. It may seem strange to see currency and reserves listed as liabilities of the central bank because those things are the assets of commercial banks. In fact, for everyone but the central bank, the central bank's notes are assets or things owned. But for the central bank, its notes are things owed (liabilities). Every financial asset is somebody else's liability, of course. A promissory note (IOU) that you signed would be your liability, but it would be an asset for the note's holder or owner. Similarly, a bank deposit is a liability for the bank but an asset for the depositor. In like fashion, commercial banks own their deposits in the central bank (CB) (reserves), so they count them as assets. The CB owes that money to commercial banks, so it must count them as liabilities. The same goes for banknotes: the public owns them, but the CB, as their issuer, owes them. (Don't be confused by the fact that what the CB owes to holders is nothing more than the right to use the notes to pay sums the holders owe to the government for taxes and the like.)

Currency in circulation (C) and reserves (R) compose the monetary base (MB, aka high-powered money), the most basic building blocks of the money supply. Basically, $MB = C + R$, an equation you'll want to internalize. In most countries, C includes banknotes and coins issued by the Treasury. We can ignore the latter because it is a relatively small percentage of the MB, and the Treasury cannot legally manage the volume of coinage in circulation in an active fashion, but rather only meets the demand for each denomination: .01, .05, .10, .25, .50, and 1.00 coins. (The CB also supplies the \$1.00 unit, and for some reason Americans, for example, prefer \$1 notes to coins. In most countries, coins fill demand for the single currency unit denomination.) C includes only banknotes and coins in the hands of nonbanks. Any banknotes in banks is called vault cash and is included in R, which also includes bank deposits with the CB. Reserves are of two types: those required or mandated by the central bank (RR), and any additional or excess reserves (ER) that banks wish to hold. The latter are usually small, but they can grow substantially during panics like that of September–October 2008 global financial crisis.

Central banks, of course, are highly profitable institutions because their assets earn interest but their liabilities are costless, or nearly so. Printing money en masse with modern technology is pretty cheap, and reserves are nothing more than accounting entries. Many central banks, including the CB, now pay interest on reserves, but of course any interest paid is composed of cheap notes or, more likely, even cheaper accounting entries. Central banks, therefore, have no gap problems, and liquidity management is a snap because they can always print more notes or create more reserves. Central banks anachronistically own prodigious quantities of gold, but some have begun to sell off their holdings because they no longer convert their notes into gold or anything else for that matter. Gold is no longer part of the MB but is rather just a commodity with unusually good monetary characteristics (high value-to-weight ratio, divisible, easily authenticated, and so forth).



The Process of Credit Creation

We are now ready to understand how the central bank creates money and influences the money supply (MS) with the aid of the T-accounts — accounts that show only the changes in balance sheets. Like regular balance sheets, however, T-accounts must balance (asset changes must equal liability changes). Central banks like the CB influence the MS via the MB. They control their monetary liabilities, MB, by buying and selling securities, a process called open market operations. If a central bank wants to increase the MB, it need only buy a security. (Any asset will do, but securities, especially government bonds, are generally best because there is little default risk, liquidity is high, and they pay interest.) If a central bank bought a \$10,000 bond from a bank, the following would occur:

Banking System	
Assets	Liabilities
Securities -\$10,000	
Reserves +\$10,000	

The banking system would lose \$10,000 worth of securities but gain \$10,000 of reserves (probably a credit in its account with the central bank but, as noted above, banknotes or other forms of cash also count as reserves).

Central Bank	
Assets	Liabilities
Securities +\$10,000	Reserves +\$10,000

The central bank would gain \$10,000 of securities essentially by creating \$10,000 of reserves. Notice that the item transferred, securities, has opposite signs, negative for the banking system and positive for the central bank. That makes good sense if you think about it because one party is selling (giving up) and the other is buying (receiving). Note also that the central bank's liability has the same sign as the banking system's asset. That too makes sense because, as noted above, the central bank's liabilities are everyone else's assets. So if the central bank's liabilities increase or decrease, everyone else's assets should do likewise.

If the central bank happens to buy a bond from the public (any nonbank), and that entity deposits the proceeds in its bank, precisely the same outcome would occur, though via a slightly more circuitous route:

Some Dude	
Assets	Liabilities
Securities -\$10,000	
Checkable deposits +\$10,000	
Banking System	
Assets	Liabilities
Reserves +\$10,000	Checkable deposits +\$10,000



Central Bank	
Assets	Liabilities
Securities +\$10,000	Reserves +\$10,000

If the nonbank seller of the security keeps the proceeds as cash (bank notes), however, the outcome is slightly different:

Some Dude	
Assets	Liabilities
Securities -\$10,000	
Currency +\$10,000	
Central Bank	
Assets	Liabilities
Securities +\$10,000	Currency in circulation +\$10,000

Note that in either case, however, the MB increases by the amount of the purchase because either C or R increases by the amount of the purchase. Keep in mind that currency in circulation means cash (like bank notes) no longer in the central bank. An IOU in the hands of its maker is no liability; cash in the hands of its issuer is not a liability. So although the money existed physically before Some Dude sold his bond, it did not exist economically as money until it left its papa (mama?), the central bank. If the transaction were reversed and Some Dude bought a bond from the central bank with currency, the notes he paid would cease to be money, and currency in circulation would decrease by \$10,000.

In fact, whenever the central bank sells an asset, the exact opposite of the above T-accounts occurs: the MB shrinks because C (and/or R) decreases along with the central bank's securities holdings, and banks or the nonbank public own more securities but less C or R.

The nonbank public can influence the relative share of C and R but not the MB. Say that you had \$55.50 in your bank account but wanted \$30 in cash to take your significant other to the carnival. Your T-account would look like the following because you turned \$30 of deposits into \$30 of bank notes:

Your T-Account	
Assets	Liabilities
Checkable deposits -\$30.00	
Currency +\$30.00	

Your bank's T-account would look like the following because it lost \$30 of deposits and \$30 of reserves, the \$30 you walked off with:

Your Bank	
Assets	Liabilities
Reserves -\$30.00	Checkable deposits -\$30.00



The central bank's T-account would look like the following because the nonbank public (you!) would hold \$30 and your bank's reserves would decrease accordingly (as noted above):

Central Bank	
Assets	Liabilities
	Currency in circulation \$30.00
	Reserves -\$30.00

The central bank can also control the monetary base by making loans to banks and receiving their loan repayments. A loan increases the MB and a repayment decreases it. A \$1 million loan and repayment a week later looks like this:

Central Bank		
Assets	Liabilities	Date
Loans +\$1,000,000	Reserves +\$1,000,000	January 1, 2010
Loans -\$1,000,000	Reserves -\$1,000,000	January 8, 2010
Banking System		
Assets	Liabilities	Date
Reserves +\$1,000,000	Borrowings +\$1,000,000	January 1, 2010
Reserves -\$1,000,000	Borrowings -\$1,000,000	January 8, 2010

A Simple Model of Multiple Deposit Creation

The central bank pretty much controls the size of the monetary base. (The check clearing process and the government's banking activities can cause some short-term flutter, but generally the central bank can anticipate such fluctuations and respond accordingly.) That does not mean, however, that the central bank controls the money supply, which consists of more than just MB. (M1, for example, also includes checkable deposits.) The reason is that each \$1 (or €1, etc.) of additional MB creates some multiple > 1 of new deposits in a process called multiple deposit creation.

Suppose Some Bank wants to decrease its holding of securities and increase its lending. It could sell \$1 million of its securities to the central bank. The T-accounts would be:

Some Bank	
Assets	Liabilities
Securities -\$1 million	
Reserves +\$1 million	
Central Bank	
Assets	Liabilities
Securities +\$1 million	Reserves +\$1 million

Some Bank suddenly has \$1 million in excess reserves. (Its deposits are unchanged, but it has \$1 million more in cash.) The bank can now make more loans. So its T-account will be the following:



Some Bank	
Assets	Liabilities
Loans +\$1 million	Deposits +\$1 million

Deposits are created in the process of making the loan, so the bank has effectively increased M1 by \$1 million. The borrower will not leave the proceeds of the loan in the bank for long but instead will use it, within the guidelines set by the loan's covenants, to make payments. As the deposits flow out of Some Bank, its excess reserves decline until finally Some Bank has essentially swapped securities for loans:

Some Bank	
Assets	Liabilities
Securities ?\$1 million	
Loans +\$1 million	

But now there is another \$1 million of checkable deposits out there and they rarely rest. Suppose, for simplicity's sake, they all end up at Another Bank. Its T-account would be the following:

Another Bank	
Assets Bank	Liabilities
Reserves +\$1 million	Checkable deposits +\$1 million

If the required reserve ratio (rr) is 10 percent, Another Bank can, and likely will, use those deposits to fund a loan, making its T-account:

Another Bank	
Assets	Liabilities
Reserves +\$.1 million	Checkable Deposits +\$1 million
Loans +\$.9 million	

That loan will also eventually be paid out to others and deposited into other banks, which in turn will lend 90 percent of them ($1 - rr$) to other borrowers. Even if a bank decides to invest in securities instead of loans, as long as it buys the bonds from anyone but the central bank, the multiple deposit creation expansion will continue, as in [Figure 3.1 "Multiple deposit creation, with an increase in reserves of \\$1 million, if \$rr = .10\$ ".](#)

Figure 3.1 Multiple deposit creation, with an increase in reserves of \$1 million, if $rr = .10$



Bank	Increase in Deposits (\$)	Increase in Loans (\$)	Increase in Reserves (\$)
Some	0	1,000,000	0
Another	1,000,000	900,000	100,000
Yet Another	900,000	810,000	90,000
Still Another	810,000	729,000	81,000
You Get the Picture	729,000	656,100	72,900
...
Totals	\$10 million	\$10 million	\$1 million

Notice that the increase in deposits is the same as the increase in loans from the previous bank. The increase in reserves is the increase in deposits times the required reserve ratio of .10, and the increase in loans is the increase in deposits times the remainder, .90. Rather than working through this rather clunky process every time, you can calculate the effects of increasing reserves with the so-called simple deposit multiplier formula:

$$\Delta D = (1/r) \times \Delta R$$

where:

ΔD = change in deposits

ΔR = change in reserves

rr = required reserve ratio

$1/0.1 \times 1 \text{ million} = 10 \text{ million}$, just as in [Figure 3.1 "Multiple deposit creation, with an increase in reserves of \\$1 million, if rr = .10"](#)

Practice calculating the simple deposit multiplier in Exercise 2.

Exercise

Use the simple deposit multiplier $\Delta D = (1/rr) \times \Delta R$ to calculate the change in deposits given the following conditions:

Required Reserve Ratio	Change in Reserves	Answer: Change in Deposits
.1	10	100
.5	10	20
1	10	10
.1	-10	-100
.1	100	1,000
0	43.5	ERROR—cannot divide by 0



Suppose the CBERal Reserve wants to increase the amount of checkable deposits by \$1,000,000 by conducting open market operations. Using the simple model of multiple deposit creation, determine what value of securities the CB should purchase, assuming a required reserve ratio of 5 percent. What two major assumptions does the simple model of multiple deposit creation make? Show the appropriate equation and work.

The CB should purchase \$50,000 worth of securities. The simple model of multiple deposit creation is $\Delta D = (1/rr) \times \Delta R$, which of course is the same as $\Delta R = \Delta D/(1/rr)$. So for this problem $1,000,000/(1/.05) = \$50,000$ worth of securities should be purchased. This model assumes that money is not held as cash and that banks do not hold excess reserves.

Pretty easy, eh? Too bad the simple deposit multiplier isn't very accurate. It provides an upper bound to the deposit creation process. The model simply isn't very realistic. Sometimes banks hold excess reserves, and people sometimes prefer to hold cash instead of deposits, thereby stopping the multiple deposit creation process cold. If the original borrower, for example, had taken cash and paid it out to people who also preferred cash over deposits no expansion of the money supply would have occurred. Ditto if Some Bank had decided that it was too risky to make new loans and had simply exchanged its securities for reserves. Or if no one was willing to borrow. Those are extreme examples, but anywhere along the process leaks into cash or excess reserves sap the deposit multiplier. That is why, at the beginning of the chapter, we said that depositors, borrowers, and banks were also important players in the money supply determination process. In the next section, we'll take their decisions into account.

Broad Money Multiplier for M1

To review, an increase (decrease) in the monetary base (MB, which = C + R) leads to an even greater increase (decrease) in the money supply (MS, such as M1 or M2) due to the multiple deposit creation process. In the previous section, you also learned a simple but unrealistic upper-bound formula for estimating the change that assumed that banks hold no excess reserves and that the public holds no currency.

To get a more realistic estimate, we'll have to do a little more work. We start with the observation that we can consider the money supply to be a function of the monetary base times some money multiplier (m):

$$\Delta MS = m \times \Delta MB$$

This is basically a broader version of the simple multiplier formula discussed in the previous section, except that instead of calculating the change in deposits (ΔD) brought about by the change in reserves (ΔR), we will now calculate the change in the money supply (ΔMS) brought about by the change in the monetary base (ΔMB). Furthermore, instead of using the reciprocal of the required reserve ratio ($1/rr$) as the multiplier, we will use a more sophisticated one (m_1 , and later m_2) that doesn't assume away cash and excess reserves.

We can add currency and excess reserves to the equation by algebraically describing their relationship to checkable deposits in the form of a ratio:

$$C/D = \text{currency ratio}$$

$$ER/D = \text{excess reserves ratio}$$



Recall that required reserves are equal to checkable deposits (D) times the required reserve ratio (rr). Total reserves equal required reserves plus excess reserves:

$$R = rD + ER$$

So we can render $MB = C + R$ as $MB = C + rrD + ER$. Note that we have successfully removed C and ER from the multiple deposit expansion process by separating them from rrD . After further algebraic manipulations of the above equation and the reciprocal of the reserve ratio ($1/rr$) concept embedded in the simple deposit multiplier, we're left with a more sophisticated, more realistic money multiplier:

$$m1 = 1 + (C/D) / [rr + (ER/D) + (C/D)]$$

Or

$$m = \frac{D + C}{RR + ER + C}$$

Dividing each variable on the right hand side gives the respective deposit ratios. Thus, the currency deposit ratio, C/D; required reserve deposit ratio, RR/D; and the excess reserve deposit ratio, ER/D.

$$m = \frac{(D/D) + (C/D)}{(RR/D) + (ER/D) + (C/D)}$$

Simplifying (7) gives:

$$m = \frac{1 + c}{r + e + c}$$

So if

Required reserve ratio (rr) = .2

Currency in circulation = \$100 billion

Deposits = \$400 billion

Excess reserves = \$10 billion

$$m1 = 1 + (100 / 400) / (.2 + (10 / 400) + (100 / 400)) \quad m1 = 1.25 / (.2 + .025 + .25) \quad m1 = 1.25 / .475 = 2.6316$$

Practice calculating the money multiplier in Exercise 1.

Exercises

Given the following, calculate the M1 money multiplier using the formula $m1 = 1 + (C/D) / [rr + (ER/D) + (C/D)]$.

Currency	Deposits	Excess Reserves	Required Reserve Ratio	Answer: m1
100	100	10	.1	1.67
100	100	10	.2	1.54
100	1,000	10	.2	3.55
1,000	100	10	.2	1.07
1,000	100	50	.2	1.02
100	1,000	50	.2	3.14
100	1,000	0	1	1



Once you have m , plug it into the formula $\Delta MS = m \times \Delta MB$. So if $m1 = 2.6316$ and the monetary base increases by \$100,000, the money supply will increase by \$263,160. If $m1 = 4.5$ and MB decreases by \$1 million, the money supply will decrease by \$4.5 million, and so forth. Practice this in Exercise 2.

Calculate the change in the money supply given the following:

Change in MB	m1	Answer: Change in MS
100	2	200
100	4	400
-100	2	-200
-100	4	-400
1,000	2	2,000
-1,000	2	-2,000
10,000	1	10,000
-10,000	1	-10,000

The M2 Money Multiplier

Note that $m1$ is the M1 money multiplier. With a little bit more work, one can also calculate the M2 money multiplier ($m2$). We want to do this because M2 is a more accurate measure of the money supply than M1, as it is usually a better indicator of changes in prices, interest rates, inflation, and, ultimately, aggregate output. (And hence whether you and your family live in a nice place with a 3D HDTV, three big refrigerators, etc., or if you live in “a van down by the river.

Recall from lecture one notes that $M2 = C + D + T + MMF$, where T = time and savings deposits and MMF = money market funds, money market deposit accounts, and overnight loans. We account for the extra types of deposits in the same way as we accounted for currency and excess reserves, by expressing them as ratios against checkable deposits:

(T/D) = time deposit ratio

(MMF/D) = money market ratio

which leads to the following equation:

$$m2 = 1 + (C/D) + (T/D) + (MMF/D) / [rr + (ER/D) + (C/D)]$$

Once you calculate $m2$, multiply it by the change in MB to calculate the change in the MS, specifically in M2, just as you did in Exercise 2. Notice that the denominator of the $m2$ equation is the same as the $m1$ equation but that we have added the time and money market ratios to the numerator. So M2 is always $M2$ would equal $m1$ iff $T = 0$ and $MMF = 0$, which is highly unlikely. Note: if means if and only if. $> m1$, ceteris paribus, which makes sense when you recall that M2 is composed of M1 plus other forms of money. To verify this, recall that we calculated $m1$ as 2.6316 when

Required reserves (rr) = .2

Currency in circulation = \$100 million

Deposits = \$400 million

Excess reserves = \$10 million

We will now add time deposits of \$900 million and money market funds of \$800 million and



calculate M2:

$$m_2 = 1 + (C/D) + (T/D) + (MMF/D) / [rr + (ER/D) + (C/D)]$$

$$m_2 = 1 + (100/400) + (900/400) + (800/400) / [.2 + (10/400) + (100/400)]$$

$$m_2 = 1 + .25 + 2.25 + 2 / (.2 + .005 + .25)$$

$$m_2 = 5.5 / .455 = 12.0879$$

This is quite a bit higher than m1 because time deposits and money market funds are not subject to reserve requirements, so they can expand more than checkable deposits because there is less drag on them during the multiple expansion process.

Practice calculating the M2 money multiplier on your own in the exercise.

Exercise

Calculate the M2 money multiplier using the following formula: $M2 = 1 + (C/D) + (T/D) + (MMF/D) / [rr + (ER/D) + (C/D)]$.

Currency	Deposits	Excess Reserves	Required Reserve Ratio	Time Deposits	Money Market Funds	Answer: M2
100	100	10	0.1	1,000	1,000	18.33
100	100	10	0.2	1,000	100	10
100	100	10	0.2	100	1,000	10
1,000	100	10	0.2	1,000	1,000	3.01
1,000	100	50	0.2	1,000	1,000	2.90
100	1,000	50	0.2	1,000	1,000	8.86
100	1,000	0	1	1,000	1,000	2.82
100	1	10	0.1	1,000	1,000	19.08

Limitation to this credit creation

The ability of the commercial bank to create credit depends on the amount of deposits by customers.

The habit of the customers. The habit of the people will influence the commercial banks' ability to give out loans. If the people don't have a banking habit, then the commercial bank will be handicapped.

Collateral or security proper against default and/or bad debt. In the case where one does not have the required collateral one is not likely to get loans.

Minimum reserves ratio: This is a rate fixed by the central bank mandating the commercial banks to pay a fixed percentage of their deposits as reserves. It limits the ability of the commercial banks to give out loans.

Excess reserves of commercial banks: Formerly, the excess reserves included secondary reserves plus required reserves (RR). This became a problem to commercial bank since they did not have enough to lend out as loans. This led to the abolishing of the secondary reserves.

Leakages: If the commercial banks grant loan to somebody who does not save it in any account, holds it as cash in hand.

If the commercial banks decide not to grant loans and allow huge sums of reserves in their books, then the process of multiple deposit creation is stalled or the magnitude of the multiplier reduced.



Factors that Determine the Money Multiplier

The Required Reserve Ratio

The Required Reserve Ratio (or the minimum cash reserve ratio or the reserve deposit ratio) is an important determinant of money supply. An increase in the required reserve ratio reduces the supply of money with commercial banks and decrease in the required reserve ratio increases money supply. The RR is the ratio of cash to current and time deposit liabilities which is determined by law. Every commercial bank is required to keep a certain percentage of these liabilities in the form of deposits with the central bank of the country. But notes or cash held by commercial banks in their tills are not included in the minimum required reserve ratio. The money multiplier and the money supply are negatively related to the required reserve ratio, r .

Currency ration, c

An increase in the currency ratio means that depositors are converting some of their checkable deposits into currency. As shown earlier, checkable deposits undergo multiple expansions while currencies do not. Hence when checkable deposits are converted into currency, there is a switch from a component of the money supply that undergoes multiple expansions to one that does not undergo multiple expansions. The overall level of multiple expansion declines, and so must the multiplier. The money multiplier and the money supply are negatively related to the currency ratio, c .

Excess reserves, e

When banks increase their holdings of excess reserves to checkable deposits, the banking system, in effect, has fewer reserves to support checkable deposits. This means that given the same level of H , banks will contract their loans, causing a decline in the level of checkable deposits and money supply, and the money multiplier will decrease. The money multiplier and the money supply are negatively related to the excess reserve ratio, e .

b) The cost to a bank of holding excess reserves is its opportunity cost, the interest that could have been earned on loans or securities if they had been held instead of excess reserves. A decrease in the interest rate, conversely, will reduce the opportunity cost of excess reserves, and e will rise.

1.3.3 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 section². 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 (M_0) and the stock of money (e.g. M_4). 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

² The notes on these two approaches are based on Bain, K and Howells (2003), *Monetary Economics and its Theoretical Basis*, Palgrave, Macmillan, pg. 49-70



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.

The latter is certainly a powerful insight. After all it says that the stock of money is given by the size of the base and in the absence of any deliberate decision on the part of the central bank, the money stock remains constant. It encourages the impression that the monetary authorities are central and all-powerful in the determination of the money stock because banks' ability to acquire non-reserve assets (e.g. loans and advances) are reserve constrained. But 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. We turn now to a more formal examination of the base multiplier approach. We begin by defining the two stocks:

$$M \equiv C_p + D_p \dots\dots\dots 3.1$$

and

$$B \equiv C_b + C_b + D_b \dots\dots\dots 3.2$$

M is (broad) money and consists of notes and coin in circulation with the non-bank public (C_p) plus their holdings of bank deposits (D_p). 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 (C_b) and banks' own deposits at the central bank (D_b). In practice, B corresponds to M0. If we now refer to $C_b + D_b$ as bank reserves and denote them R, then 3.2 can be rewritten as:

$$B \equiv C_p + R \dots\dots\dots 3.3$$

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:

$$\frac{M}{B} \equiv \frac{C_p + D_p}{C_p + R} \quad \dots 3.4$$

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

$$\frac{M}{B} \equiv \frac{\frac{C_p}{D_p} + \frac{D_p}{D_p}}{\frac{C_p}{D_p} + \frac{R}{D_p}} \quad \dots 3.5$$

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

$$\frac{M}{B} \equiv \frac{\alpha + 1}{\alpha + \beta} \quad \dots 3.6$$

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:

$$M = B \cdot \frac{\alpha + 1}{\alpha + \beta} \quad \dots 3.7$$

and

$$\Delta M = \Delta B \cdot \frac{\alpha + 1}{\alpha + \beta} \quad \dots 3.8$$

Notice that in a fractional reserve system, β will have a value less than one and the term $(\alpha + 1)/(\alpha + \beta)$, 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. These assumptions amount to a description of a monetary system where the money supply is exogenously determined and we can immediately see why the B-M model tends to be favoured as a way of describing and analyzing changes in the money stock in an exogenous regime: by rearranging two simple definitions we are quickly led to this conclusion.

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 maximizing behaviour just because we are dealing with money. That said, we do not promise an exhaustive account of how maximization 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 i_m . 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.

Furthermore, one of the reasons for holding deposits is to have access to the payments mechanism. Just how attractive deposits are as a means of payment depends upon current usage — many fewer transactions involved bank deposits a hundred years ago than they do now — and this depends to some extent upon technological considerations. The widespread use of deposits as means of payment requires the development of an efficient cheque clearing system. Since the mid-1960s the big developments in the payments system have involved electronic payments — automating them first of all so that customers could set up standing order or direct debit instructions and then making electronic transfers possible, most recently in the form of debit cards. As the services offered by deposits increase and improve, so they become more attractive relative to cash.

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.

$$\alpha \equiv \frac{C_p}{D_p} = f(i_m, T) \quad \dots 3.9$$

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, i_b . Where reserves do pay interest, then the cost will be the return on reserves, i_r 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, i_d . This is the rate of interest announced periodically, usually monthly, by the central bank. In the UK and the eurozone it is a rate of interest charged by the central bank on short-dated repurchase deals with banks, using government bonds as the underlying security. Reserve holdings will also depend upon any mandatory reserve requirement, RR , and, lastly, upon the variability of inward and outward flows to which banks are subject, σ . This last factor is relevant because the primary purpose of reserves is to enable individual banks to meet demands for cash or, more importantly, for transfers of deposits as customers make payments to customers of other banks or to the government. The majority of payments are offsetting (payments from bank A to bank B will roughly cancel); reserves are necessary to meet the balance. Provided this balance is predictable, the need for reserves will be limited to the predicted net flow. If it is unpredictable, then additional funds have to be held. The greater the variance (or standard deviation) of the flows, the greater the margin that will be necessary.

In summary, then:

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

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. But with the numerator already larger than the denominator by virtue of the '1', any change in α must have a bigger effect proportionate effect upon the denominator. 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:

$$M = f(\underset{+}{B}, \underset{-}{\alpha}, \underset{-}{\beta}) \quad \dots 3.11$$



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:

$$M = f(B, i_m, T, i_r, i_b, i_d, RR, \sigma) \quad \dots 3.12$$

$\begin{matrix} + & & + & & - & & + & & - & & - \\ + & & + & & - & & - & & - & & - \end{matrix}$

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.

We turn now to how this account of money supply determination can be presented diagrammatically. The account of money supply determination which we have just given is more familiar than it may seem since it is what is assumed, but rarely spelt out, in money market diagrams where a vertical money supply curve intersects a downward sloping money demand curve.

This is what we have drawn in Figure 3.1, though we have given the money supply curve a positive slope for reasons we return to at the end of this section. Before we do that, let us be clear how changes in the variables listed in 3.12 will be reflected in the diagram. 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, i_d , i_r , i_m , σ , T since these cause a change in the value of the multiplier.

Notice that we have omitted the bond rate, i_b , from this list. This is because the bond rate must appear on the vertical axis. This is because the purpose of drawing the money supply curve in interest-money space at all is ultimately to discuss money market equilibria, the interaction of supply and demand. With a downward sloping demand curve in the diagram, the rate on the vertical axis must be the opportunity cost of holding money. Strictly, in a modern monetary system, one might argue that this rate ought to be a spread term, representing the difference between the bond rate (appearing as a proxy for the return on 'non-money financial assets' which agents could hold as an alternative) and money's own rate (effectively the weighted average rate on cash and deposits). This is true but does not change the point we are about to make. If we put a spread term on the vertical axis it remains the case that a rise in bond rate increases the opportunity cost of holding money. As the size of the spread increases the quantity of money demanded declines. The crucial point is that it is the bond rate which must appear on the vertical axis, either on its own (if money is noninterest bearing) or as part of a spread term.

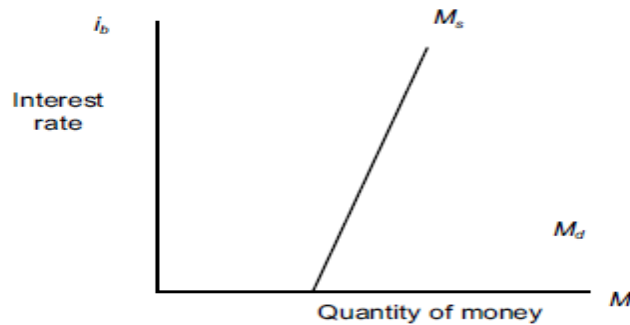
Now we can see why the money supply curve is drawn with a positive slope. In our discussion of β , we saw that banks would economize on reserves if returns on other assets increased; this would reduce the value of their reserve ratio (3.10) and this in turn (3.12) increases the money supply.

In short, the money supply shows some degree of elasticity with regard to the bond rate and since the bond rate appears in the diagram on the vertical axis, the effect of changes in the bond rate must be captured by giving a positive slope to the money supply curve. If as seems reasonable, banks' behaviour towards reserves is dependent upon non-reserve interest rates, the 'vertical'

money supply curve must have some positive slope and one might argue that the money supply has acquired some degree of endogeneity, contrary to what we said at the beginning of this section about the B-M approach being associated with exogenous money regimes. Davidson (1988 p.156) does indeed refer to this aspect of the money supply as ‘interest-endogeneity’. This form of endogeneity is, however, extremely limited. In a fully-endogenous monetary regime, it is generally accepted that continuous expansion of the money stock, with little, if any, effect upon interest rates is the norm.

Clearly that is not compatible with what we see in Figure 3.1 where a continuous expansion of the money supply is possible, ceteris paribus only if the level of interest rates i_b rises without limit.

Figure 3.1: The money supply curve



But the more normal case of course is that the authorities have some range within which they wish to see i_b remain. In circumstances of full-endogeneity continuous expansion requires the authorities to change one of the other variables in 3.12 and we shall see in the next chapter that this is the monetary base, B.

1.3.4 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.

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 ΔL_p (for new lending to the non-bank private sector) and ΔL_g (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:

$$M \equiv C_p + D_p \dots\dots\dots 3.13/3.1$$

and then rewrite it in flows:

$$\Delta M \equiv \Delta C_p + \Delta D_p \dots\dots\dots 3.14$$

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.

$$\Delta D_p \equiv \Delta L_p + \Delta L_g \dots\dots\dots 3.15$$

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:

$$\Delta L_g \equiv PSBR - \Delta G_p - \Delta C_p \pm \Delta ext \dots\dots\dots 3.16$$

where ΔG_p 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:

$$\Delta D_p \equiv \Delta L_p + PSBR - \Delta G_p - \Delta C_p \pm \Delta ext \dots\dots\dots 3.17$$

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 ΔC_p 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’.



$$\Delta M \equiv \text{PSBR} - \Delta G_p \pm \Delta \text{ext} + \Delta L_p \dots \dots \dots 3.18$$

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 analyze 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. 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.

The two approaches compared

While the B-M and FoF approaches are different ways of analyzing the quantity of monetary assets, both consist of rearranging identities at least one of which — the money stock and its components — is common to both.

In fact, even though each approach offers a different range of insights and highlights different features of the monetary system as being significant, it is possible to reconcile the two approaches. Indeed, it is perfectly possible to analyze money supply changes or flows by using an identity which features the monetary base while one could, if one were so inclined, analyze the existing stock of money in terms of the amount of lending. Each approach is, strictly speaking, agnostic as regards the underlying behavioural characteristics of the monetary system, but each furnishes insights

which are more relevant to a certain type of regime and has thus become associated with it. We shall see more of this in a moment, but let us firstly see that the two approaches are formally equivalent.

The B-M approach consists of a statement about the monetary base and two behavioural relations (see 3.6). We can write the FoF approach in exactly the same terms if we remember that the monetary base consists of cash held by the non-bank public (C_p) together with bank lending to the public sector in the form of reserve assets ($Db + Cb$). Bank lending to the public sector in the form of reserve assets must be equal to total bank lending to the public sector minus bank holdings of non-reserve assets (e.g. bank holdings of government bonds, G_b). So (in changes):

$$\Delta B \equiv \Delta C_p + (\Delta L_g - \Delta G_b) \dots \dots \dots 3.19$$



and, substituting 3.16 and rearranging:

$$\Delta B \equiv \Delta C_p - \Delta G_b + (\text{PSBR} - \Delta G_p \pm \Delta \text{ext} - \Delta C_p) \dots \dots \dots 3.20$$

From 3.18 and 3.20 we can obtain:

$$\Delta M \equiv \Delta B + \Delta G_b + \Delta B L_p \dots \dots \dots 3.21$$

What 3.21 shows is that we can make control of changes in the money stock appear to depend upon control of the base together with two behavioural relationships, in this case the banks' demand for government debt (ΔG_b) and lending to the non-bank private sector (ΔL_p), almost as easily as making it depend upon flows of new lending.

In the UK, for example, monetary analysis has tended to follow the FoF rather than the B-M approach. Some of the reasons for this are historic. These encouraged the FoF approach years ago and thus ensured a lasting role if only through inertia. But the FoF also has one overwhelming contemporary advantage that we come to in a moment, but which really forms the theme of the next chapter. We look at four older reasons first. In the UK, analysis for policy purposes has often focused on the broad money aggregates — M3 until 1989 and M4 thereafter. This does not require but it does permit the FoF approach which puts the whole of bank lending on the right hand side.

Such an approach cannot be applied to a monetary aggregate containing only a subset of deposits (e.g. M1) since the balance sheet identity requires only that total lending is matched by total deposits, and there is no way in which a subset of loans can be linked to any subset of deposits. In other policy regimes, in the US for example, the policy emphasis has often been upon these narrower aggregates and the FoF approach does not work.

We noted earlier that the B-M approach emphasizes the availability of reserves as a constraint on bank lending while the FoF approach focuses upon the general public's desire for bank credit. The tradition in the UK is for much short-term bank lending to be based upon the overdraft system whereby a maximum credit limit is agreed in advance and the borrower then uses (and is charged for) only that fraction of the loan that is required on a day-to-day basis. Clearly in these circumstances, a proportion of bank lending is done at the discretion of the borrower. Furthermore, it cannot be reserve-constrained. A bank that enters into overdraft contracts must guarantee to meet 100 per cent of the commitment if called upon.

Thirdly, the FoF approach allows all the credit counterparts to monetary growth to be identified separately. This was particularly important in the days when UK governments frequently ran large budget deficits some of which had to be financed by monetary means. With the independence of the Bank of England and the separation of monetary from fiscal policy (since 1997) and a policy of fully-funding budget deficits, this is a less compelling argument than it once was.



Another compelling reason for the popularity of the FoF in the UK involves ‘credit rationing’. The literature began with Stiglitz and Weiss in 1981 who advanced a number of reasons why it might be rational for banks to ration the volume of their lending in order to screen out some unsafe borrowers who would be willing and able to pay the going price. The rationality of apparently foregoing profitable opportunities derives from the presence of asymmetric information. It is argued that borrowers have a much better idea about the risks attached to the projects for which they take out loans than do the providers of the loans. It is very difficult for banks to assess the creditworthiness of borrowers and their projects, this gives rise to moral hazard and adverse selection problems. The borrower characteristics that banks might use in the screening are discussed in Leland and Pyle (1977) and Diamond (1984) but the important point from the FoF perspective is that variations in the flow of lending are partly the outcome of banks’ lending decisions (Stiglitz and Weiss, 1981) and while this is the case there is little point in focusing upon changes in the availability of reserves.

The final and by far the most powerful reason for the widespread adoption of the FoF framework is that it is easier to apply to the way in which the UK authorities have, in practice, tried to influence monetary conditions. The FoF approach gives a central role to flows of new bank lending and it is the flow of bank credit that the UK authorities have focused on, albeit in differing ways, since 1945. Up until 1971, this control consisted of an evolving collection of direct interventions — ‘moral suasion’ imposed on banks to discriminate by type of borrower, then by specifying minimum deposits and maximum payback periods for consumer loans. The first of these was a supply-side constraint but the latter were intended to work on the demand for loans as potential borrowers ruled themselves in or out depending upon the severity of the conditions.

In 1971 the Competition and Credit Control arrangements swept away all direct controls and stated the intention of relying upon variations in the price of credit, the short term rate of interest, to regulate the demand for credit. In the inflationary years of the 1970s, the authorities had occasional failures of nerve when it was clear that interest rates needed to be held in double figures, and there were occasional outbursts of direct control in the form of supplementary special deposits (a reversion to supply-side control).

But in 1981, market methods were restored and the last twenty years have seen a steady convergence in central bank operating procedures towards adjustment of short-term interest rates (Borio, 1997). The short-term rate over which central banks have direct control is the lender of last resort or rediscount rate which we have already met as i_d in 3.10. But in the B-M approach the purpose of raising (for example) i_d would be explained as an attempt to increase the reserve ratio and reduce the size of the multiplier. In practice, raising i_d is assumed to cause banks to raise their lending and borrowing rates and thus to reduce the demand for net new bank lending and thus to slow the creation of new deposits. The quantity of reserves and the resulting size of reserve ratios has nothing to do with it. In spite of the occasional appearance of ‘ratios’ in UK monetary regulations, none of them have been ratios of deposits to reserve assets under the control of the central bank. Monetary regulation has always targeted bank lending and never the quantity of reserves.

Furthermore, it is the rate of money (or credit) expansion that has exercised monetary authorities the world over. Nowhere is the stock of any particular interest. A rise in interest rates (today) or a



tightening of credit terms (in the past) was never intended to produce an absolute reduction in the stock of monetary assets or their credit counterparts. This is quite difficult to deal with in a B-M framework. Recall that we began by saying that the major ‘insight’ of the approach was that if the authorities did nothing (by way of changing the quantity of reserve assets) then the money stock would be unchanged. But in practice, the money stock expands continuously at the going rate of interest. If the authorities do nothing (to change the level of interest rates), in the real world the money stock expands at its current rate. Thus, the real reason why the FoF approach to money supply determination has been so attractive in the UK over the years is that the

Bank of England has targeted the flow of new lending and sought to control it through the demand side by changing interest rates. As we shall see in the next chapter, years of experience have proved that there is no realistic alternative and the Bank of England has readily acknowledged the fact.

Summary

In the last two sections, we have seen that there are two ways of analyzing changes in the quantity of money. One focuses upon stocks and looks at the multiple relationship between the monetary base and broad measures of money; the other focuses on flows of new loans and new deposits. Although either can be used to analyze changes in money in any monetary system and under any policy regime, each approach carries with it unstated assumptions about the nature of the regime it is analyzing and each is easier to use and provides more relevant insights when applied to the type of regime which it is assuming. Thus the B-M approach, through its emphasis upon the stock of monetary base is most helpful in analyzing monetary change in a system where the central bank can and does control the quantity of base directly and where the cash/deposit preferences of banks and their clients are stable. The flow of funds or credit-counterparts approach is more helpful in looking at a system where the monetary authorities are more concerned with the rate of monetary expansion and try to influence it through the flow of new bank loans.

1.3.5 Fiscal Balance and the Money Supply Process

A fiscal balance, either in deficit or surplus, is also an important source of expansion of money supply in the economy. There are two possible links between budget deficit and growth in money supply. First, when following an expansionary fiscal policy the government raises its expenditure without financed by extra taxation and thereby causing a budget deficit, it will tend to raise interest rate. This happens when budget deficit is financed through borrowing from the market.

As a result, demand for money or loanable funds increases which, given the supply of money, causes interest rate to rise. Rise in interest rate tends to reduce or crowd out private investment. If the Central Bank is following the policy of a fixed interest rate target, when the government resorts to borrowing to finance the budget deficit, then to prevent the rise in interest rate the Central Bank will take steps to increase the money supply in the economy.

The second link between budget deficit and expansion in money supply is direct. This occurs when the Central Bank itself purchases government securities when the government resorts to borrowing. The Central Bank is said to monetize budget deficit when it purchases government securities as it prints new notes for the purpose and gives it to the government for meeting public expenditure.

In some countries such as the US, Federal Reserve (which is the Central Bank of the USA) enjoys



a good deal of independence from the Treasury (i.e., the Government) and voluntarily decides when and how much to purchase government securities to finance its budget deficit.

Central Bank's Dilemma:

The Central Bank of a country faces a dilemma in deciding whether or not to monetize budget deficit. If the Central Bank does not monetize budget deficit to meet its increased expenditure, the government will borrow from the market and in the absence of any accommodating monetary policy this will tend to raise interest rate and thereby reduce or crowd out private investment.

Referring to the policy of Federal Reserve of the United States, Dornbusch, Fischer and Startz write, "There is accordingly a temptation for the Federal Reserve to prevent crowding out by buying government securities thereby increasing the money supply and hence allows an expansion in income without a rise in interest rates". But the policy of monetization of budget deficit by the Central Bank involves a risk. If the economy is working near-full employment level, that is, at near-full production capacity, monetization of budget deficit will cause inflation in the economy. However, if the economy is in the grip of a severe depression, the risk of causing inflation through monetization of budget deficit and consequent growth in money supply is not much there. It follows from above that in any particular case the Central Bank, if it enjoys freedom from the Government, has to judge whether it should adopt accommodatory monetary policy to achieve its goal of interest-targeting or allow fiscal expansion through monetization of budget deficit accompanied by the tight monetary policy to check inflation. It is the latter course of action that was adopted by Reserve Bank of India before 1995 when government's fiscal deficit was high and a good part of it was monetized by it.

1.3.6 Empirical Studies of Money Supply

In this section, we review a number of empirical studies on the money supply process using cointegration and error-corrections techniques, as captured in Handa (2009). We will then present a detailed empirical case study of money supply in Ghana.

Cointegration and error-correction models of the money supply

There are few cointegration studies on the money supply function and its major components. We draw the following findings from Baghestani and Mott (1997) to illustrate the nature of empirical findings on money supply and the problems with estimating this function when monetary policy shifts.

Baghestani and Mott performed cointegration tests on USA monthly data for three periods, 1971:04 to 1979:09, 1979:10 to 1982:09 and 1983:01 to 1990:06, using the Engle-Granger techniques. Their variables were log of M1, log of the monetary base (B) and an interest rate variable (R). The last was measured by the three-month commercial paper rate for the first two periods and by the differential between this rate and the deposit rate paid on Super NOWs (Negotiable Orders of Withdrawal at banks) introduced in January 1983. Further, the discount rate was used as a deterministic trend variable, since it is constant over long periods. The data for the three periods was separated since the Federal Reserve changed its operating procedures between these periods.



Baghestani and Mott could not reject the null hypothesis of no cointegration among the designated variables for 1971:04 to 1979:09. Further, for 1979:10 to 1982:09, while M0 and R possessed a unit root, M1 did not, so the cointegration technique was not applied for this period. The only period which satisfied the requirement for cointegration and yielded a cointegration vector was 1983:01 to 1990:06. The error-correction model was also estimated for this period. The cointegration between the variables broke down when the period was extended beyond 1990:06. These results have to be treated with great caution. As indicated on money-demand estimation, cointegration is meant to reveal the long-run relationships and, for reliable results, requires data over a long period rather than more frequent observations, as in monthly data, over a few years. The three periods used by Baghestani and Mott were each less than a decade.

For 1983:01 to 1990:06, Baghestani and Mott concluded from their cointegration–ECM results that the economy’s adjustments to the long-run relationship occurred through changes in the money supply and the interest rate, rather than in the monetary base. Comparing their findings across their three periods, we see that changes in the central bank policy regime, such as targeting monetary aggregates or interest rates, are extremely important in determining the money supply function in terms of both its coefficients and whether there even exists a long-run relationship. Further, even regulatory changes such as permitting, after 1980, the payment of interest on checkable deposits can shift the money-supply function.

CASE STUDY

An Empirical Analysis of the Money Supply Process in Ghana: 1983-2006³

Abstract

This paper examines the major drivers of the asset counterpart of the observed money supply in Ghana since the adoption of the Economic Recovery Programmes in Ghana. Using the traditional money multiplier approach, the relative contributions of fiscal financing and capital inflows to the money supply process were examined. It is found that until the mid-nineties, fiscal deficit financing was the major driver of the money supply process. In the later years, however, changes in the Net Foreign Assets of the Bank of Ghana, driven largely by foreign aid and remittances inflows, appear to be the major cause of monetary expansion. Until 2003 when discipline improved, government borrowing was also the major component and source of changes in the net domestic assets of the BoG. This, the paper argues, implies that the use of foreign exchange market intervention could be an effective way of controlling money supply.

Theoretical Framework and the Model

The theoretical foundation of the Ghanaian monetary policy strategy, and therefore, of our model is the standard theory of money supply determination, i.e., the monetary base model. It can be seen as a simple extension of the traditional bank deposit multiplier approach to deposit creation. Consider the following balance sheet identity (see Addison, 2001):

³ Excerpts from Sanusi, A. R. (2010), “An Empirical Analysis of the Money Supply Process in Ghana: 1983-2006” *Journal of Banking and Finance*, Vol. 2, No. 1, 2010



$$M2 = mm_2 \times M0$$

Where mm_2 is the broad money multiplier, $M2$ is the broad money supply, and $M0$ is the monetary base. The multiplier mm_2 is not unique, its components depends on the definition of the money supply used. However, for brevity, $M2$ multiplier can be written as:

$$mm_1 = \frac{1+c}{r+c} \quad \text{and} \quad mm_2 = \frac{1+tsfd}{r+c+r*tsfd}$$

Where c currency-deposit ratio; r is the reserve ratio; $tsfd$ is the ratio of time, savings and foreign currency deposit to total deposit ratio.

Assuming that the multiplier can be predicted fairly accurately, or is stable, and then the $M2$ target can be achieved by setting the corresponding level of $M0$ through OMO or foreign exchange reserve management. This is because the monetary base can be decomposed as follows:

$$M_0 = NFA_{bog} + NDA_{bog} \quad 2$$

$$NDA_{bog} = NCCG_{bog} + NICBP_{bog} + OIN_{bog} \quad 3$$

$$M_0 = NFA_{bog} + NCCG_{bog} + NICBP_{bog} + OIN_{bog} \quad 4$$

where: NFA_{bog} is the net foreign asset of the Bank of Ghana; NDA_{bog} is the net domestic asset of the Bank of Ghana; $NCCG_{bog}$ is the net credit to central government; $NICBP_{bog}$ is the net claims on Banks and public; and OIN_{bog} is other items (net) of the BoG.

Equation 4 above represents the model. Given the multiplier, it suggests that money supply expansion can be driven by either rising net foreign asset of the Bank of Ghana, net lending to the government by the Bank of Ghana, net lending to banks and public. Because these are net claims on the government, the banks and the public, open market sales have contractionary effects on $NCCG$ and $NICBP$, while open market purchases have the opposite effect. Similarly, sales of foreign currency by the central bank have a contractionary effect on the NFA , while purchases expand it. Thus, OMO and foreign exchange market intervention can be used through the balance sheet of the BoG to regulate the level of monetary base and, given the multiplier, the money supply. However, instability or unpredictability of the multiplier may hinder the attainment of a desired monetary target.

The model, equations 1 to 4, can also be represented in terms of the rate of growth of the broad money supply as follows:



$$\Delta M_2 = mm_2 \times \Delta M_0 \quad 1b$$

$$\Delta M_0 = \Delta NFA_{bog} + \Delta NDA_{bog} \quad 2b$$

$$\Delta NDA_{bog} = \Delta NCCG_{bog} + \Delta NICBP_{bog} + \Delta OIN_{bog} \quad 3b$$

$$\Delta M_0 = \Delta NFA_{bog} + \Delta NCCG_{bog} + \Delta NICBP_{bog} + \Delta OIN_{bog} \quad 4b$$

In the next section, the model is empirically applied to the pre-inflation targeting period in Ghana.

Empirical Analysis

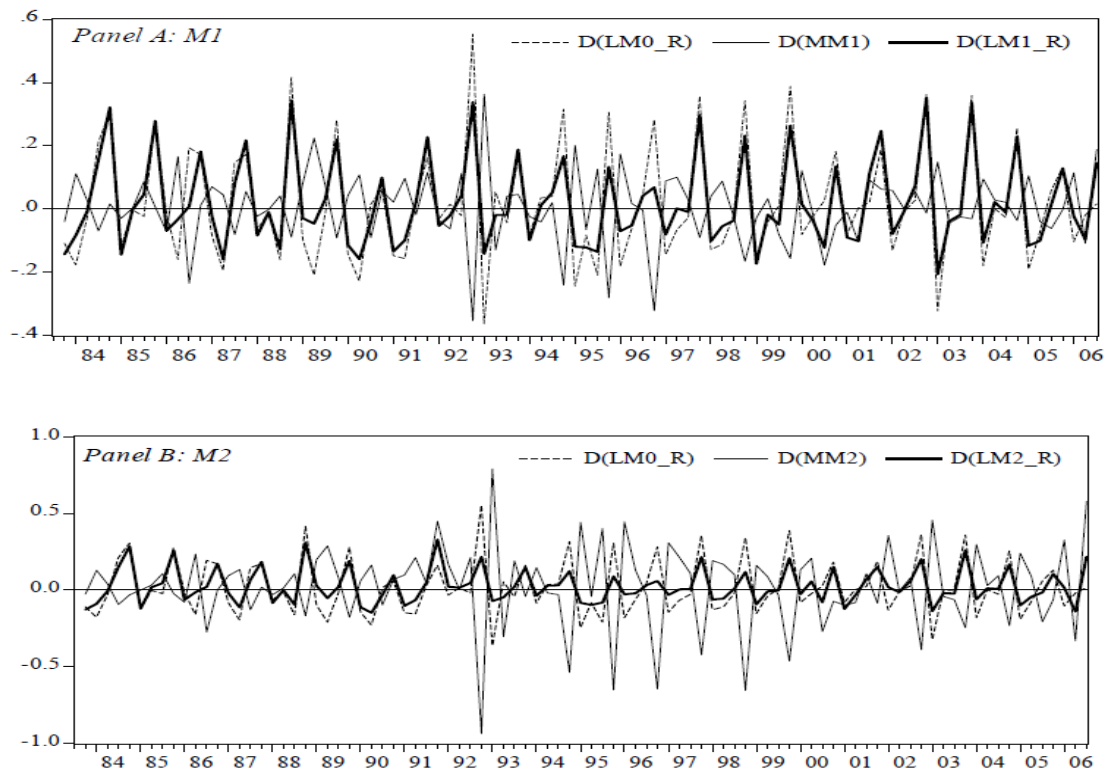
The Data

In this section, the model is estimated using the quarterly data of the Ghana's monetary survey obtained from the IMF's International Financial Statistics for the period 1983Q2-2006Q4. The choice of this period is informed by the need to cover the post 1983 reform period before the formal adoption of inflation targeting in December, 2006.

Decomposition of M1 and M2 (Equation 1b)

Figure 1 plots the estimates of Equation 1b, showing changes in real M1, real M0 and the M1 multiplier. It could be observed that the changes in multipliers and monetary base tended to be somewhat offsetting, as would be expected given some stability in the demand for real money balances. However, the quarterly fluctuations in both M1 and M2 tend to be associated with net movements dominated by either the multiplier or the monetary base (Figures 1). Except in a very few cases, net changes in M0 tend to contribute a relatively higher share of the observed fluctuations in both aggregates, especially M1 after 1992. In the case of M2, the money multiplier offset tends to matter more in the later years – a jump in M0 is offset partially by a fall in the M2 multiplier (Figure 1 panel B)4.

Figure 1. Quarterly Change in Real M_1 , Real M_0 and Multiplier



Source: Computed by the author with data obtained from International Financial Statistics

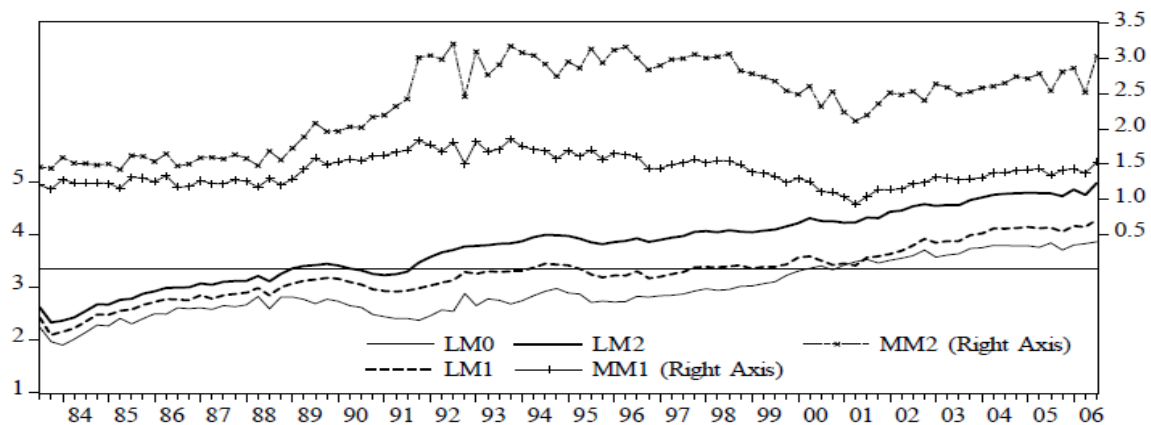
Figure 2 plots (seasonally adjusted) money supply, monetary base and the multipliers, motivated by equation 1. It is clear that the multipliers have been subject to both short-term fluctuations and long term trend variation. Earlier in the reform period (1983Q3 to 1988Q3) both M_1 and M_2 multipliers have been somewhat stable, hovering around 1.2 and 1.5 respectively. This is due to stability in the reserve (R) and time, saving and foreign currency deposit (TSFD) ratios (Figure 3, panel A). However, the effective implementation of the first phase of the Financial Sector Adjustment Programme (FINSAP-I) between 1988 and 1991 led to a significant increase in the multipliers, with that of M_2 becoming more variable (see Figure 1 and 2; and IMF, 1999). The M_1 and M_2 multipliers rose to around 1.5 and 3.0 respectively during this period, due to the decline in the public's cash holding (as both TSFD and demand deposits, DD, rose) and to a decline in the bank's reserves reflecting, in part, the restoration of confidence in the banking system (Figure 3, panels A and B) 5. This movement of money into the banking system was facilitated by the increase in the BoG's rediscount rate (in stages, reaching around 35%) thereby encouraging banks to seek deposits elsewhere. As inflation was also declining, real interest rates on deposits had become substantially positive for the first time since the launch of the ERP (except briefly in 1985; Sanusi, 2009).

Between 1998Q2 and 2001Q1, however, both multipliers declined steadily from around 1.6 and 3.3 in 1998 to around 1.05 and 2.2 in 2001 for M_1 and M_2 respectively. This mainly reflects bank reserves and currency rising faster than demand deposits, (Figure 3, Panels A and B) with both reserves ratios reaching their peak in 2001. After 2001, the multipliers rose again to stabilize at

around 1.4 and 2.7, respectively for M1 and M2, as the currency and reserve ratios declined.

In summary, although the multipliers have not empirically been constant as the programming model had assumed, they have been fairly stable and predictable. Changes in the money supply have tended to be more as a result of changes in the monetary base. The next section therefore returns to the analysis of the components of the monetary base.

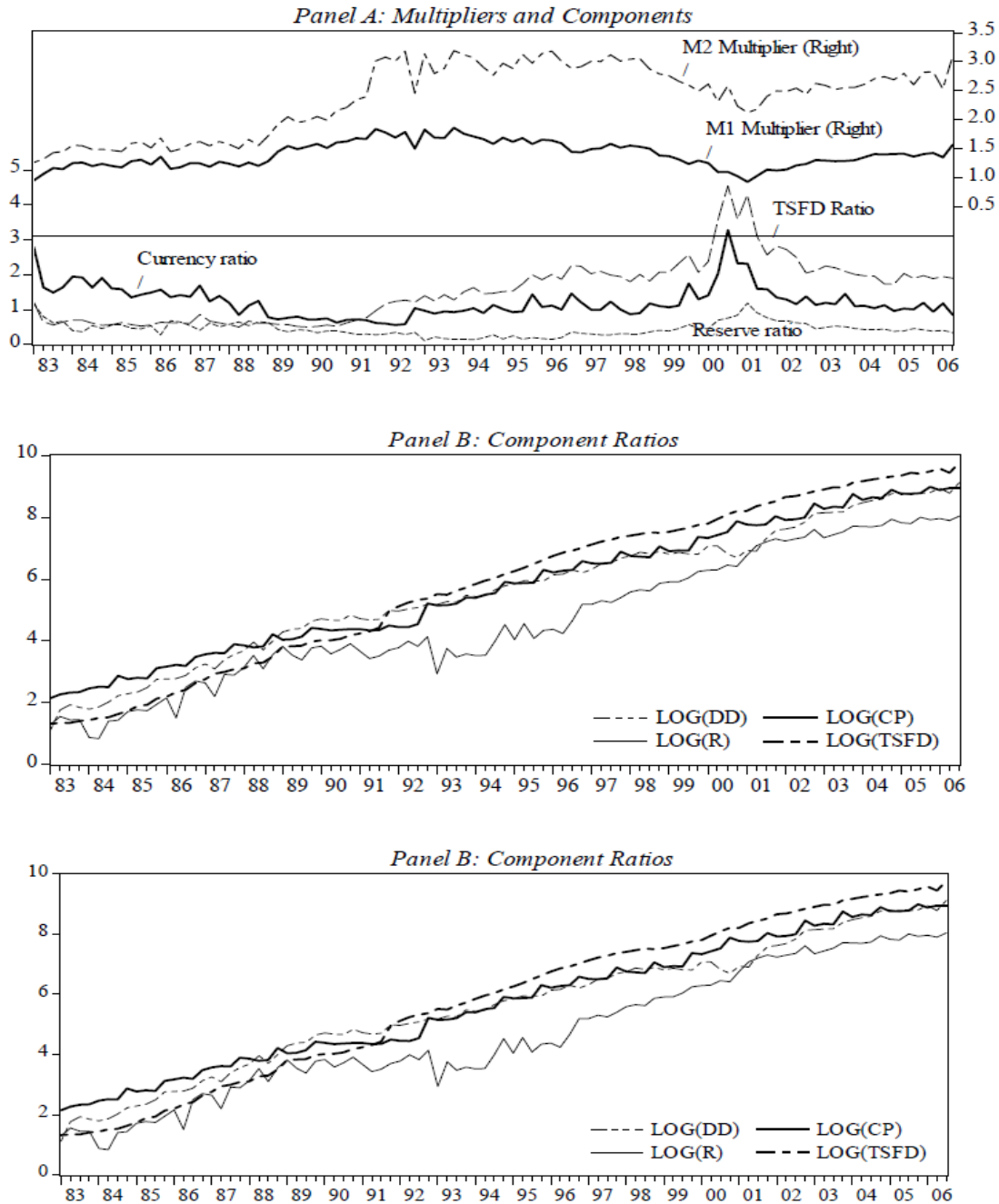
Figure 2. Monetary Aggregates (in Logarithm)



Source: Author's calculations with data obtained from International Financial Statistics



Figure 3. Multipliers, Ratios and their Components



Source: Author's calculations with data obtained from International Financial Statistics

4.3 Sources of Monetary base (Equation 2b)

It was observed above that changes in monetary base contribute comparatively more than the changes in multipliers to changes in the monetary aggregates. In this section, the various sources of the monetary base expansion are examined since the launch of the programme. In Figure 4, we



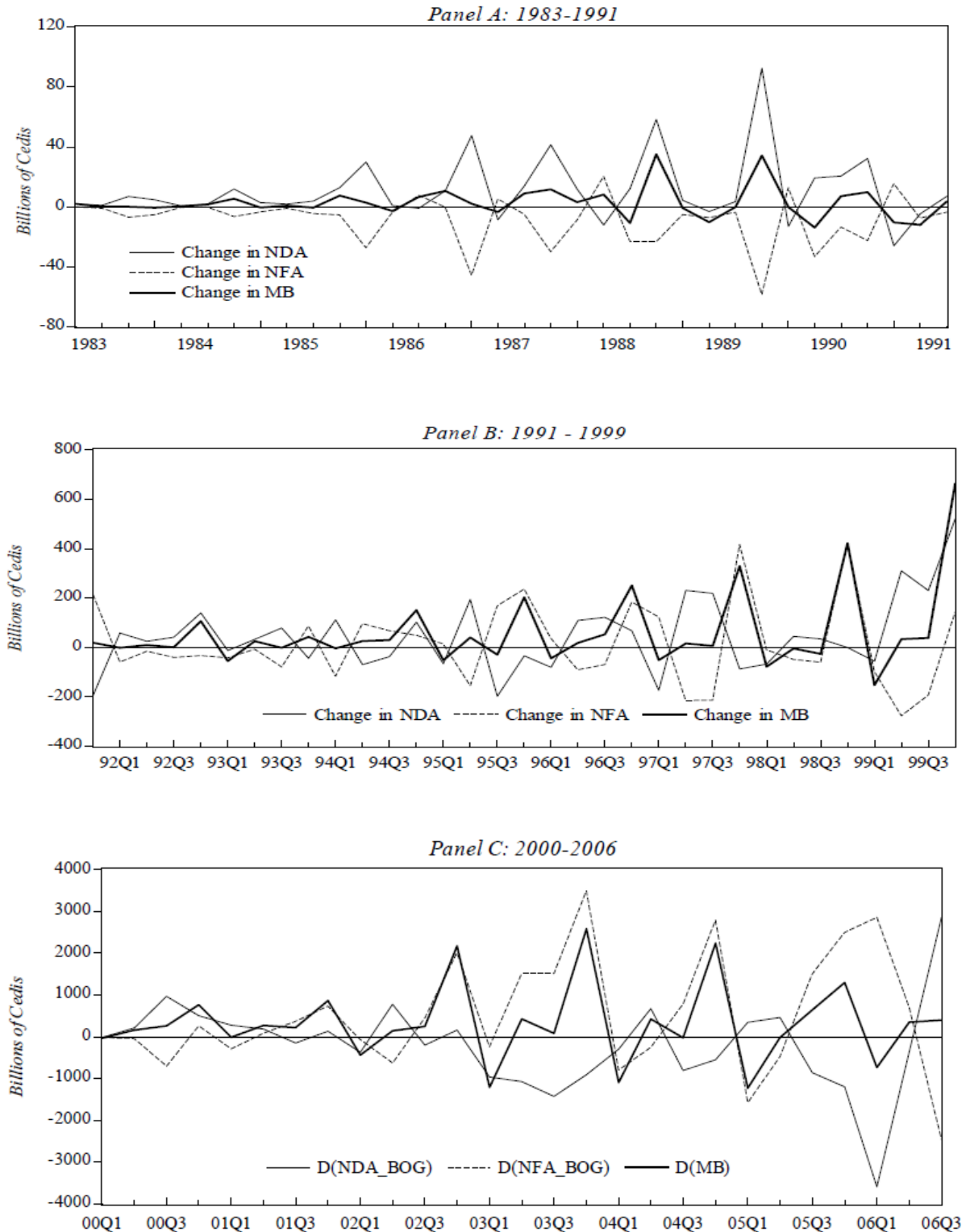
plot equation 2b showing the two components of the changes in monetary base, i.e. ΔNFA_{bog} and ΔNDA_{bog} . It is noteworthy that over the sample period, the changes in NDA and NFA tended to be inversely related and, in some quarters, almost offsetting, leading to small or no change in $M0$. This is suggestive of the use of one or the other of NDA and NFA for sterilization purposes⁶. For instance, in the early years of the reforms, when foreign exchange inflows were not a major source of liquidity, the excessive lending to government for deficit financing was sterilized mainly through the sales of donor supplied foreign exchange (Sowa, 2004)⁷. The predominant use of NFA (or foreign exchange intervention) to sterilize expansions in NDA is reflected in Figure 4 by the tendency of NFA to fall when NDA was rising (negative ΔNFA and positive ΔNDA), especially up to the end of 1995. The use of foreign exchange intervention during this period was made easier for at least two reasons: first, the net foreign exchange inflows were relatively small. Hence, the BoG's sales of foreign exchange were not generally enough to satisfy the foreign exchange market, to which it was a major supplier.

Therefore, increased sales of foreign exchange to sterilize NDA expansion could not have seriously hampered the programmes' objective of a depreciated cedi. Secondly, given the shallowness of the financial market, there were few, if any, alternatives to foreign exchange sterilization (such as sales of securities).

However, since 1996, the NFA by itself had become a source of liquidity due to the increased inflows of foreign exchange from foreign aid and external loans for cocoa purchase financing and remittances. This is reflected in panel B of Figure 4 as increases in $M0$ are now associated with increases in NFA (see also the decomposition of equation 2 in Figure A1 in the Appendix). The BoG, therefore, replaced NDA with $M0$ as its operational target. The task for the BoG has since been to control the growth of monetary base (when both NDA and NFA are expanding) without appreciating the cedi in the process. Accumulation of NFA was therefore used to the extent that it does not lead to the appreciation of the cedi. The burden of controlling the growth of $M0$ was therefore placed generally on limiting NDA. However, as will be shown later, because of the persistence of large public sector borrowing requirement (PSBR) that had to be mostly financed by the BoG, the control of NDA to reduce $M0$ growth had been initially very difficult⁸. As such, many $M0$ growth targets have been missed as both NFA and NDA grew simultaneously⁹. As shown in Figure 4, the reductions in NDA have predominantly been quite insufficient (and sometime impossible) to offset the increase in NFA¹⁰, leading to large increases in the $M0$.

Since 2003 when the BoG was granted *de jure* independence, the inverse relationship between NFA and NDA started to appear regular again. This suggests that the BoG during this period has been better able to achieve reduction in the NDA. As we shall see later, this is partly because of a reduction in lending to government, and intensive use of OMO as the financial market has deepened. In the next section, the NDA will be decomposed in order to examine its major drivers.

Figure 4. Contribution of Changes to NDA and NFA to Changes in MB



Source: Data obtained from International Financial Statistics

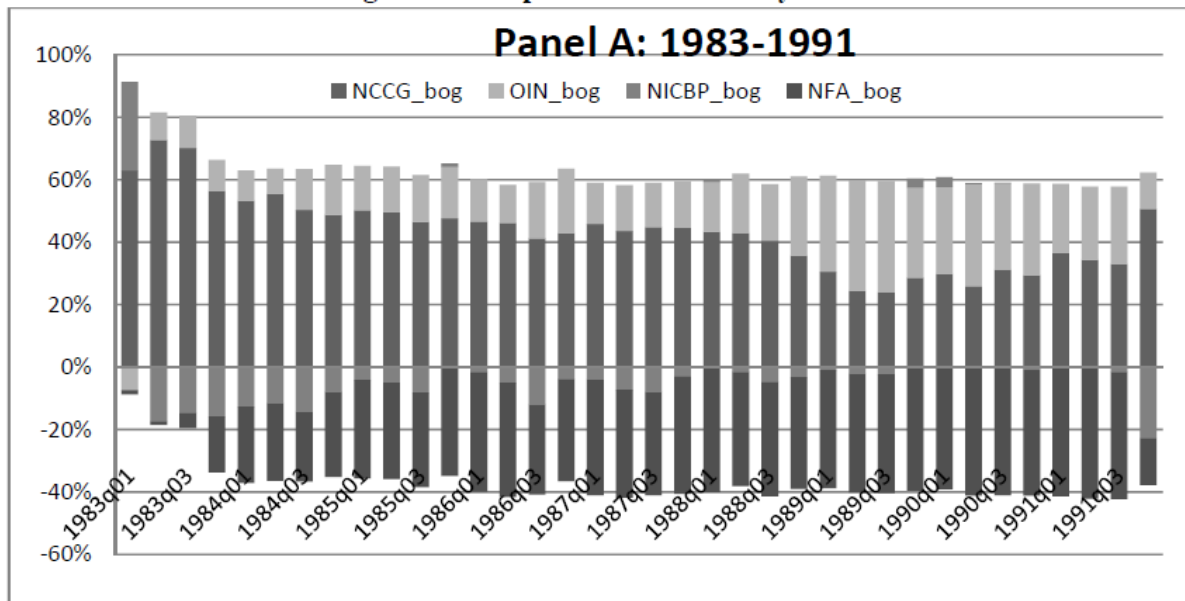


Decomposition of NDA (Equation 4)

In Figure 5, we decomposed money base into NFA and the various components of the NDA over the sample period (i.e., net credit to central government, NCCG, net indebtedness to banks and public, NICBP and other items net, OIN). It can be observed that prior to 2003 (except between 1989 and 1991) the NCCG had been predominantly the largest component of the monetary base. NFA and NICBP have mainly been negative, thus serving as offsetting factors. This reflects the BoG's use of both foreign exchange market intervention and sales of securities to the private sector as well as reserve requirement for monetary management. For example, since 1990, the steady increases in the secondary reserves requirement (reaching 35% in 2004) has increased commercial banks holding of government securities, and hence the BoG's indebtedness to the commercial banks¹¹. Later, when the NFA became a major source of liquidity, there was pressure on the BoG to sterilize via reduction in the NDA. However, because of the inherent fiscal weakness and the resulting persistent PSBR, reduction in the NDA has been mainly via decreased NICBP. As noted earlier, this reduction is achieved first by forcing banks to acquire government's securities and BoG's bills using their primary and secondary reserve requirements¹². Later, the BoG resorted to OMO as the major instrument of monetary management. Between 2001 and early 2002, government's official borrowing was mainly from the non-bank public, and moved from a net borrower to a net depositor in the banking system as its fiscal position improved.

Since the end of 2001, there have been some dramatic changes in the monetary management and outcomes in Ghana, particularly in terms of the sources of monetary base expansion. Owing to the recovery of foreign exchange inflows from aid, remittances and cocoa purchase loans, the expansion of NFA started to be a major source of monetary base expansion. Indeed by the second quarter of 2003, NFA had taken over from NCCG (and the NDA) as the major counterpart of M0 expansion. There are identifiable reasons for these developments: first, the resumption of huge external financial support, good cocoa harvests and increased domestic revenue generation had strengthened the government's fiscal position, leading to declining PSBR. For instance by 2003, zero net domestic financing of the fiscal deficit was over-achieved, with a net repayment equivalent of 0.4% of GDP (CEPA, 2004). Second, the conferment of legal independence to the BoG, and the capping of government financing to a limit of 10 percent of its revenue encouraged budget financing from the non-bank public. For instance, several securities of different maturities were introduced into the market. These include the Government of Ghana Inflation Linked bond (in 2001), cocoa bills (in 2002) and the 2-year and 3-year fixed and floating government bonds (in 2004). With these, and as the financial market deepened, the BoG had become more able to sterilize any increases in the NDA that might result due to NCCG (see Figure 5 Panel C). Consequently, there has been decline in both the level of NDA and its contribution to the expansion of the monetary base.

Figure 5. Components of Monetary Base



Conclusions

This paper examined the money supply process since the adoption of the ERP with the aim of identifying the major asset counterparts of the changes in the observed monetary aggregates. The major findings can be summarized as follows: first, the money multipliers have been subject to short-term fluctuations and long-term trend movements, but the net changes in money shock seems to be mainly driven by changes in monetary base. Second, changes in monetary base appear to reflect changes in both NDA and NFA of the BoG. However, while changes in NDA dominated before 1996, NFA started to have a major influence subsequently and, by 2003, changes in NFA were the major counterparts of changes in monetary base. Third, changes in the NCCG have been the major driver of NDA expansion throughout the sample. Finally, there is evidence that the BoG used both foreign exchange market interventions and open market operations to sterilize the monetary impacts of NCCG and inflows of foreign exchange. With the evidence of substantial rise in the demand for real money balances, the effectiveness of these interventions can be expected to increase, especially as the recent GDP growth is sustained (hence lower inflation). One policy implication of the increasing dominance of the NFA in the money supply process is that foreign exchange intervention would be an effective tool of monetary control.

Discussions and Reviewed Question

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 (C_r) 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.

In the B-M approach, explain the effects of the following and show them diagrammatically:

- an introduction of a mandatory reserve ratio in excess of the prudential ratio currently in force;
- the development of new deposit liabilities with zero reserve requirements;
- a dramatic increase in the number and distribution of cash machines.

Using figure 3.1, show the difference in impact on money market equilibrium of a given reduction in reserve assets when (a) the money supply curve shows some positive elasticity with respect to the bond rate and (b) when the money supply curve is completely inelastic with respect to the bond rate.

In the flow of funds analysis, explain the effect of an increase in the government's budget deficit, *ceteris paribus*.

What steps might the authorities take to offset the monetary effects of events in question 4?

Why, according to the flow of funds approach, does the choice of exchange rate regime make monetary control more, or less, difficult for the authorities?



1.4 MONEY, PRICES AND EMPLOYMENT

Introduction

Welcome to the fourth section of this course where we focus principally on money and inflation as well as money and employment. 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.

In many places around the world, it is by now well understood that the two episodes most commonly seen as major monetary policy failures since the founding of the Federal Reserve, namely the Great Depression of the 1930s and the Great Inflation of the 1970s, were episodes where policymakers failed to properly monitor and heed the warnings present in the behavior of money. In large part because of these experiences, the Federal Reserve has regularly monitored the growth of money since the late 1970s.

However, the behavior of monetary aggregates may not always serve as a particularly reliable guide to inflation. Over shorter horizons, in particular, cyclical developments and transitory changes in the velocity of money present non-trivial complications. 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. The process of constructing monetary aggregates is inherently an empirical enterprise, fraught with the difficulties of any such enterprise. Over longer horizons, financial.

In this section, we shall study the various theories propounded to explain the relationship between money, inflation and employment.

Objectives

<p>By the end of this section you should be able to;</p> <ul style="list-style-type: none">Explain the theoretical links between money and inflationExplain monetary control and inflationDescribe theories of money growth and business cyclesExplain expectations of the real business cycle and expected inflationExplain the relationship between money, inflation and employment



1.4.1 Money and Theories of Inflation

Many people have wrong interpretation to what inflation is all about. In this section, we are going to digest what economists mean when they say inflation. Inflation is a very complex term which has seen tremendous changes since it was first defined by neo-classical economists. 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.”

More specifically, 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.’

But Keynes in his General Theory thought otherwise. He was of the view that the economy was not always at full 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.

I shall try to show that there are only two basic theories of inflation - (1) One is the institutional theory of inflation and the other (2) one is the money stock theory of inflation. Money stock theory of inflation considers the Government and the Central Bank to be the generators of inflation while the institutional theories consider this or that section of the people to be responsible for inflation. Let us first get familiar with these theories so that our task is henceforth eased. In what follows we discuss the various theories of inflation.

The Cost-Push Theory of Inflation

The cost-push theory of inflation is the wage push or the profit-push theory of inflation. In every



process of inflation 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 services. 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.

At certain times the increase in money wages and prices affect a few sectors of the economy. However products from such sectors are used as inputs for the production of goods and services in other sectors. Hence the production costs of these other sectors rise and thereby causing the prices goods produced in these sectors to also rise. Thus wage-push inflation in a few sectors of the economy may soon be translated into inflationary pressures in the entire economy.

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. Given the demand conditions as represented by the demand curve D, the initial supply curve So is shown to shift to S1 in response to cost-increasing pressures from oligopolies, unions, etc. as a result of rise in money wages. Consequently, the equilibrium position shifts from E to E1 reflecting rise in the price level from P to P1 and fall in output, employment and income from Y1 to Y1 level.

In diagram (A) of the figure, as the price level rise, the LM curve shifts to the left to LM, position because with the increase in the price level to P1 the real value of the money supply falls. Similarly, the /S curve shifts to the left to IS1 position because with the increase in the price level the demand for consumer goods falls due to the Pigou effect. Accordingly, the equilibrium position of the

economy shifts from E to E_1 where the interest rate increases from r to r_1 and the output, employment and income levels fall from the full employment level of Y_f to Y_1 .

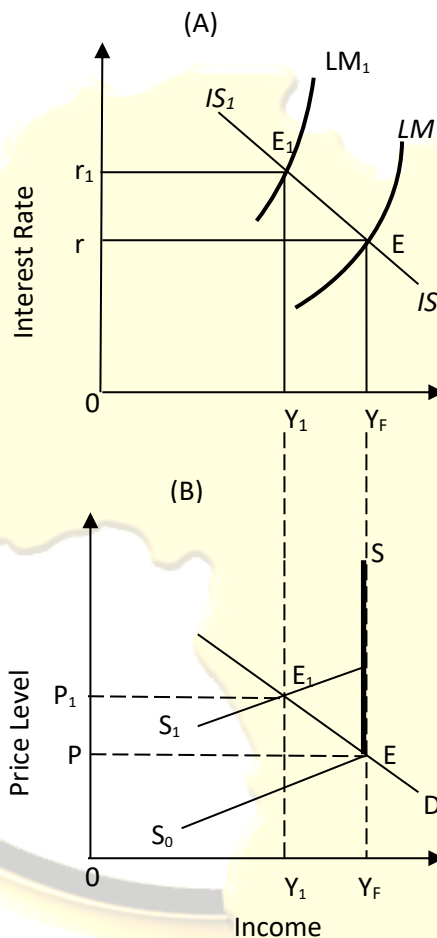


Figure 4.1

Figure 4.2

Demand-Pull or Monetary Theory of Inflation

Now let us discuss the demand-pull 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." Now/ 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.”

Two principal theories attempt to explain the demand-pull inflation, namely the Monetarists and Keynesians theories. We shall also discuss a third one propounded by the Danish economist, Bent Hansen.

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.

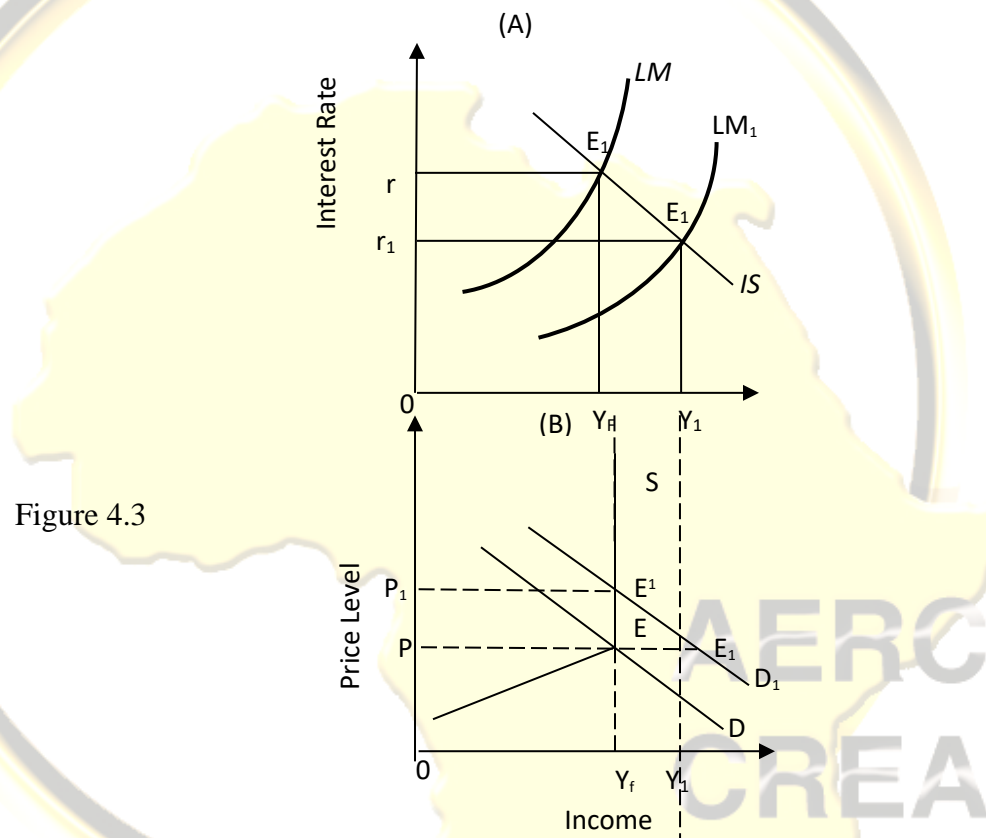
Assuming V and Q as constant, the price level (P) varies proportionately with the supply of money (M). With flexible wages, the economy was believed to operate at full employment level. The labour force, the capital stock, and technology also changed only slowly over time. Consequently, the amount of 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 it 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 everywhere 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 fact 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). Suppose the money supply is increased at a given price level P as determined by

demand (D) and supply (S) curves in diagram (B) of the figure. The initial full employment situation at this price level is shown by the intersection of IS and LM curves at E in diagram (A) of the figure where r is the interest rate and Y_f is the full employment level of income. Now with the increase in the quantity of money, the LM curve shifts rightward to LM_1 and intersects the IS curve at E_1 such that the equilibrium level of income rises to Y_1 and the rate of interest is lowered to

r1. As the aggregate supply is assumed fixed, there is no change in the position of the IS curve.



The aggregate demand thus rises which shifts the D_1 creating excess demand in created equivalent to $EE_1 (= TF Y_1)$ in diagram (B) of the figure. This raises the price level, the aggregate supply being fixed, as shown by the vertical portion of the supply curve S . The rise in the price level reduces the real value of the money supply so that the LM curve shifts to the left to LM . Excess demand will not be eliminated until aggregate demand curve D_1 cuts the aggregate supply curve S at E .

This means a higher price level P_1 in diagram (B) and return to the original equilibrium position E in the upper Panel of the figure where IS cuts the LM curve. The “result, then, is self-limiting, and the price level rises in exact proportion to the real value of the money supply to its original value.”

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. In the real world excess demand and cost-push forces operate simultaneously and interdependently to form an inflationary process. Thus, inflation is mixed demand-pull and cost-push when price level changes reflect upward shifts in both aggregate demand and supply functions. However, they may not start simultaneously.

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. This is illustrated in Figure 4. The initial equilibrium is at Y_F level of full employment income determined by aggregate demand D_0 and aggregate supply S_0 curves at A . The price level is P_0 with increase in aggregate demand from D_0 to D_1 and D_2 given the vertical portion of the supply curve S_0 S , prices rise from P_0 to P_2 to P_5 , the inflationary path being A , B and C . This sustained increase in prices has also been the result of the increase in money, wage rates due to increase in aggregate demand at the full employment level. When prices rise, producers are encouraged to increase output as their profits rise with increased aggregate demand. They, therefore, raise the demand for labour thereby increasing money, wages which further lead to increase in demand for goods and services. So long as the demand for output continues to raise money incomes, inflationary pressures will continue.

Suppose now an inflationary process that may begin from the supply side due to increase in money wage rates. This will raise prices every time there is a wage-push. But the rise in prices will not be sustained if there is no increase in demand. This is illustrated in Figure 6.3 where given the aggregate demand curve D , wage-push shifts the supply curve S to S_1 . The new equilibrium is at E . This raises the price level from P to P_1 and lowers output and employment to Y_2 below the full employment level Y_1 . A further wage-push will again shift the supply curve to S_2 and the new equilibrium; will be at F . given the demand curve D thereby raising the price level further to P_3 and also reducing output and employment to Y_1 . In the absence of increase in aggregate demand this cost-push inflationary process will not be a sustained one and will sooner or later come to an end.

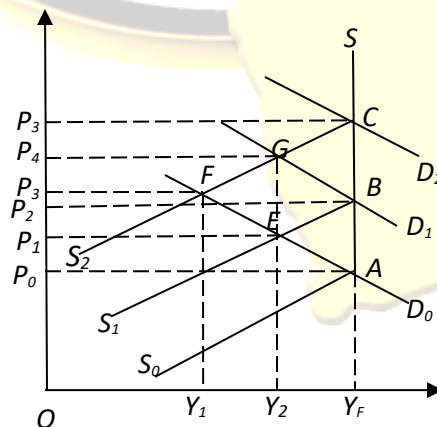


Fig 4. 3



The cost-push inflationary process will be self-sustaining only if every wage-push is accompanied by a corresponding increase in aggregate demand. Since every cost-push is accompanied by a fall in output and employment along with a price increase, it is likely that the government will adopt expansionary monetary and fiscal policies in order to check the fall in output and employment. In this way, cost-push will lead to a sustained inflationary process because the government will try to achieve full employment by raising aggregate demand which will, in turn, lead to further wage-push and so on.

Such a situation is again explained with the help of Figure 6. 3. Suppose there is a wage-push at E which shifts the supply curve from S1 to S2 and equilibrium is established at F with the demand curve D0. The price level rises to P3 and the level of employment is reduced to Y1. When due to an expansionary monetary and fiscal policy, aggregate demand increases to D1, the new equilibrium position is at G where the price level rises to P4 and the level of employment rises to Y2. A further increase in demand shifts the aggregate demand curve upward to D2, such that equilibrium is attained at point C where the price level rises to P2 and the economy attains the full employment level YF. Thus a wage-push accompanied by an increase in aggregate demand through expansionary monetary and fiscal policies traces out a ratchet-like inflationary path from A to E to F to G and to C.

Other Schools of thought on inflation

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 .Pi. Keynes, 1940) and the cost-push theory was contained in his "General Theory."

Keynesians and 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, because in U.S.A. during Great Depression, it was widely believed that the Federal Reserve System was expanding the money supply through the activation of monetary policy and still the economy was not responding and the effective demand was not reviving. So he felt that the monetary policy cannot deliver the goods and hence 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.

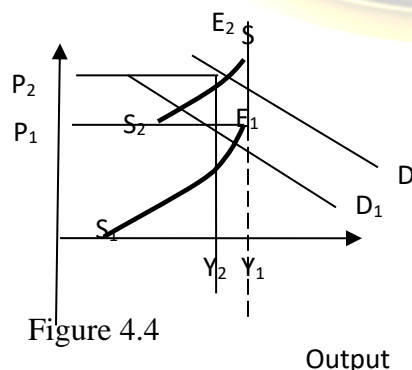
Increase in money supply to take the place of inactive money may come into operation through the activation of the monetary policy, but he had no faith in monetary policy, as according to him, the monetary policy was discredited during Great Depression. But being a monetary economist throughout his life, by advocating deficit budget, he, in fact, was advocating the policy of the expansion of money supply, of course, through the activation of fiscal policy. But, now it is no secret that during Great Depression, the Federal Reserve System was actually following the policy of contraction of money supply and not expansion of money supply. So "Great Depression" was actually "Great Contraction" and was a sound testimony to the efficacy of the monetary policy, of course, here for the worse, But, it is interesting to know how Keynes explains inflation with the help of excess demand without openly bringing into focus the expansion of money supply and shows the development of the inflationary gap.'

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. We analyze these channels in some more details.

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. Figure 6. 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 S_1 to S_2 . Since the production of goods is inelastic due to structural rigidities after a point, the supply curve is shown as vertical from point E_1 onwards. The initial equilibrium is at E_1 where the curves D_1 and S_1 intersect at the output level OY_1 and the price level is OP_1 . When supply falls due to increase in costs, the supply curve shifts from S_1 to S_2 and it intersects the demand curve L_2 at E_2 and production falls from OY_1 , to OY_2 and the price level rises from OP_1 to OP_2 .

Another reason behind structural inflation is that the rate of export growth in a developing economy is slow and unstable and very much inadequate to support the required growth rate of the economy. The sluggish growth rate of exports and the foreign exchange constraint lead to the adoption of the policy of industrialization based on import substitution. Such policies require the use of protective measures which, in turn, causes a rise in prices of industrial products, and incomes in the non-agricultural sectors and eventually leading to further rise in prices. Moreover, the policy leads to a cost-push rise in prices because of the rise in price of imported materials and equipment and protective measures. The policy of import substitution also tends to be inflationary because of the relative inefficiency of the new industries during the “learning” period.

Open and Suppressed Inflation

Inflation may be regarded as open when the goods or factor markets are allowed to operate freely in setting price of goods and services and inputs without any interruption from government. Thus open inflation is the result of the uninterrupted operation of the market mechanism. In a perfect market system there are no checks or controls on the distribution of commodities by the government. Excess demand over supply is what tends to lead to open inflation in such markets and when not checked could ultimately result in hyper-inflation.

Suppressed Inflation on the other hand results from intervention from governments through the imposition of physical and monetary controls to check open inflation. It is also known as repressed or suppressed inflation. The free functioning of the market is often suppressed by the use of licensing, price controls and rationing in order to repress extensive rise in prices.

Furthermore, suppressed inflation also results when efforts are made to increase domestic production and reduce import demand by tariffs, import restrictions, limits on foreign loans, voluntary import agreements, etc. So long as such controls exist, the present demand is postponed and there is diversion of demand from controlled to uncontrolled commodities. But as soon as these controls are removed, there is open inflation.

Suppressed inflation adversely affects the economy in several ways of which the most prominent ones include following:

Prices of uncontrolled commodities normally rise very high when the distribution of other goods are controlled.

Suppressed inflation tend to reduce the incentive to work as people do not get the goods they wish to have.

Controlled distribution of goods also leads to misallocation of resources. This results in the



diversion of productive resources from essential sectors needed by the society. Frictions increase in the labour market when high inflation is associated with higher unemployment. Suppressed inflation leads to black marketing, corruption, hoarding and profiteering. It invites extra-legal powers of control.

1.4.2 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.

In many countries, it is by now well understood that the two episodes most commonly seen as major monetary policy failures, namely the Great Depression of the 1930s and the Great Inflation of the 1970s, were episodes where policymakers failed to properly monitor and heed the warnings present in the behavior of money. In large part because of these experiences, the Federal Reserve has regularly monitored the growth of money since the late 1970s.

However, the behavior of monetary aggregates may not always serve as a particularly reliable guide to inflation. Over shorter horizons, in particular, cyclical developments and transitory changes in the velocity of money present non-trivial complications. 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 section, 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:

$$\mu + \Delta v = \pi + \Delta q \quad \dots\dots\dots 1)$$



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, $(\Delta v - \Delta v^*)$. 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:

$$\mu + \Delta v^* + (\Delta v - \Delta v^*) = \pi + \Delta q^* + (\Delta q - \Delta q^*) \dots \dots \dots 2)$$

Rearranging terms to express this relationship in terms of inflation yields:

$$\pi = \mu - \Delta q^* + \Delta v^* - (\Delta q - \Delta q^*) + (\Delta v - \Delta v^*) \dots \dots \dots 3)$$

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 μ^* reflect this adjusted money growth:

$$\mu^* \equiv \mu - \Delta q^* + \Delta v^* \dots \dots \dots 4)$$

Collecting the two cyclical terms

$$\eta = -(\Delta q - \Delta q^*) + (\Delta v - \Delta v^*) \dots \dots \dots 5)$$

And rewriting the equation, yields

$$\pi = \mu^* + \eta \dots \dots \dots 6)$$

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.

The relationship embedded in equation (6) has served as the basis for determining reference and monitoring values for the growth of monetary aggregates for a long time. Milton Friedman's famous prescription during the late 1960s and early 1970s that monetary policy in the United States should aim to keep the growth rate of M2 stable at four percent serves as an example. His prescription was based on the observation that equilibrium M2 velocity appeared to be close to a



constant and the consensus view at the time that the natural growth rate of output was four percent. The prescription suggested that abstracting from cyclical effects, stable M2 growth at a four percent level would achieve near price stability. Another example is the monetary framework adopted by the Bundesbank from the mid-1970s until the 1990s.

Although the relationship between inflation and money growth in equation (10) follows from an identity and should be beyond dispute, it is not always sufficiently appreciated. There are at least two reasons for this confusion. First, over short horizons, this relationship is in large part overshadowed by cyclical factors. Second, without the proper adjustment for changes in Q^* and V^* , money growth and inflation may not appear to track each other even over medium-run horizons. We illustrate each of these difficulties in turn.

The obvious pitfall here, of course, comes from the fact that the most useful piece of information provided by money growth regards lower frequency movements in inflation so that any detrending of the series removes a crucial piece of information from the analysis. Although it is not uncommon in practice, detrending of inflation may be a seriously flawed procedure in disentangling the relationship between monetary aggregates and inflation. In short, failing to properly adjust for underlying movements in natural growth or equilibrium velocity may obscure the fundamental link between money growth and inflation but does not in any sense reduce its significance and value for monitoring inflation.

Empirical Evidence of a Money-Inflation Link

Milton Friedman claimed that “inflation is always and everywhere a monetary phenomenon.” *A Monetary History of the United States, 1867–1960*. We know this isn’t true if one takes a loose view of inflation because negative aggregate supply shocks and increases in aggregate demand due to fiscal stimulus can also cause the price level to increase. Large, sustained increases in the price level, however, are indeed proximately caused by increases in the money supply and only by increases in the money supply. The evidence for this is overwhelming: all periods of hyperinflation from the American and French Revolutions to the German hyperinflation following World War I, to more recent episodes in Latin America and Zimbabwe, have been accompanied by high rates of money supply (MS) growth. In most of those instances, the government printed money in order to finance large budget deficits.

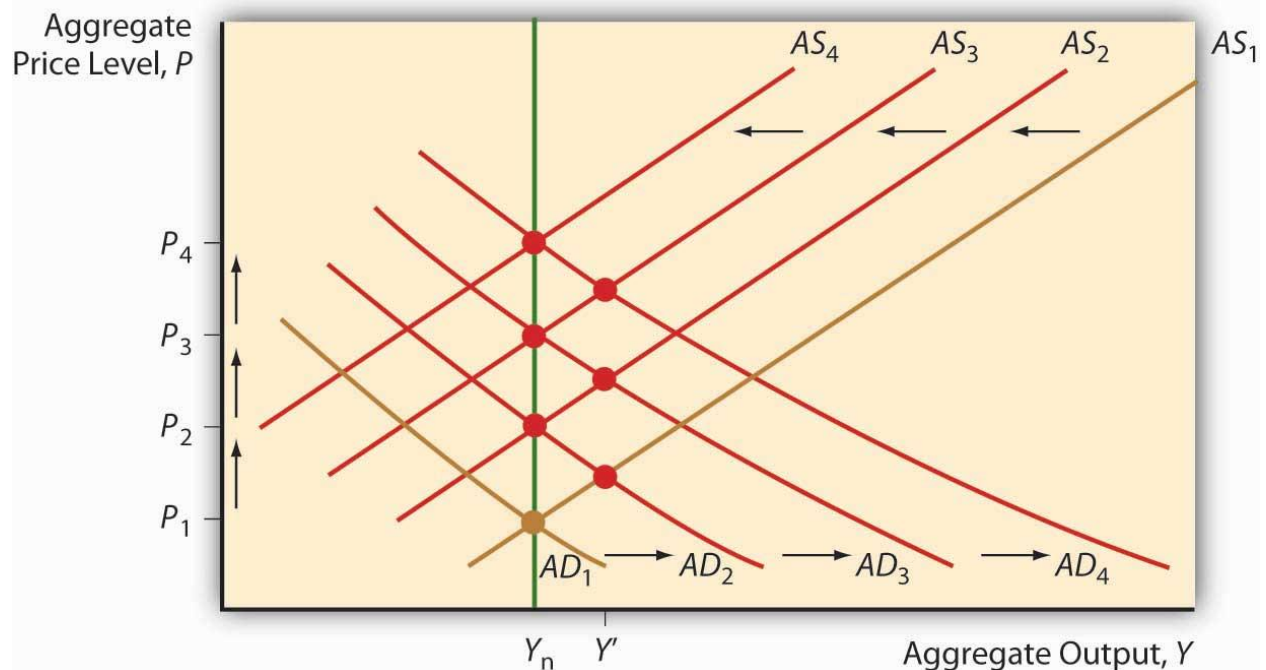
The rebel American, French, and Confederate (Southern) governments could not raise enough in taxes or by borrowing to fund their wars, the Germans could not pay off the heavy reparations imposed on them after World War I, and so forth. We know that the deficits themselves did not cause inflation, however, because in some instances governments have dealt with their budget problems in other ways without sparking inflation, and in some instances rapid money creation was not due to seriously unbalanced budgets. So the proximate cause of inflation is rapid money growth, which often, but not always, is caused by budget deficits. Moreover, the MS increases in some circumstances were exogenous, so those episodes were natural experiments that give us confidence that the reduced-form model correctly considers money supply as the causal agent and that reverse causation or omitted variables are unlikely.

A negative supply shock, the almost complete cutoff of foreign trade, could well have hit poor

Johnny Reb (the South) as well. That would have decreased output and driven prices higher, prices already raised to lofty heights by continual emissions of too much money.

Economists also have a structural model showing a causal link between money supply growth and inflation at their disposal, the AS-AD model. Recall that an increase in MS causes the AD curve to shift right. That, in turn, causes the short-term AS curve to shift left, leading to a return to Y_{nrl} but higher prices. If the MS grows and grows, prices will go up and up, as in [Figure 4.1 "Inflation as a response to a continually increasing money supply"](#).

Figure 4.6 Inflation as a response to a continually increasing money supply

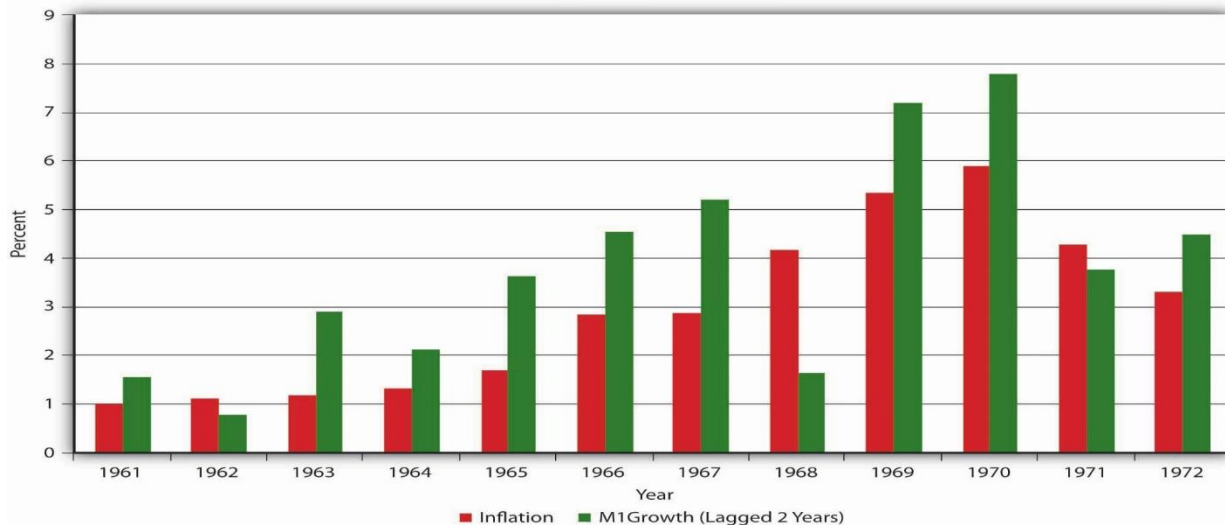


Nothing else, it turns out, can keep prices rising, rising, ever rising like that because other variables are bounded. An increase in government expenditure G will also cause AD to shift right and AS to shift left, leaving the economy with the same output but higher prices in the long run (whatever that is). But if G stops growing, as it must, then P^* stops rising and inflation (the change in P^*) goes to zero. Ditto with tax cuts, which can't fall below zero (or even get close to it). So fiscal policy alone can't create a sustained rise in prices. (Or a sustained decrease either.)

Negative supply shocks are also one-off events, not the stuff of sustained increases in prices. An oil embargo or a wage push will cause the price level to increase (and output to fall, ouch!) and negative shocks may even follow each other in rapid succession. But once the AS curve is done shifting, that's it— P^* stays put. Moreover, if Y^* falls below Y_{nrl} , in the long run (again, whatever that is), increased unemployment and other slack in the economy will cause AS to shift back to the right, restoring both output and the former price level!

So, again, Friedman was right: inflation, in the sense of continual increases in prices, is always a monetary phenomenon and only a monetary phenomenon. This is not to say, however, that negative demand shocks might not contribute to a general monetary inflation.

Figure 4.7 U.S. M1 and P growth



The data clearly show that M1 was growing over the period and likely causing inflation with a two-year lag. M1 grew partly because federal deficits increased faster than the economy, increasing the debt-to-GDP ratio, eventually leading to some debt monetization on the part of the Fed. Also, unemployment rates fell considerably below the natural rate of unemployment, suggesting that demand-pull inflation was taking place as well.

1.4.3 Money Growth and Business Cycles

The purpose of this section is to introduce the study of the relationship between money growth and business cycles. By business cycles we mean fluctuations of output around its long-term growth trend.

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 II—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.' 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. Secondly, the extreme variability of the length of the leads would seem to suggest, if anything, (the 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.

Let's now discuss some historical theories about the relationship between Money and business cycle

An old monetary theory of business cycles was put forward by Hawtrey⁴. 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. Business cycles are caused by the expansion and contraction of bank credit. Hawtrey's business cycle theory is based on three important factors:

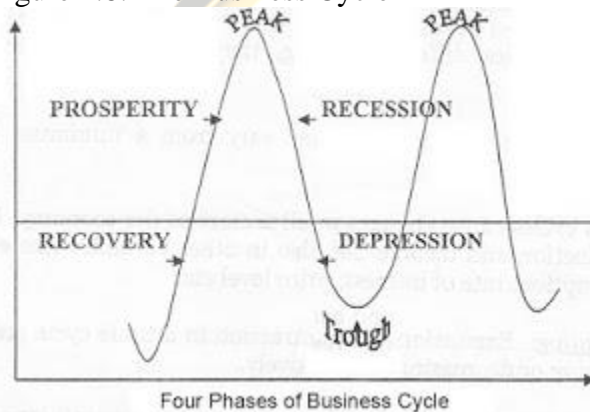
1. Traders play an important role in the economy. They are very sensitive to the change of rate of interest.
2. Money supply in the economy is affected by the level of consumer spending.
3. At the sudden crash of boom, banks suspend credit and call on the borrowers to return the loans.

According to Arthur F. Burns and W. C. Mitchell, a typical or standard trade cycle consists of four

⁴ Purely Monetary Theory of Trade Cycle: by Ralph G. Hawtrey (1926): (1879-1971

closely interrelated phases of revival, expansion, recession, and contraction. The peak and trough are the critical mark-off points 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:

Figure 4.8: The 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. When the banks have excess reserves the rate of interest is lowered, producers and traders will be induced to borrow more from banks. It has already been pointed out that the business people are very sensitive to change in the rate of interest. Borrowing at low rate of interest lead to expansion in business activities and rise in the price level. Producers employ more people this leads to more income and more production. The income goes in the hands of the factors of production. The increased income is spent on consumer goods thus increase in demand of consumer goods. The increase demand leads to further expansion of demand of investment goods. In this way a cumulative expansion takes place during the prosperity. Banks grant more and more loans to business. The boom crashes when banks stop expansion of credit.

The downswing or Depression:

How does the depression develop according to this theory? As said above, the banks suddenly suspend their policy of credit expansion which they were following. Why do they do so? With the expansion of credit the banks reach at maximum point beyond which they cannot any more loans. This may be because of the understanding that the peak has reached and that the economy may take a downturn in the immediate future. The scarcity of cash forces banks to raise the rate of interest and start withdrawing the short term and call loans from their clients. This comes as big shock to the businessmen who were enjoying the liberal policy of banks. The sudden call backs of



loans forces businessmen to sell their stock at any price and repay the loans. This depresses the market. Prices crash and with every fall in prices the desire to dispose of the stocks leads to nervousness and collapse of the market. Once the downtrend starts it gathers the momentum with the lapse of time. There is an atmosphere of pessimism and gloom throughout the economy. This is depression.

Conditions for revival:

During the depression the rate of interest is low and banks have excess reserves. The conditions are favourable for revival. The low rate of interest induces businessmen to borrow and the excess reserves with banks induces banks to lend. The revival starts and because of its cumulative character leads to prosperity and boom conditions. In short it can be said that elastic money supply is the root cause of the operation of a trade cycle.

Critical Appraisal:

Hawtrey maintains that the economy under gold standard and fixed exchange rate system makes his model of business cycles self-generating as there is built-in tendency for the money supply to change with the emergence of trade deficit and trade surplus which cause movements of gold between countries and affect money supply in them.

Changes in money supply influence economic activity in a cyclical fashion. However, Hawtrey's monetary theory does not apply to the present-day economies which have abandoned gold standard in 1930s. However, Hawtrey's theory still retains its importance because it shows how changes in money supply affect economic activity through changes in price level and rate of interest. In modern monetary theories of trade cycles this relation between money supply and rate of interest plays an important role in determining the level of economic activity.

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.

Hayek's Monetary Version:

Hayek suggests that it is monetary forces which cause fluctuations in investment which are prime cause of business cycles⁵. In this respect Hayek's theory is similar to Hawtrey's monetary theory except that it does not involve inflow and outflow of gold causing changes in money supply in the

⁵ Friedrich August von Hayek, 1899-1992: *Monetary Theory and the Trade Cycle* , 1929



economy.

To begin with, let us assume that the economy is in recession and businessmen's demand for bank credit is therefore very low. Thus, lower demand for bank credit in times of recession pushes down the money rate of interest below the natural rate. This means that businessmen will be able to borrow funds, that is, bank credit at a rate of interest which is below the expected rate of return in investment projects. This induces them to invest more by undertaking new investment projects. In this way, investment expenditure on new capital goods increases.

This causes investment to exceed saving by the amount of newly created bank credit. With the spurt in investment expenditure, the expansion of the economy begins. Increase in investment causes income and employment to rise which induces more consumption expenditure. As a result, production of consumer goods increases. According to Hawtrey, the competition between capital goods and consumer goods industries for scarce resources causes their prices to rise which in turn push up the prices of goods and services.

But this process of expansion cannot go on indefinitely because the excess reserves with the banks come to an end which forces the banks not to give further loans for investment, while demand for bank credit goes on increasing. Thus, the inelastic supply of credit from the banks and mounting demand for it because the money rate of interest to go above the natural rate of interest.

This makes further investment unprofitable. But at this point of time there has been over-investment in the sense that savings fall short of what is required to finance the desired investment. When no more bank credit is available for investment, there is decline in investment which causes both income and consumption to fall and in this way expansion comes to an end and the economy experiences downswing in economic activity.

However, after a lapse of sometime the fall in demand for bank credit lowers the money rate of interest which goes below the natural rate of interest. This again gives boost to investment activity and as a result recession ends. In this way alternating periods of expansion and contraction occur periodically.

1.4.4 Expectations of the Real Business Cycle and Expected Inflation

Background: Real Business Cycle (RBC) Theory and Classical Monetary Models

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. It rested on three basic claims:

- 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). That view had an important corollary: Stabilization policies may not be necessary or desirable, and they could even be counterproductive. This was in contrast with the conventional interpretation, tracing back to Keynes (1936), of recessions as periods with an inefficiently low utilization of resources that could be brought to an end by means of economic policies aimed at expanding aggregate demand.

- 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. Such an interpretation of economic fluctuations was in stark contrast with the traditional view of technological change as a source of long term growth, unrelated to business cycles.

- 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. The latter continued to rely on large-scale macroeconometric models despite the challenges to their usefulness for policy evaluation (Lucas 1976) or the largely arbitrary identifying restrictions underlying the estimates of those models (Sims 1980).

The attempts by Cooley and Hansen (1989) and others to introduce a monetary sector in an otherwise conventional RBC model, while sticking to the assumptions of perfect competition and fully flexible prices and wages, were not perceived as yielding a framework that was relevant for policy analysis. The resulting framework, which is referred to as the classical monetary model, generally predicts neutrality (or near neutrality) of monetary policy with respect to real variables. That finding is at odds with the widely held belief (certainly among central bankers) in the power of that policy to influence output and employment developments, at least in the short run. That belief is underpinned by a large body of empirical work, tracing back to the narrative evidence of Friedman and Schwartz (1963), up to the more recent work using time series techniques, as described in Christiano, Eichenbaum, and Evans (1999).

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. 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.



The real business cycle propositions rest on the assumption that all markets can be taken to be competitive and efficient (i.e. continuous equilibrium) in the economy. This assumption is not consistent with models of the Keynesian paradigm, since they incorporate market imperfections and/or failure of the economy to achieve long-run equilibrium instantly after a demand shock. In these models, shifts in aggregate demand, whether through shifts in investment and other private sector variables or in monetary and fiscal policy, can produce changes in output and be a source of, or contribute to the continuation of, business cycles. More specifically on monetary policy, market imperfections can create non-neutrality of money, so that fluctuations in the money supply can add to output fluctuations. Conversely, the appropriate monetary policy can reduce the severity of cyclical fluctuations due to aggregate demand shocks coming from the private sector. Further, Keynesians do not deny that shifts in the fundamental determinants of output, mentioned above, can also cause output fluctuations.

Therefore, the core of the debate about the validity of real business cycle theory is not about whether shocks to technology and factor inputs can cause cyclical fluctuations, for that is not in dispute. It is rather about whether shocks to aggregate demand can cause such fluctuations and whether monetary policy can moderate them. Real business cycles and the modern classical school deny that they can, or do so in a significant manner, while Keynesians assert that they can do so. This issue is easily testable by the appropriate causality tests. The consensus on the empirical evidence seems to be that the major part (in some estimates, as large as 70 percent) of the fluctuations in output can be attributed to productivity shocks. This is a testament to the success of real business cycle theory, as compared with Keynesian ideas from the 1940s to the 1970s that had attributed most business cycle fluctuations to shifts in aggregate demand.

However, the empirical evidence leaves a very significant part of the fluctuations in output that cannot be explained by shifts in technology and preferences. Overall, the empirical evidence, as well as intuition, seems to indicate that fluctuations in aggregate demand, in addition to changes in technology and preferences, do cause fluctuations in output and employment and that money supply growth is positively related to output growth. Therefore, real business cycle theory is not strictly valid, and monetary policy can be pursued in appropriate cases to reduce output fluctuations.

The exponents of the real business cycle theory also prefer to test this theory by the calibration and simulation of models rather than by the econometric testing of their hypotheses. The former procedure requires a priori specification of the likely values of the parameters, on which there can be considerable doubts. Further, the findings may not be robust to small changes in these assumed values, or consistency with the empirical observations may require implausible values. Consequently, this testing procedure and its reported findings have not won general acceptance.

There seem to be at least two major contributions of the real business cycle theory. One, it has firmly established that changes in technology and preferences do cause cyclical fluctuations in output and may do so significantly more than fluctuations in aggregate demand. Two, the approach initiated by the real business cycle agenda to macroeconomic modeling is now firmly established. This approach requires that macroeconomics be based on optimization over time by individual economic agents in a dynamic context. This stochastic dynamic intertemporal approach to



macroeconomics permeates current macroeconomic models, including the new Keynesian model, which is presented in the next chapter. The major deficiency and unrealistic assertion of the real business cycle theory is that it denies demand shifts any role in output fluctuations.

The empirical evidence on the impact of changes in aggregate demand on output is often on the impact of money supply changes, which change aggregate demand, on output. The influential study by Friedman and Schwartz (1963a,b) used evidence from over 100 years of US data to show clear evidence that money supply changes lead, and therefore Granger cause, changes in real economic activity. However, inside money (i.e. deposits in banks) is the largest component of money. Subsequent contributions by other authors showed that deposits respond to macroeconomic disturbances, so that money is more highly correlated with lagged output than with future output; i.e. deposits lag rather than lead output. However, monetary aggregates such as M2 still lead output. Further, if the central bank uses the interest rate as its operating monetary policy target, and money supply responds endogenously to it, the evidence seems to show that changes in interest rates lead output.

To conclude, empirical evidence shows that while shocks to real factors such as technology and preferences do cause fluctuations in output, shocks to monetary policy variables of money and interest rates also do so. Models of the modern classical school and real business cycle theory do not provide a satisfactory explanation for the latter finding. In recent years, sticky price and inflation models of the new Keynesian school have been proposed to explain economic fluctuations. An example of these studies is provided by Ireland (2001b).

1.4.5 Money and Employment

We consider the impact of changes in money stock and interest rates on real income and employment. However, our ultimate concern is with their effect on real variables and on the rate of inflation.

Before Keynes's General Theory, this was the preserve of the Quantity Theory of Money, which suggested that, in anything other than the short run, any change in the rate of growth of the money supply would simply lead to inflation. 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. 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. In more detailed models, prices had to rise before the economy was at full employment because an increase in employment required a reduction in real wages and this could only occur through an increase in the general price level. There was thus an inherent notion of a trade-off between reductions in unemployment and increases in the price level.

Despite this, there was little enquiry into this trade-off until 1958 when A W Phillips first constructed the Phillips curve (Phillips, 1958). Section 8.2 deals with the original Phillips curve and the subsequent attack on the idea of the existence of a long-run trade-off between wage inflation and unemployment in the Friedman-Phelps expectations-augmented Phillips curve.

Unfortunately for the New Classical model, it is clear from the evidence that there is a short-run trade-off between inflation and unemployment. A monetary policy shock does have real effects, at least in the short-run. Further, the impact of such a shock on unemployment precedes the impact on the rate of inflation. The New Classical model had a powerful effect on the way in which people looked at economic policy. In particular, it led to the policy irrelevance proposition that the authorities cannot influence real variables by boosting or squeezing aggregate demand.

The simple Phillips curve

After World War II, the UK government accepted for the first time the obligation to try to run the economy as close to full employment as possible, although the term 'full employment' was never precisely defined. Keynes's General Theory had suggested that economies in deep recession could reduce unemployment by expanding aggregate demand and that, in such circumstances, fiscal policy was likely to provide a more powerful instrument than monetary policy. There appeared to be empirical support for these ideas. Unemployment had been high in the 1930s when demand was low; it was non-existent during the war years when demand for everything outstripped supply; and it seemed in the 1950s that expansionary demand management could reverse small increases in unemployment.

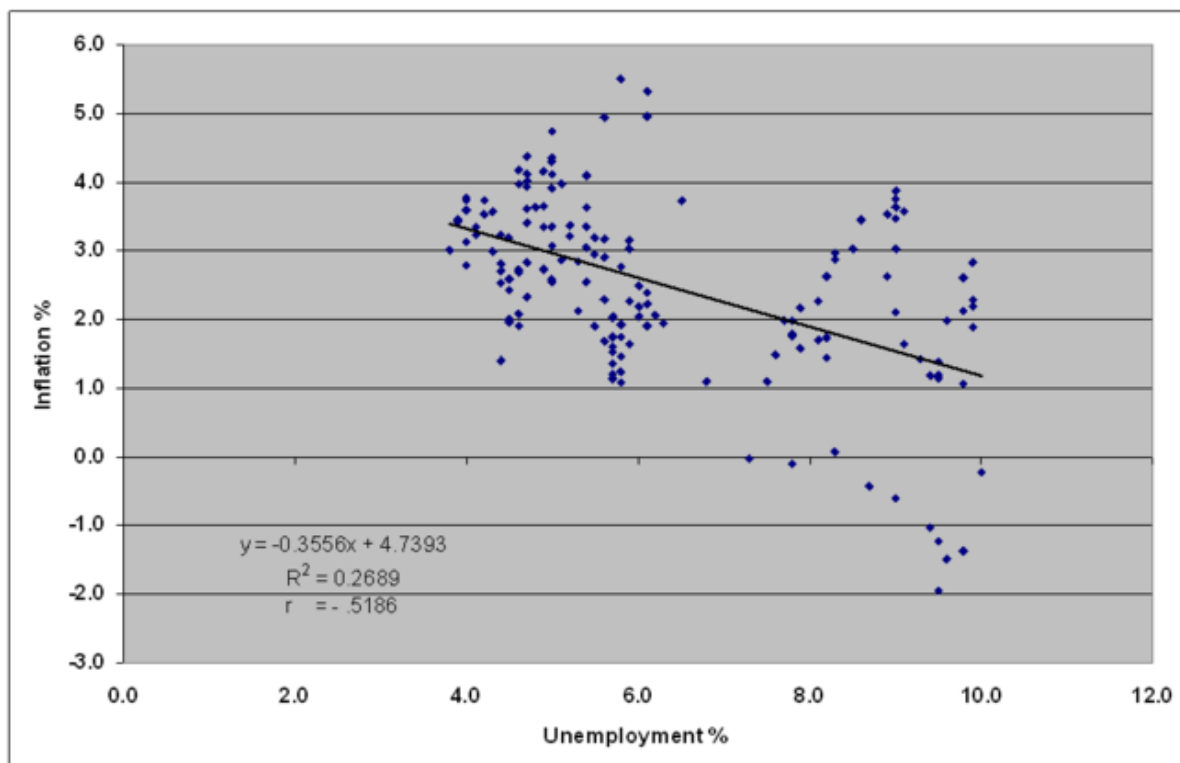
After 1958, the idea that governments could effectively choose the level of employment and output up to some critical full employment level, enjoyed what appeared to be overwhelming empirical support from the work of A W Phillips (1958). The Phillips curve plotted the relationship in the UK between the recorded level of unemployment (U) and the rate of change of money wages (\dot{w})



from 1861 to 1957. The rate of change of money wages was used as a proxy for inflation since price inflation data was not available for the early years. Figure 4.4 shows a simple Phillips curve with wage inflation on the vertical axis. However, it was easy to move from wage inflation to price inflation by allowing for increases in labour productivity and the Phillips curve is almost always drawn in price inflation/unemployment space.

The theory of the Phillips curve seemed stable and predictable. Data from the 1960's modeled the trade-off between unemployment and inflation fairly well. The Phillips curve offered potential economic policy outcomes: fiscal and monetary policy could be used to achieve full employment at the cost of higher price levels, or to lower inflation at the cost of lowered employment. However, when governments attempted to use the Phillips curve to control unemployment and inflation, the relationship fell apart. Data from the 1970's and onward did not follow the trend of the classic Phillips curve. For many years, both the rate of inflation and the rate of unemployment were higher than the Phillips curve would have predicted, a phenomenon known as "stagflation." Ultimately, the Phillips curve was proved to be unstable, and therefore, not usable for policy purposes.

U.S. Phillips Curve: Inflation vs. Unemployment Rate (1/2000 – 4/2013)



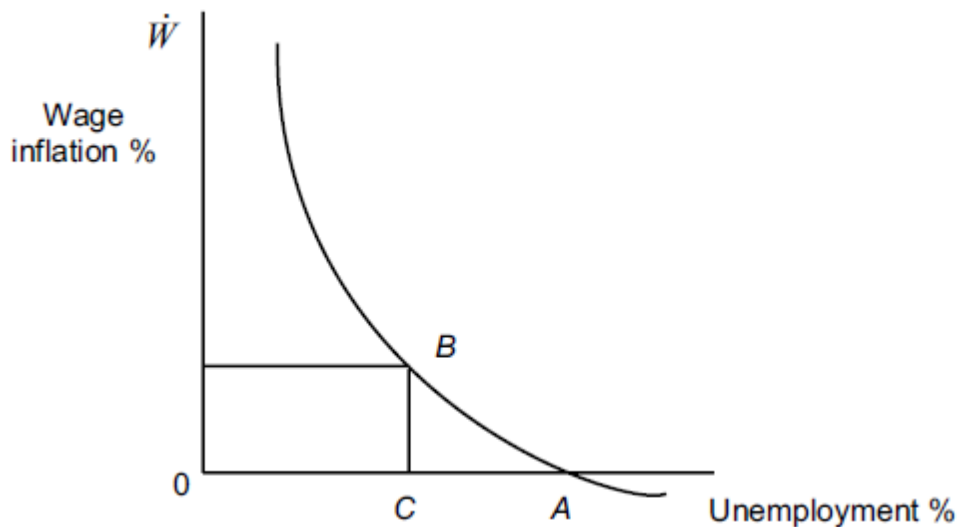
Source: FRED Database
"CPIAUCSL" – Consumer Price Index for All Urban Consumers (% Change from Year Ago)
"Unemploy" – Unemployment Rate

US Phillips Curve (2000 – 2013): The data points in this graph span every month from January 2000 until April 2013. They do not form the classic L-shape the short-run Phillips curve would

predict. Although it was shown to be stable from the 1860's until the 1960's, the Phillips curve relationship became unstable – and unusable for policy-making – in the 1970's.

The implication seemed clear. The evidence suggested firstly that the economy could be run at various levels of employment and, consequently, output. Secondly, it suggested that the level of unemployment could be reduced without producing inflation until it fell to the level of unemployment at which the curve cut the horizontal axis (5.5 per cent in Phillips's original study). Thirdly, the government appeared able to choose to run the economy at even lower levels of unemployment if they so wished, but at the cost of inflation. They could, for example, choose point B in Figure 4.9. The original study suggested that an unemployment level of 2.5 per cent required acceptance of a 2 per cent rate of inflation. Thus was born the idea of a stable trade-off between unemployment and inflation.

Figure 4.9: The Simple Phillips Curve



Empirical support for the Phillips curve trade-off was found in many economies in the early 1960s, but Phillips's statistical study needed theoretical support. Much of standard Keynesian macroeconomics assumed constant prices. Where prices were introduced, the analysis was in terms of the price level rather than the rate of inflation. Lipsey (1960) and others provided some theoretical support. However, neoclassical economists remained skeptical because, in conventional microeconomic analysis, employment (and hence unemployment) levels depended on the real wage, not the money wage as implied by the Phillips curve. One way of bringing the statistical evidence into line with microeconomic theory was to assume a zero rate of expected inflation. In other words, workers always took the existing money wage as equivalent to the real wage — a restatement of the existence of money illusion.

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. Of the many attempts made to explain the movement away from the original Phillips curve, the Friedman/Phelps model conformed best to the standard theory that rational labour market decisions were based on real wages. In other words, it was an extension of the dominant neoclassical theory of market behaviour. This ensured its survival ahead of other theories that depended on institutional changes and the existence of class conflict to explain the growth of cost inflation.

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 real wage 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 long-run 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.

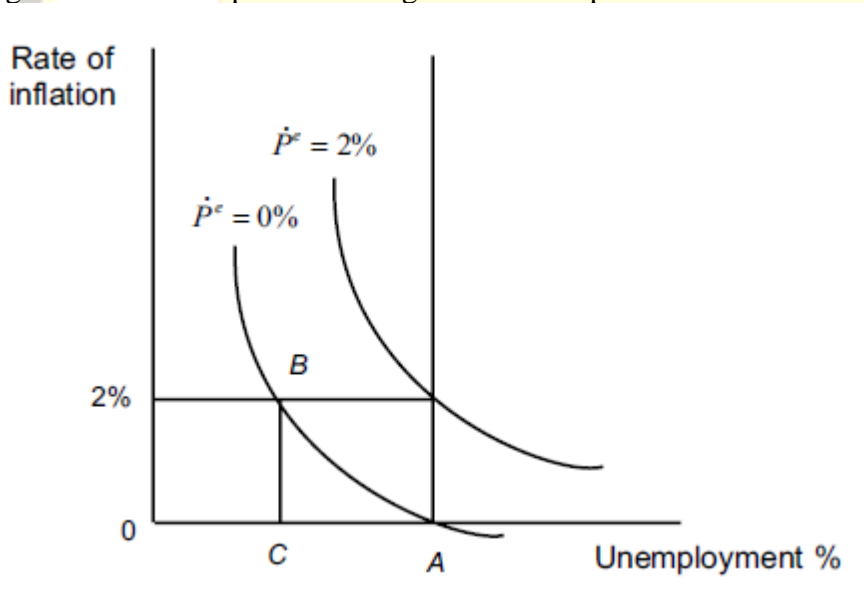
The natural rate of unemployment could occur with any rate of inflation and would do so as long as the expected rate of inflation was equal to the actual rate of inflation. The notion of a long run trade-off between unemployment and inflation had been completely removed. The rate of inflation would be explained, as in the Quantity Theory of Money, by the rate of growth of the money supply. The model, thus, supports the simple rule of monetary policy proposed by Milton Friedman — that the rate of growth of the money supply in a stable price environment should be kept equal to the rate of change in real income. 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. At the lower real wage rate, employers hire more workers and expand production. Output and employment increase and we move along the short-run Phillips curve from A to B. However, workers gradually adapt their expectations to take into account the true rate of inflation and, so long as the rate of inflation remains at 2 per cent, they will eventually forecast it correctly. Money wages are pushed up to restore the initial real wage and the economy returns to equilibrium, again at the natural rate of unemployment but at a higher rate of inflation than previously. That is, the original short-run Phillips curve applied only as long as expected inflation remained at 0 per cent.

When expectations were changed, the curve shifted to cut the long-run vertical Phillips curve at the, now expected, actual rate of inflation of 2 per cent.

Figure 4.10: The expectations-augmented Phillips curve



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 but only 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.

The most prominent explanation of the damage done to the price mechanism by volatile inflation came from Lucas (1972, 1973). He assumed that firms know the current price of their own goods but only learn what happens to prices in other markets with a time lag. When the current price of its output rises, a firm has to decide whether this reflects a real increase in demand for its own product or a general increase in prices resulting from random demand shocks. In the former case, the rational response would be to increase its output; in the latter case, it should not do so. That is, firms have to distinguish between absolute and relative prices. The signal that should be provided to producers by changes in relative prices is being confused by the possibility of inflation, especially by volatile inflation. Firms face a signal extraction problem. The greater the variability of the general price level, the more difficult it is for a producer to extract the correct signal, and the smaller the supply response is likely to be for any given change in prices. Far from there being a trade-off between unemployment and inflation, the accepted theory now suggested that inflation caused unemployment to increase.

To reduce unemployment in the long-run, governments were required to keep inflation low and to attempt to lower the NAIRU through supply-side measures. There was also bad news for those authorities who started with a high rate of inflation and wished to get it down. Reducing the rate of growth of the money supply would push inflation down but workers would continue for some time to expect the previous high rate of inflation and would continue to push money wages up in line with their expectations. Real wages would rise, output would fall, and unemployment would increase beyond the NAIRU. The amount of output lost in order to bring about a fall in inflation was called the sacrifice ratio. Of course, in the long run, workers would adjust their expectations and unemployment would fall back to the NAIRU.

However, the short-term costs in terms of lost output and increased unemployment could be high, especially since the theory did not indicate how long it would take workers to adjust their expectations. The 'long run' is a logical construct — the time that it takes for workers to obtain full information about changing prices. However, in a constantly changing world, this could be a very long time. Indeed, there is no reason to believe that any economy ever reaches the long-run. Thus, within the Friedman/Phelps model, monetary policy might have considerable and continuing real effects.

There are other objections to the theory. Firstly, the evidence that inflation was very costly for economies even at low levels was not strong. The principal loss for an economy identified by Friedman and others (called the shoe leather cost of inflation) was a welfare cost, which depended on people switching from money to other assets because of inflation. However, if one accepts the Keynesian proposition that there are close substitutes for money, this cost might not be very great at low inflation rates. Further, one could argue that low rates of inflation might be desirable since a zero rate of inflation for the economy as a whole would require prices to be falling in some



sectors and falling prices have always been associated with low levels of confidence. Of course, as we have noted above, the model suggests that continuing attempts by the authorities to exploit the short-term unemployment/ inflation trade-off produce accelerating inflation and so eventually the costs of inflation must increase, whatever one's view about the closeness of substitutes for money. Even so, much time might pass before the costs of inflation become serious for an economy.

Secondly, the view that inflation was caused by the monetary authorities implied a belief in a stable demand for money function and an exogenous money supply, which, are both open to serious doubt — especially in the case of exogenous money.

Thirdly, unemployment might also have long-run impacts. It has been argued that increases in unemployment damage confidence leading to lower investment and economic growth and might lower the skill levels of workers causing reductions in labour productivity. That is, increased unemployment in the short-run could cause higher unemployment in the long run and the long-run costs of unemployment might be greater than the long-run costs of low inflation.

The debate over the expectations-augmented Phillips curve thus led to many attempts to enumerate and compare the various costs of both inflation and unemployment. If the costs of unemployment were high relative to those of low rates of inflation and if economies never reached long-run equilibrium positions, there was still a case for attacking unemployment by expanding aggregate demand. Nonetheless, the Friedman/Phelps model, together with the experience of stagflation in many developed economies in the 1970s, was influential in the increasing acceptance by governments of the limitations of demand management policies. Governments everywhere began to pay much greater attention to the supply side of the economy.

Discussions and Review Questions

Compare and contrast the monetarist, Keynesian and the structuralist view of inflation, use diagrams if any.

Distinguish between Open and suppressed inflation.

Discuss whether the existence of business cycles and the observed positive correlation between real and monetary variables mean that the modern classical models are neither valid nor relevant for policy purposes.

Specify a model that generates real business cycles only. Discuss whether this model allows for the observed cyclical correlation between money and output.

Where would the combination of inflation and unemployment in your country in 2020 lie on the original Phillips curve diagram?

Why is the natural rate of unemployment referred to as 'natural'?



Explain the basis of Milton Friedman’s simple rule of monetary policy — that the rate of growth of the money supply in a stable price environment should be kept equal to the rate of change in real income.

Why was the ‘shoe leather cost’ of inflation so called? What other costs are there of anticipated inflation?





1.5 CENTRAL BANKING AND MONETARY POLICY

Introduction

In this section we shall focus on monetary policy and central banking. I shall attempt to define the concept of ‘Monetary Policy’ and see how applicable it is to real world situation. Also, an attempt will be made to explore the functions of the central bank and main objectives of monetary policy. You may recall that in Section 3 we learned about how the central bank creates and determines the money stock in the economy. Because the quantity of money has important implications for economic activities, it is essential we understand how the central banks conduct such monetary policy in practice and which policy variables the tools of monetary policy are targeted at. This section will focus on this and monetary policy transmission mechanism to the economy.

We shall also examine the goals and operating targets of monetary policy. The two major operating targets of monetary policy are the money supply and the interest rate. Note that the central banks of different countries usually have their own distinctive and somewhat different sets of goals in their mandates from their respective legislative authorities. However, as we shall see in this section, there is also a high degree of similarity in the goals, broadly defined, among them. Further, the mandate assigned to a given central bank is normally broad enough to allow it a great deal of latitude in the goals it does choose to pursue in practice.

This section also focuses on the analytical treatment of three major issues: independence of the central bank, time consistency of policies and the credibility of central bank objectives and policies. Assuming a potential for trade-offs among goals, this section examines the determination of the choices made and the potential for conflicts among the monetary and fiscal authorities. This discussion leads to the examination of the independence of central banks from governments and legislatures. This will lead us to examine the theoretical modelling of the role of the central bank and its reaction functions.

I shall also take you through the competing views on the determination of the rate of interest and focuses on their differences and validity. And highlight the very important difference between the comparative static and the dynamic determination of the rate of interest. Before concluding this section, I shall also explain the fact that the major reasons for the variations among interest rates are the differences in the term to maturity and the differences in risk. To explain the former, it is important that the riskiness of bonds be held constant across assets of different maturities. This is made possible by confining the comparison to government bonds of different maturities and studying their yield curve. The main theory for explaining the term structure of interest rates is the expectations hypothesis.



Explain the objectives and functions of the central bank

Explain theories of central bank independence

Describe the monetary policy transmission mechanism

Distinguish among monetary policy targets, interest rates target, inflation target and Instruments (Direct and Indirect)

Explain the theoretical relationship between interest rates and Monetary Policy, specifically the Taylor's Rule

Explain the theoretical modelling of the role of Central Banks, its reaction and loss functions.

Describe the Three Equation Model of Monetary Policy and the monetary policy rule

Explain a simple Vector Autoregressive (VAR) models for analyzing monetary policy.

Appreciate empirical studies on Central banking and Monetary Policy with emphasis on Africa.

Explain theory of interest Rates: interest rate determination, portfolio choice theory the risk and Term Structure of Interest Rates;

Explain bond pricing, yield curve and the expected future spot interest rates

1.5.1 A review of Objectives and Functions of the Central Bank

Most central banks across the globe perform similar functions. However, you will discover at the end of the lessons that the motive of central banking in advanced countries is sometimes different from that of the less developed economies. Central banking in most countries – rich or poor - aims to achieve monetary stability – a sound currency, with a stable exchange rate and/or low inflation. Nonetheless, central banks in the developing countries tend to have extra responsibilities and assume much more importance than their counterparts in developed countries. Why this is the case? As I hope by now you cannot wait to discover this yourself, I shall ask you to come along with me to explore this section with relish.



The Central Bank

A central bank is often named after the country in which it operates. For instance, there is Bank of England, Bank of Ghana, Bank of France, The Federal Reserve System in America, Reserve Bank of India, etc. But what is a central bank? Generally, a central bank is often defined by the functions it performs. A central bank, which is sometimes referred to as a monetary authority or reserve bank, is a public institution that usually issues the currency, regulates the [money supply](#), and controls the interest rates in a country. Central banks often also oversee the [commercial banking system](#) of their respective countries while possessing a monopoly on printing the national currency, which usually serves as the nation's [legal tender](#). According to A.C.L. Day, a central bank is “to help control and stabilize the monetary and banking system”.

Within the democratic system of government, most central banks are independent, meaning their operations are devoid of government interference. Or should we say their operations should be devoid of any government intervention. But is it really the case, particularly in most developing countries? Well, we may not be in a position to answer that now - let's leave that for another time. The central bank is often defined by the functions it performs.

Functions of the Central Banks

The primary function of a central bank is to provide the nation's money supply, but more active duties include controlling [interest rates](#) and acting as a [lender of last resort](#) to the [banking sector](#) during times of financial crisis. It may also have supervisory powers, to ensure that banks and other financial institutions do not behave recklessly or fraudulently. The specific functions of a central bank are as follows:

Supervision of the banking system: Central bank supervises the banking system of the country. Central may be responsible for banking system. They collect information from commercial bank and take necessary decision by two ways- a) bank examine and b) bank regulation

Advice a government on monetary policy: The decision on monetary policy may be taken by the central bank. Monetary policy refers to interest rates and money supply. The central bank will cooperate with the government on economic policy generally and will produce advice on monetary policy and economic matters, including all the statistics.

Issue of banknotes: The central bank controls the issue of banknotes and coins. Most payments these days do not involve cash but cheques, standing order, direct debit, credit cards and so on. Nevertheless, cash is important as bank's cash holdings are a constraint on creation of credit, as we have seen. The power of printing currency enables the central bank to be able to make loans when everyone else cannot. In this regard the central bank can protect other banks from the effects of bank runs which increase the stability of the financial system.



Acting as banker to other banks: The Central bank will act as banker to the other banks in the country. As well as holding accounts with international bodies like IMF World bank. It is a common habit for the central bank to insist that the other banks hold non-interest bearing reserves with in proportion to their deposit.

Acting as banker to government: Normally a central bank acts as the government's banker. It receives revenues for Taxes and other income and pay out money for t6he government's expenditure. Usually, it will not lend to the government but will help the government to borrow money by the sales of its bill and bonds.

Raising money for the government: The government Treasury bill and bond markets are covered by the central bank. While sometimes the treasury or ministry of finance handle;

The central bank is the "lender of last resort". Borrowing from the central bank at the discount rate is associated with the notion of the central bank acting as the lender of last resort in the economy. While commercial banks with inadequate reserves can borrow from those with surpluses, a reserve shortage in the financial system as a whole cannot be met in this manner and could force the economy into a liquidity and credit crunch. The discount window – i.e. the ability to borrow from the central bank – is therefore a “safety” valve for the economy. The discount window also acts as a safety valve for an individual bank that needs reserves but is unable or unwilling to borrow from private financial institutions. However, in the United States, borrowing from the central bank invites the scrutiny of the central bank into the borrowing bank's management of its affairs and acts as a disincentive to frequent borrowing from the central bank, as against borrowing in the market. Further, banks are not permitted to make chronic use of the discount window for meeting liquidity needs.

Central Banking in both Advanced and Less Developed Economies

The motive and importance of central banking in advanced countries are different from that of the less developed economies. Central banking in most countries – rich or poor - aims to achieve monetary stability – a sound currency, with a stable exchange rate and/or low inflation – and financial sector stability – sound banks (and other financial institutions) which provide good services without undertaking excessive risk, and an effective non-cash payment system.

In less developed economies, certain important questions arise with respect to the functions of the central bank. These questions may include the following: What are central banks, and what can they do to improve the lot of the vulnerable in society? Is central banking relevant to the poor and vulnerable in poor and fragile developing economies? And can central banks in developing countries do anything to promote employment, or economic growth, or tackle poverty in other



ways? Helping central banks in developing countries to provide macro stability may be one of the most effective ways of providing aid. Good central banking should benefit the whole population – even in developing countries, where the predominant use of cash means that the interest rate has little direct relevance to most of the population (cash does not carry an interest rate); where there may even be a preference for another central bank’s notes (US dollars or euros for instance); and where the banking system may represent a closed door (literally) to the majority of the population in many developing countries.

In developed countries, most people give relatively little thought to monetary or financial stability, because they have them – in the same way that few people think about the plumbing until/unless a pipe bursts. They tend not to worry about the impact of inflation on the timing of their decisions – at least since inflation has dropped to low and stable levels

- since it is too low to make much difference. And bank failures – especially of large banks
- are deemed so unlikely (and are in practice very rare) that they are not a matter of major concern.

And while people may grumble that cheques take three days to clear, the payment systems are easy to use and reliable. To this extent, central banks may feel they have succeeded when the population does not think about them or what they do. The situation is different in many developing countries, and especially in the poorer countries, where inflation tends to be much higher, the banking sector more fragile, and the payment system rudimentary and often cash-based. People will then tend to worry about the value of the domestic currency, and the reliability of the banks, or try to avoid using them altogether.

As a rule of thumb, when inflation is high and volatile (the two normally go together), and the exchange rate unstable, there is a resource transfer to those in the population most adept at managing a difficult financial situation. This tends to mean that the rich get richer and the poor get poorer.

“Inflation also tends to lead to an unequal redistribution of wealth to the benefit of the wealthy who can hedge themselves against inflation and to the detriment of the poor who have neither the resources nor the skills to protect themselves. In a real sense, central banks are there to protect those who cannot protect themselves against the vagaries of inflation.” (Tito Mboweni, Governor, Reserve Bank of South Africa.)



Most central banks have limited visibility to the public: they undertake transactions only with commercial banks and do not, as a rule, provide any services direct to individuals. But by providing a large degree of certainty in the value of money and in the financial system, building trust and promoting efficiency, central banks can help to create a stable basis on which the economy can develop, to the benefit of all. This stability can be especially important to the less financially-sophisticated members of society, who often do not have an effective choice nor the means to protect themselves against monetary or financial instability.

Some of the key prioritization and sequencing issues for a central bank to take note include:

Is the currency stable or not – in terms of the exchange rate and inflation? If not, then stabilisation should take priority over the development of the financial infrastructure for a currency which the population may be trying to avoid using.

Similarly, if poor fiscal behaviour or other instability is still stoking inflation, there may be little point in replacing poor quality bank notes, since new notes may rapidly become devalued.

If the economy is largely cash based, the jump to a state-of-the-art electronic payment system is probably too big. An interim, less sophisticated system which can be introduced much faster and more cheaply should be explored.

Is the political and security situation perceived to be a significant risk? If so, there is unlikely to be much demand for large corporate loans and efforts to promote this sector may be futile. But micro-lending could still be effective.

Is the banking sector fragile? Better to improve banking supervision and put the banks onto a sound footing before encouraging the population to keep their savings in banks rather than under the mattress.

Is economic growth constrained by the lack of credit provision or by its cost?

How can the central bank support financial sector development without taking on a commercial or development banking role?

Most developing countries have a shortage of human resources skilled in central banking. It makes sense to focus effort on priority areas, and on areas when the effort is likely to reap results, while at the same time developing something of a vision for the central bank. The long march starts with the first step. Waiting until the situation is better before planning for the long-term may mean waiting forever.



It is argued that for central banks to promote sustainable economic growth, reduce poverty and support the provision of financial services to vulnerable groups, they should provide good quality currency and keeping inflation low (monetary stability); reduce the risk of bank failure (financial stability); and supporting non-cash payment systems. The attempt by central banks to micro-manage other aspects of the economy (perhaps by non-market mechanisms) almost always fails, and tends to be detrimental to market development, with a longer-term impact on monetary and financial stability, and on economic growth.

Central banking in developing economies is characterized by the provision of a reliable currency for transactions purposes, and – particularly in developing economies - a degree of exchange rate stability. Cash may be the most visible manifestation of the central bank. Most countries have their own currency, though many developing countries are also likely to operate with a second currency. e.g. US dollars, pound sterling, the euro, etc. If the domestic currency is not trusted, then economic agents will seek to use an alternative – hence the degree of ‘dollarization’ in many developing countries. Closely associated with printing of notes and coins is the risk of counterfeiting. The only very short-term solution to widespread (fear of) counterfeiting may be to switch into foreign currency.

Printing a new domestic currency, out of country, is possible (good quality machinery will not be available domestically); but will take at least three-four months even if old designs and plates can be used (but with appropriate security features) and could easily be two or three times as long. The cost of replacing a currency can be high. In the euro area it was estimated as perhaps 0.4% of GDP. In a developing country, the figure could easily be 1% of GDP. Normally, because the government ‘borrows’ from the central bank, increasing cash in circulation without increasing the supply of goods and services is usually done in the developing economies. In a post-conflict situation, and in many transitional countries (especially post hyper-inflation), the local currency is likely to be undervalued. But some people will nevertheless want to switch into foreign currency because of the uncertainties still associated with the local currency. There is little that the central bank on its own can do about this in the short run – unless it has a sufficient supply of foreign currency which it can provide to the market and this eventually increases the supply of foreign currency in the country.

To substantially reduce the security risk of transporting large amounts of cash around a country in a possibly unstable environment, the use of a non cash payment system is ideal. Non-cash payment



systems include cheques, direct credits and direct debits, and debit cards (credit cards may need to be approached more cautiously because of the credit risk involved). More sophisticated retail electronic payment systems, such as credit and debit cards, and ATMs are alternatives to the cash payment system. This type of system is more efficient from an economic point of view. Some developed countries still use cash. For relatively large expenditures, for instance buying cars (Germany has one of the highest levels of cash usage in payments in Europe); but few would want to make commercial payments in cash. Yet in some countries there is no reliable alternative, with payments to the value of millions of dollars being made in cash. This clearly adds to the cost and risks of trade, especially between different regions. Another important benefit of non-cash payment systems is that they create an audit trail for income and expenditure. Corruption and theft of state funds in particular, and money laundering, become much harder. In many countries this alone would more than justify the expense of building a non-cash payment system. Electronic banking is so common in advanced economies. It is therefore not surprising that it is making entry into less developed economies.

The Currency Board

What Does Currency Board Mean?

A currency board is defined as an exchange rate arrangement in which the exchange rate is fixed to an anchor currency. In other words, it is a monetary authority that makes decisions about the valuation of a nation's currency, specifically whether to peg the exchange rate of the local currency to a foreign currency, an equal amount of which is held in reserves. The currency board then allows for the unlimited exchange of the local, pegged currency for the foreign currency. A currency board can only earn the interest that is gained on the foreign reserves themselves, so those rates tend to mimic the prevailing rates in the foreign currency. In fact, a currency board also differs from a typical peg in its commitment to the system, which is usually enshrined in law and in the Central Bank charter.

There are two main reasons why countries have typically used currency boards. In some cases the currency board is a cheaper alternative to having a common currency. For example, for the Eastern Caribbean countries it seems relatively obvious they should use the US Dollar as currency to maximize the benefits from a stable exchange rate arrangement with their almost exclusive trading partner. However, the currency board allows them to keep the exchange rate fixed without giving up the seignorage revenue of domestic currency. In other cases countries have resorted to a Currency Board as a way out of monetary and inflation chaos. Argentina's currency board experience in the 90s and Bulgaria's currency board are appropriate examples.



Like most of the world's economies, Ghana does not have a currency board. In Ghana., for example, the Bank of Ghana is a true central bank, which operates as a lender of last resort, engaging in forward contracts and trading Treasury securities in the open market. The exchange rate is allowed to float, and is determined by market forces as well as the authority's monetary policies. By contrast, currency boards are rather limited in their power. They essentially hold the required percentage of pegged currency that has been previously mandated, and exchange local currency for the pegged (or anchor) currency, which is typically the U.S. dollar or the euro.

Objectives or Goals of Monetary Policy

Monetary policy basically refers to the type of stabilization policies adopted by the central bank (or monetary authorities) of a country to address certain economic imbalances. It has a narrow and a broad perspective. In the narrow perspective, monetary policy refers to the policy actions undertaken by a central bank (monetary authorities) of a country take to control or change the supply of money to achieve the objectives of general economic policy. In a broader spectrum, however, monetary policy refers to the set of procedures and measures taken by a central bank (CB) to manage money supply, interest rate and exchange rates to influence credit conditions and to achieve certain economic objectives.

The CB uses the banking system to control the money supply and interest rates. The CB could conduct monetary policy by simply printing paper currency, but it does not use this method. Rather, it creates special checking accounts for banks called reserve accounts. The banks can use the funds in their reserve accounts just like currency to make loans. When the balances in these reserve accounts rise, the money supply expands and interest rates fall.

Though the goals of monetary policy have been changing with the evolution of central banking and changes in both the behaviour and performance of different economies, there is a widely held view that the ultimate goals of monetary policy at present (both for developed and developing countries) are price stability, full employment, economic growth, balance of payments equilibrium (exchange rate stability) and interest rate stability (financial stability). These goals, though inter-related, may be contradictory.

Price Stability

Price stability is the first monetary policy objective we will discuss. Though economist and laymen equally favour a policy of price stability because fluctuations in prices bring uncertainty and instability to the economy, there are disagreements on its definition and pursuit. Papademos (2006



pp 1), for instance, defines price stability as “a state in which the general price level is literally stable 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”. Similarly, Volcker (1983 pp 1) considers price stability as a “situation in which expectations of generally rising (or falling) prices over a considerable period are not a pervasive influence on economic and financial behaviour”. Additionally, Greenspan (1996 pp 1) believes price stability occurs when “economic agents no longer take account of the prospective change in the general price level in their economic decision making”.

These disagreements notwithstanding, price stability is not consistent with prices remaining unchanged indefinitely. Comparatively, prices will change as fluctuating tastes alter the composition of demand as new products are developed and as cost reduces because of technological changes. Also, differential price changes are essential for resource allocation in market economies. Thus, price stability may be consistent with the general level of prices changing but not that significant to alter economic decision making.

On the pursuit of price stability, disagreements exist on the type of price level to be stabilized. Should the relative or general price level be stabilized; or the wholesale, retail, consumer or producer goods be stabilized? There is no specific criterion with regards to the choice of price level. Halm suggests the compromise solution would be to try to stabilize a price level which would include consumer’s goods prices as well as wages. But this will necessitate an increase in the quantity of money but not as much as it is implied in the stabilization of consumer’s good prices. Alternatively, innovations may reduce the cost of production but a policy of stable prices may bring larger profits to producers at the cost of consumers and wage earners.

Despite these drawbacks, rising and falling prices are both bad because they bring unnecessary hardships to some and undue advantage to others. A price stability policy is thus an essential action that keeps the value of a currency stable, eliminate cyclical fluctuations, help in reducing inequalities of income and wealth, secure social justice and promote economic welfare. Monetary policy can be used to achieve price stability in different ways. For instance, when an economy suffers a recession, monetary policy could be an 'easy money policy' (where economic agents can easy get access to money) but when the economy is experiencing inflationary pressures, there should be a 'dear money policy' to revamp economic activities.

Full Employment

The concept of full employment became predominantly discussed after Keynes's publication of the "General Theory" in 1936. Full employment, according to Keynes, refers to the absence of involuntary unemployment; in simple terms, a situation in which everybody who wants jobs get jobs. However it does not mean that there is zero unemployment. It is consistent with frictional



and voluntary unemployment. To achieve full employment, Keynes advocated an increase in effective demand to bring about a reduction in real wage. Hence full employment, in the Keynesian paradigm, is one of maintaining adequate effective demand. It is in fact 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 test of full employment is hence a test in which further increases in effective demand is not accompanied by an increase in 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.

Other authorities defined full employment in different ways. Lord Beveridge in his book Full employment in a Free Society defined full employment as a situation where there were more vacant jobs than unemployed men so that the normal lag between losing one job and finding another will be very short. Also, the American Economic association Committee views full employment as a situation where all quantified persons who wants jobs at the current wage finds full time jobs. But in all definitions, full employment does not mean zero unemployment.

Full employment can be achieved if the monetary policy is expansionary. In that way, the supply of credit is encouraged and this could help create more jobs in different sectors of the economy.

Economic Growth

Economic growth is currently 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. In a wider perspective, economic growth implies an increase in the standard of living of people and a reduction in income inequalities. While there is a consensus that economic growth is desirable for all countries, there are disagreements over the 'magic number' viz-a-viz the annual growth rate which an economy should attain. Generally, there is the belief that growth should be continual as innovations tend to increase productive technologies of both capital and labour overtime. This is not to say economies only grow with technological innovations. Production might not increase due to the lack of demand or the lack of improvements in the quality of labour which may retard the growth of the productive capacity of the economy.



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.

Balance of Payments Equilibrium

The last objective of monetary policy to be discussed in this section is that of maintaining equilibrium in the balance of payments for a country. 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 capital by tourists, and foreign governments using the host country's currency to operate in the host country. In all but the rarest of cases, the current account is dominated by transfers from cross-border exchanges of goods and services. A positive current account balance means that the country in question is exporting more goods and services than it is importing. A negative current account balance means that a country is importing more than it is exporting. The capital account, on the other hand, measures the value of the flow of capital for "capital transactions."

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. The net of the two accounts is the "balance of payment." Policymakers are always on the watch for the composition of capital flows used to offset their current account deficit. Simply because the capital account is running a surplus does not mean that policymakers should be unconcerned. Short-term capital flows are more dangerous than long-term flows because they are more likely to suddenly flow outward and destabilize the country's macroeconomic picture. So, as an example, if a country running a current account deficit and has a capital account surplus composed predominantly of foreign direct investment (the direct purchase of assets in the host country), or FDI, then the deficit is more sustainable than if the capital account was composed of short-term portfolio investments.

Recent interest in the achievement of balance of payments equilibrium was necessitated by the phenomenal growth in world trade as against the growth of liquidity. It was recognized that deficits in the balance of payments could retard the attainment of other macroeconomic objectives as a deficit in the balance of payments is tantamount to an outflow of capital (gold in the olden days). But will a surplus in the balance of payments perform any better? Clearly, a country with a net debt must be at a surplus to repay the debt over a reasonably short period. Once this debt has been repaid and an adequate level of reserve is built, a zero-balance maintained overtime would meet the policy objective of equilibrium in the balance of payments.



Many developing countries suffer disequilibrium in their balance of payments position and monetary policy can be used to correct this. Since the balance of payments has two aspects i.e. the 'BOP Surplus' and the 'BOPs Deficit', the corrective measures here could be two or a mixture of both. If there is a 'BOPs surplus', it reflects an excess money supply in the domestic economy, while a 'BOPs deficit' is consistent with stringency of money supply. Monetary policy, can thus, be employed to reduce money supply in the former and increase money supply in the latter to counter the BOPs disequilibrium.

Interest-Rate Stability

Interest-rate stability is desirable because fluctuations in interest rates can create uncertainty in the economy and make it harder to plan for the future. Fluctuations in interest rates that affect consumers' willingness to buy houses, for example, make it more difficult for consumers to decide when to purchase a house and for construction firms to plan how many houses to build. 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. In recent years, more pronounced interest-rate fluctuations have been a particularly severe problem for savings and loan associations and mutual savings banks, many of which got into serious financial trouble in the 1980s and early 1990s.

Price Stability and the Role of a Nominal Anchor

In the preceding section, it was established that there is a growing consensus that high inflation is damaging to economic welfare, so it must be controlled for reasonable price stability to be achieved. Unfortunately there is a problem of the exact form of monetary regime to be adopted for this to be achieved within the shortest possible time. Associated to these monetary regimes are specific nominal anchors that are used to maintain a reasonable level of price stability. So what is a nominal anchor for monetary policy?



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 speaking, 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.

Adherence to a nominal anchor forces a nation’s monetary authority to conduct monetary policy so that the nominal anchor variable such as the inflation rate or money supply stays within a narrow range. A nominal anchor thus keeps the price level from growing or falling too fast and thereby preserves the value of a country’s money. Thus, a nominal anchor of some sort is a necessary element in successful monetary policy strategies.

One reason a nominal anchor is necessary for monetary policy is that it helps promote price stability, which most countries now view as the most important goal for monetary policy. A nominal anchor promotes price stability by tying inflation expectations to low levels directly through its constraint on the value of domestic money. A more subtle reason for a nominal anchor’s importance is that it can limit the time-inconsistency problem. The time inconsistency problem is explained in more details in the next section.

The Time Inconsistency Problem

The literature on time inconsistency was stimulated by the seminal paper of Kydland and Prescott (1977). 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-consistency problem of discretionary monetary policy thus arises because economic behaviour 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. This situation is described by saying that discretionary monetary policy is time-consistent; that is, 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.

Understandably, a central bank will do better if it does not try to boost output by surprising people with an unexpectedly expansionary policy, but instead keeps inflation under control. However, even if a central bank recognizes that discretionary policy will lead to a poor outcome – high inflation with no gains on the output front – it may still fall into the time-consistency trap, because politicians are likely to apply pressure on the central bank to try to boost output with overly expansionary monetary policy.

Although the analysis sounds somewhat complicated, the time-consistency problem is actually something we encounter in everyday life. For example, at any given point in time, it seems to make sense for a parent to give in to a child to keep the child from acting up. The more the parent gives in, however, the more demanding the child is likely to become. Thus, the discretionary time-consistent actions by the parent lead to a bad outcome – a very spoiled child – because the child's expectations are affected by what the parent does. Books on parenting suggest a solution to the time-consistency problem would be by telling parents they should set rules for their children and to stick to them. A nominal anchor is like a behaviour rule. Just as rules help to prevent the time consistency problem in parenting, a nominal anchor can help to prevent the time consistency problem in monetary policy. Other solutions include contractual arrangements, delegation of decisions and institutional and legal constraints (see Drazen, 2000a).

Price Stability as the Primary Goal of Monetary Policy

As noted previously the inconsistency between price stability and output, especially in the short run. In the long run, however, no inconsistency exists between the price stability goal and the other goals mentioned earlier. The natural rate of unemployment is not lowered by high inflation, so higher inflation cannot produce lower unemployment or more employment in the long run. In other words, there is no long-run trade-off between inflation and employment. In the long run, price stability promotes economic growth as well as financial and interest-rate stability. Although price stability is consistent with the other goals in the long run, in the short run price stability often conflicts with the goals of output stability and interest-rate stability. For example, when the economy is expanding and unemployment is falling, the economy may become overheated, leading to a rise in inflation. To pursue the price stability goal, a central bank would prevent this



overheating by raising interest rates, an action that would initially cause output to fall and increase interest-rate instability. How should a central bank resolve this conflict among goals?

Hierarchical Versus Dual Mandates

Because price stability is crucial to the long-run health of the economy, many countries have decided that price stability should be the primary, long-run goal for central banks. For example, the Maastricht Treaty, which created the European Central Bank, states, “The primary objective of the European System of Central Banks [ESCB] shall be to maintain price stability. Without prejudice to the objective of price stability, the ESCB shall support the general economic policies in the Community,” which include objectives such as “a high level of employment” and “sustainable and non-inflationary growth.” Mandates of this type, which put the goal of price stability first and then state that other goals can be pursued as long as price stability is achieved, are known as hierarchical mandates. They are the directives governing the behaviour of such central banks as the Bank of England, the Bank of Canada, and the Reserve Bank of New Zealand, as well as the European Central Bank.

In contrast, the legislation that defines the mission of the Federal Reserve states, “The Board of Governors of the Federal Reserve System and the Federal Open Market Committee shall maintain long-run growth of the monetary and credit aggregates commensurate with the economy’s long-run potential to increase production, so as to promote effectively the goals of maximum employment, stable prices, and moderate long-term interest rates.” Because, long-term interest rates will be very high if inflation is high, this statement in practice is a dual mandate to achieve two coequal objectives: price stability and maximum employment (output stability). Is it better for an economy to operate under a hierarchical mandate or a dual mandate?

Price Stability as the Primary, Long-Run Goal of Monetary Policy

Since no inconsistency exists between achieving price stability in the long run and the natural rate of unemployment, these two types of mandates are not very different if maximum employment is defined as the natural rate of employment. In practice, however, a substantial difference between these two mandates might exist because the public and politicians may believe that a hierarchical mandate puts too much emphasis on inflation control and not enough on stabilizing output. Because low and stable inflation rates promote economic growth, central bankers have come to realize that price stability should be the primary, long-run goal of monetary policy. Nevertheless, because output fluctuations should also be a concern of monetary policy, the goal of price stability should be seen as primary only in the long run. Attempts to keep inflation at the same level in the



short run, no matter what else is happening in the economy, are likely to lead to excessive output fluctuations.

As long as price stability is a long-run, but not short-run, goal, central banks can focus on reducing output fluctuations by allowing inflation to deviate from the long-run goal for short periods and, therefore, can operate under a dual mandate. However, if a dual mandate leads a central bank to pursue short-run expansionary policies that increase output and employment without worrying about the long-run consequences for inflation, the time-inconsistency problem may recur. Concerns that a dual mandate might lead to overly expansionary policy is a key reason why central bankers often favour hierarchical mandates in which the pursuit of price stability takes precedence. Hierarchical mandates can also be a problem if they lead to a central bank behaving as what the Governor of the Bank of England, Mervyn King, referred to as an “inflation nutter”—that is, a central bank that focuses solely on inflation control, even in the short run, and so undertakes policies that lead to large output fluctuations. Deciding which type of mandate is better for a central bank ultimately depends on the subtleties of how the mandate will work in practice. Either type of mandate is acceptable as long as it operates to make price stability the primary goal in the long run, but not in the short run.

1.5.2 Monetary Policy Targets, Interest Rates Target, Inflation Target and Instruments (Direct and Indirect)

The goals of monetary policy is to achieve certain national goals as we have noted earlier. As noted previously, these are full employment (or a low unemployment rate), full-employment output (or a high output growth rate), a stable price level (or a low inflation rate), a stable exchange rate (or a desirable balance of payments position), etc. These variables are simply referred to as “goals” or as “ultimate goals” of monetary policy. However, the central bank cannot achieve these goals directly by its monetary policy instruments, which are variables that it can operate on directly. Among the instruments available to the central bank are open market operations and changes in its discount/bank rate at which it lends to commercial banks and other bodies. These determine the economy’s monetary base. In many countries, the central bank can also change the required reserves (i.e. the minimum reserves the commercial banks must hold against the public’s deposits with them), which changes the “monetary base multiplier” (i.e. the money supply per dollar of the monetary base). These instrument is the overnight loan rate (called the federal funds rate in the USA) in the market for reserves, whose operation induces change in various interest rates in the economy. In what follows, we look at these tools in detail:

Tools and Instruments of Monetary Policy

The set of tools and instruments available for monetary policy differ from country to country according to differences in political systems, economic structures, statutory and institutional



procedures, development of money and capital markets and other considerations. In most countries, monetary authorities use one or more of the following to affect policy variables: changes in the legal reserve ratio, changes in the discount rate or the official key bank rate, exchange rates and open market operations. In many instances, supplementary instruments such as direct supervision or simply qualitative instruments are also employed. Although the effectiveness of monetary policy does not necessarily depend on using a wide range of instruments, coordinated use of various instruments are essential to the application of a rational monetary policy. The commonly used instruments are discussed below.

Reserve Requirement

The Central Bank may require Deposit Money Banks (DMBs) to hold a fraction (or a combination) of their deposit liabilities (reserves) as vault cash and or deposits with it. Fractional reserve banking limits the amount of loans banks can make to the domestic economy and thus limit the 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. Thus, when prices are rising, for instance, the central bank may raise the reserve requirements of DMBs to keep money within the central Bank. In so doing, the reserves of DMBs are reduced; also, their lending is reduced; and the volume of investment, output and employment are adversely affected. It needs to be mentioned here that this tool or instrument for monetary policy was suggested by Keynes in his Treaties on Money and the United States were the first to adopt it as a monetary device.

Discount Rate

Central Banks lend to financially sound Deposit Money Banks at a most favourable rate of interest, called the discount rate or fund rate. 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.

Banks' incentive to lower discount interest rates when they have excess reserves

Consumers and businesses do not borrow at the CB's funds rate. But changes in the CB funds rate usually lead to changes in the same direction in various market interest rates.



If the CB injects reserves into the banking system to lower the CB funds rate, the banks' cost of loans decline. Competition among the banks will lead them to reduce the interest rates they charge to their customers.

Another way to look at this process is to recognize that reserves pay very little interest (in most jurisdictions they paid no interest at all). If the banks agree to sell interest-bearing government bonds to the CB, they must intend to loan the reserves out. (They don't want to just sit on the barren reserve deposits). To get people to borrow the new reserves, the banks must lower interest rates.

Think about it this way: Suppose you are one of ten people selling apples at a stand along the street. You have priced them so that the demand for apples is the same as the supply. You and all the other apple stands suddenly get a new shipment of apples which you would like to sell. In order to sell these additional apples, you will have to lower the price. In addition, you will not be able to charge a higher price for apples than your competitors because consumers could always go to the competition instead.

This example is a simplified explanation of how an open market purchase works. Of course, instead of selling apples, the banks are selling loans. And instead of having a price for apples, the banks have an interest rate at which they lend.

b) Banks' incentive to increase interest rates when reserves are in short supply

If the CB reduces reserves and raises the fed funds rate, the banks' cost of funds will rise. They will have to raise interest rates and cut back on their lending.

Market interest rates paid by households and businesses do not move in lock-step with the CB funds rate. There are other influences on these interest rates that move them around independently of monetary policy. But market rates do tend to move in the same direction as the CB funds rate.

Open Market Operations (OMO)

The Central Bank may alternatively buy or sell financial securities to the banking and non-banking public populace (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 and vice versa. The following explains OMO in more detail:

a) Open-market purchase

When the CB wants to increase the money supply and lower the federal funds interest rate, it injects bank reserves into the system. If the CB wants to reduce the supply of money, it will remove ("drain") reserves from the banking system.

Suppose the Fed wants to inject reserves into the banking system. It does so by purchasing government bonds from banks. It pays for the bonds with reserve deposits. The Fed literally "creates" reserve deposits it needs to buy government bonds from banks at a price set by the money markets.

The price of bonds adjusts in the open market (bond prices rise and interest rates fall—we will not explore this reverse relationship in detail here). Reserves become less scarce, and therefore the federal funds interest rate that banks charge to lend reserves to other banks declines

Banks ultimately use excess reserves to make more loans to businesses and consumers. To lend out the excess reserves banks have to reduce interest rates. Although the Fed specifically targets the rather obscure federal funds rate, the open market purchase will eventually cause the interest rates on consumer and business loans to decline as well.

Note that by creating excess reserves in the banking system, open market purchases will raise the money supply. In the past (mostly in the 1980s and earlier), the Fed measured its policy by how quickly the measures of the money supply were growing. Now, however, monetary policy is measured by the federal funds interest rate, which gives an index of how "scarce" monetary reserves are. (When reserves are more "scarce" their price, that is, the fed funds rate, goes up and vice-versa.)

b) Open-market sales

If the Fed wants to decrease the money supply and raise the federal funds rate (if it is worried about inflation for example), it will sell government bonds to the banks. Banks will use their reserve deposits to buy the government bonds.

Reserves become more scarce, and the price of reserves (the fed funds rate) therefore rises.

Reduction in reserves forces banks to contract their loans and interest rates on consumer and business loans rises.



Another way to look at the effect on loan interest rates is to think of the fed funds rate as the cost of money to the banks. If the banks want more reserves to make loans, they can borrow reserves from other banks at the fed funds rate. When the Fed engages in open market sales, the fed funds rate rises. This raises the cost of money to the banks, and they therefore will charge higher interest rates to their household and business customers. (The opposite interpretation can be used for open market purchases discussed above.)

Open market operations fall into two categories: Dynamic open market operations are intended to change the level of reserves and the monetary base, and defensive open market operations are intended to offset movements in other factors that affect reserves and the monetary base, such as changes in Treasury deposits with the Fed or changes in float. The CB conducts conventional open market operations. Treasury and government agency securities, especially U.S. Treasury bills. The Fed conducts most of its open market operations in Treasury securities because the market for these securities is the most liquid and has the largest trading volume. It has the capacity to absorb the Fed's substantial volume of transactions without experiencing excessive price fluctuations that would disrupt the market.

Open market operations are conducted electronically through a specific set of dealers in government securities, known as primary dealers, by a computer system called TRAPS (Trading Room Automated Processing System). A message is electronically transmitted to all the primary dealers simultaneously over TRAPS, indicating the type and maturity of the operation being arranged. The dealers are given several minutes to respond via TRAPS with their propositions to buy or sell government securities at various prices. The propositions are then assembled and displayed on a computer screen for evaluation. The desk will select all propositions, beginning with the most attractively priced, up to the point at which the desired amount of securities is purchased or sold, and it will then notify each dealer via TRAPS on which of its propositions have been chosen. The entire selection process is typically completed in a matter of minutes.

Defensive open market operations are of two basic types. In a reverse repurchase agreement (often called a reverse repo), the Fed purchases securities with an agreement that the seller will repurchase them in a short period of time, anywhere from one to fifteen days from the original date of purchase. Because the effects on reserves of a repo are reversed on the day the agreement matures, a repo is actually a temporary open market purchase and is an especially desirable way of conducting a defensive open market purchase that will be reversed shortly. When the Fed wants to conduct a temporary open market sale, it engages in a matched sale–purchase transaction (sometimes called a repo) in which the Fed sells securities and the buyer agrees to sell them back to the Fed in the near future.

At times, the desk may see the need to address a persistent reserve shortage or surplus and wish to arrange a dynamic open market operation that will have a more permanent impact on the supply



of reserves. Outright transactions, which involve a purchase or sale of securities that is not self-reversing, are also conducted over TRAPS.

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 for instance, 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 moneys as loans and against specified securities and economic imbalances are addressed.

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.

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.

In all for monetary policy to be effective, the above tools can be used simultaneously. But it has been accepted by all monetary theorists that:

The success of monetary policy is nil in a depression when business confidence is at its lowest ebb.

Monetary policy is successful against inflation, and

As against fiscal policy, monetary policies possess greater flexibility and it can be implemented rapidly.

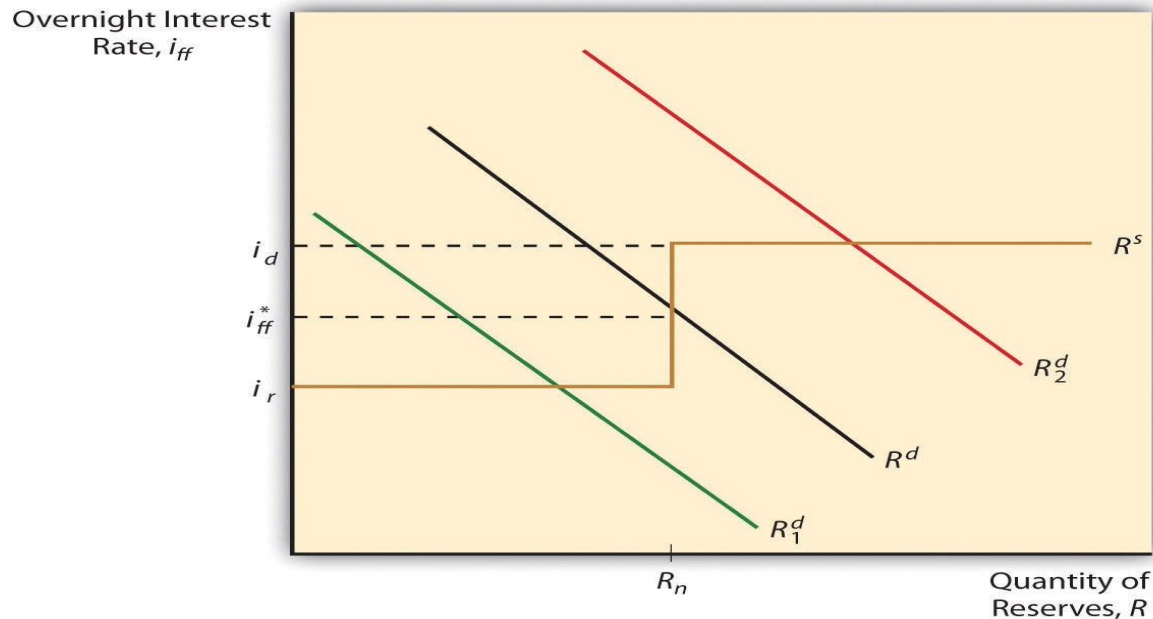
Central Banks and Demand for Reserves

As just noted, Central banks have three primary tools for influencing the money supply: the reserve requirement, discount loans, and open market operations. The first works through the money multiplier, constraining multiple deposit expansion the larger it becomes. Central banks today rarely use it because most banks work around reserve requirements. (That is not to say that reserve requirements are not enforced, merely that they are not adjusted to influence MS. Currently, the reserve requirement is often around 10 percent on transaction account deposits in many countries in Africa. The second and third tools influence the monetary base ($MB = C + R$). Discount loans depend on banks (or nonbank borrowers, where applicable) first borrowing from, then repaying loans to, the central bank, which therefore does not have precise control over MB. Open market operations are generally preferred as a policy tool because the central bank can easily expand or contract MB to a precise level. Using OMO, central banks can also reverse mistakes quickly.

In most countries, under typical conditions, the CB conducts monetary policy primarily through the discount rate (fed funds) market, an overnight market where banks that need reserves can borrow them from banks that hold reserves they don't need. Banks can also borrow their reserves directly from the CB, but, except during crises, most prefer not to because the CB's discount rate is generally higher than the funds rate. Also, borrowing too much, too often from the CB can induce increased regulatory scrutiny. So usually banks get their overnight funds from the CB funds market, which, as [Figure 5.1 "Equilibrium in the fed funds market"](#) shows, pretty much works like any other market.



Figure 5.1 Equilibrium in the CB funds market



The downward slope of the demand curve for reserves is easily explained. Like anything else, as the price of reserves (in this case, the interest rate paid for them) increases, the quantity demanded decreases. As reserves get cheaper, banks will want more of them because the opportunity cost of that added protection, of that added liquidity, is lower. But what is the deal with that weird S-looking reserve supply curve? Note that the curve takes a hard right (becomes infinitely elastic) at the discount rate. That's because, if the federal funds rate ever exceeded the discount rate, banks' thirst for CB discount loans would be unquenchable because a clear arbitrage opportunity would exist: borrow at the discount rate and relend at the higher market rate. Below that point, the reserve supply curve is vertical (perfectly inelastic) down to the rate at which the CB pays interest on reserves. Banks are, of course, unwilling to lend in the funds market at a rate below what the CB will pay it, so the curve again becomes flat (infinitely elastic).

The intersection of the supply and demand curves is the equilibrium or market rate, the actual funds rate, ff^* . When the CB makes open market purchases, the supply of reserves shifts right, lowering ff^* (ceteris paribus). When it sells, it moves the reserve supply curve left, increasing ff^* , all else constant. In most circumstances, the discount and reserve rates effectively channel the market federal funds rate into a range.

Theoretically, the CB could also directly affect the demand for reserves by changing the reserve requirement. If it increased (decreased) rr , demand for reserves would shift up (down), increasing (decreasing) ff^* . As noted above, however, banks these days can so easily sidestep required reserves that the CB's ability to influence the demand for reserves is extremely limited. Demand for reserves (excess reserves that is) can also shift right or left due to bank liquidity management



activities, increasing (decreasing) as expectations of net deposit outflows increase (decrease). Cbs try to anticipate such shifts and generally have done a good job of counteracting changes in excess reserves through OMO. Going into holidays, for example, banks often hold a little extra vault cash (a form of reserves). Knowing this, the CB counteracts the rightward shift in demand (which would increase ff^*) by shifting the reserve supply curve to the right by buying bonds (thereby decreasing ff^* by an offsetting amount).

Interrelations Among Goals, Targets and Instruments of Monetary Policy

In this subsection, we shall provide further information on the goals and instruments of monetary policy based on Handa (2009).

Besides the concepts of goals and instruments, other concepts relevant to monetary policy are those of targets, operating targets and guides. We can broadly define a target variable as one whose value the policy maker wants to change. An operating target variable is one on which the central bank can directly or almost directly operate through the instruments at its disposal. A guide is a variable that provides information on the current and future state of the economy.

Between the goals and instruments of monetary policy lie layers of intervening variables. For example, suppose the central bank wants to reduce the inflation rate. To do so, it needs to reduce aggregate demand in the economy. The reduction in aggregate demand usually requires a reduction in investment and/or consumption, which requires an increase in market interest rates. Depending on the analysis, discussion or author, these intervening variables can be referred to as intermediate targets, operating targets or even as instruments. Since a target variable is one whose value the central bank seeks to influence or control by the use of the tools at its disposal, any of the intervening variables between the goals and instruments can be referred to as a target variable. In the preceding example, aggregate demand is an intermediate variable or target, which the central bank wants to alter by using the intermediate targets of the money supply and/or interest rates which, in turn, can be altered by changes in the monetary base and the discount rate. Note that the word “target” can also be used to indicate a desirable value of a goal (e.g. inflation) or of an intermediate variable (e.g. the money supply and market interest rates).

Given the preceding discussion, Table 10.1 provides a rough classification of monetary policy instruments, operating targets, intermediate targets and goals. While Table 5.1 provides some guidance on the roles and sequence of the various monetary policy variables, there is no hard and fast rule for its classification. The central bank uses its tools to hit its operating targets, with the intention of manipulating the intermediate targets, which are the final ones of the financial system, in order to achieve its goals. Note that lags enter at each stage of this process, and both the

individual lag and the overall lag tend to vary. Further, the duration of the lags and the final impact are not usually totally predictable.

Table 5.1 Monetary policy tools, target and goals

Policy instruments	Operating targets	Intermediate targets	Goals
Open-market operations	Short-term interest rates	Monetary aggregates (M1, M2, etc.)	Low unemployment rate
Discount rate	Reserve aggregates	Interest rates (short and long term)	Low inflation rate
Reserve requirements	(monetary base, reserve, nonborrowed reserves, etc.)	Aggregate demand	Financial market stability Exchange rates

Source: Handa (2009)

Relationship between goals, targets and instruments, and difficulties in the pursuit of monetary policy

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?



To illustrate these points, let the relevant relationships be:

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

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

where:

y = (ultimate) goal variable

x = intermediate target

z = policy instrument or operating target

Ψ, θ = sets of exogenous variables

The above equations imply that:

$$y = h(z; \Psi, \theta) \quad (3)$$

so that 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 univalued 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 – again, usually an imprecise art.

Hence, the precision and clarity implied by (3) for the formulation of monetary policy and its effects is misleading. In many, if not most instances, the impact of a change in most of the potential operating variables on the ultimate goals is likely to be imprecise, difficult to predict and/or unstable. This makes the formulation of monetary policy an art rather than a science and cautions against attempts to use monetary policy as a precise control mechanism for “fine-tuning” the goals of such policy.

Another common problem with most target variables is that they are endogenous and their values depend on both demand and supply factors, so that the exogenous shocks to them could come from either demand or supply shifts. The policy maker may want to offset the effect of changes in some



of these factors but not in all cases, so that it needs to know the source of such changes before formulating its policy.

Targets of Monetary Policy

The two main operating targets usually suggested for monetary policy are:

monetary aggregates;

interest rates.

The two main targets of monetary policy highlighted in the recent literature are:

inflation rate (or the price level),⁴ or its deviation from a desired value;

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

There are also other variables that are sometimes used or proposed as the intermediate targets of monetary policy. Among these is aggregate demand (or nominal national income) and, in the case of relatively open economies, the exchange rate or the balance of payments.

Following Handa (2009), this section discusses only the relative merits and demerits of monetary aggregates and the interest rate as the chief operating target or instruments. It also presents some discussion of the price level and the inflation rate, and the output gap, as the targets of monetary policy.

Monetary Aggregates versus Interest Rates as Operating Targets

This section relies upon students' prior knowledge of the IS–LM macroeconomic model, to distinguish between the relative merits of using the money supply versus interest rates as the operating target of monetary policy. The choice between monetary aggregates and the interest rate depends critically upon the policy objective of the central bank and the structure of the economy. The following analysis, adapted from that in Poole (1970), takes this objective to be control of aggregate demand, since the central bank can only influence output and inflation, which are its final goal variables, through manipulation of aggregate demand. It further assumes that the structure of the economy can be represented by the IS–LM analysis and diagram. This diagram has aggregate real demand y on its horizontal axis and the real interest rate r on its vertical axis. The commodity market equilibrium is shown by the IS curve and the money market equilibrium



is shown by the LM curve. Their intersection determines real aggregate demand at the existing price level.

Therefore, the choice between the monetary instrument hinges on the question: which instrument provides better control over aggregate demand in the IS–LM framework? Our analysis implicitly assumes the Fisher equation for perfect capital markets and an expected inflation rate of zero, so that the nominal interest rate R is identical with the real interest rate r .

This section presents first the diagrammatic analyses of monetary versus interest rate targeting and then followed by its mathematical version.

Diagrammatic analysis of the choice of the operating target of monetary policy

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.

Our analysis starts with the initial equilibrium shown by point a , with coordinates (r_0, y_0) , in Figure 5.1a. Assume that the central bank targets the 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 IS_0 to IS_1 , aggregate demand will increase from y_0 to y_1 and the interest rate rise from r_0 to r_1 . Similarly, a negative shock, occurring, say, in the following period, which shifts the IS curve to IS_2 , will lower aggregate demand to y_2 and the interest rate to r_2 .

Compare this result with the impact of the same shock if the interest rate had been targeted. This is shown in Figure 5.3, where the interest rate is assumed to be held fixed by the authorities at the target rate r_0 , where the underline indicates that it is exogenously set by the central bank. The shifts in the IS curve, first to IS_1 and then to IS_2 , will produce movements in aggregate demand, first to y_1 and then to y_2 . This fluctuation between y_1 and y_2 is clearly greater than between y_1 and y_2 in Figure 5.4, 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.

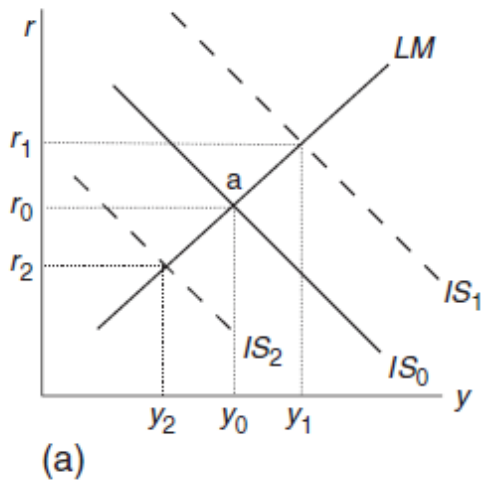


Figure 5.3

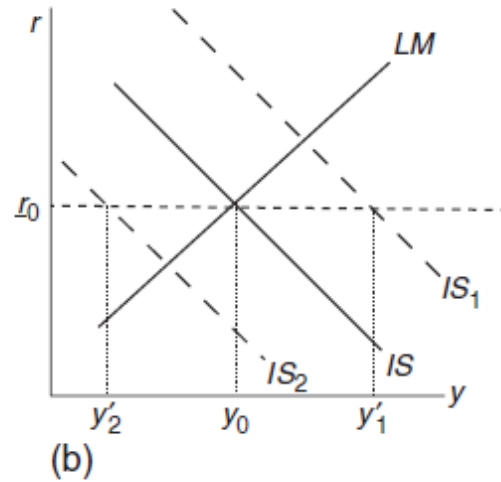


Figure 5.4

Note that such shocks do not produce changes in the interest rate, since that is being held constant through monetary policy.

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. Now suppose that money demand decreases. Given the targeted money supply, the decrease in the money demand will shift the LM curve in Figure 5.3 to the right to LM1 and increase aggregate demand from y_0 to y_1 . 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 y_2 . The aggregate demand fluctuations are then from y_1 to y_2 and the interest rate fluctuations are from r_1 to r_2 .

For interest rate targeting, assume that the real interest rate had been set at r_0 , as shown in Figures 5.5 and 5.6. Figure 5.5 shows the initial demand curve for nominal balances as M_d and the initial supply curve as M_s , with the initial equilibrium interest rate as r_0 and the initial money stock as M_0 . Now suppose that the money demand curve shifts from M_{d0} to M_{d1} . Since the interest rate is being maintained by the monetary authority at r_0 , the monetary authority will have to increase

the money supplied from M_0 to M_1 . The money stock therefore adjusts endogenously through an accommodative monetary policy to the changes in money demand.

In the IS–LM Figure 5.6, a reduction in the money demand would shift the LM curve to the right from LM_0 to LM_1 . However, given that the monetary authority maintains the interest rate at r_0 , the aggregate demand y_0 in this figure will be determined by the intersection of the IS curve and a horizontal line at the target interest rate r_0 .

Figure 5.5

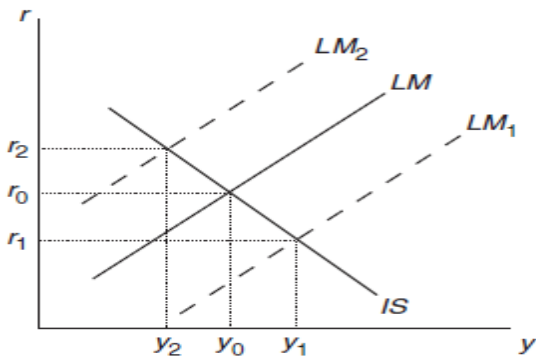


Figure 5.6

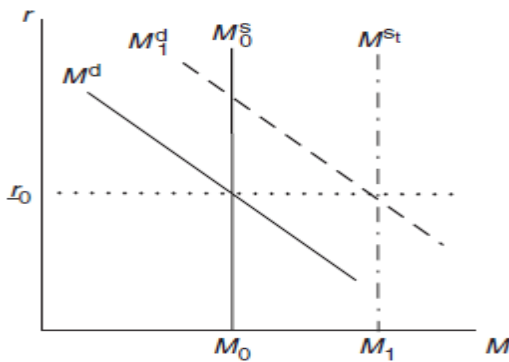
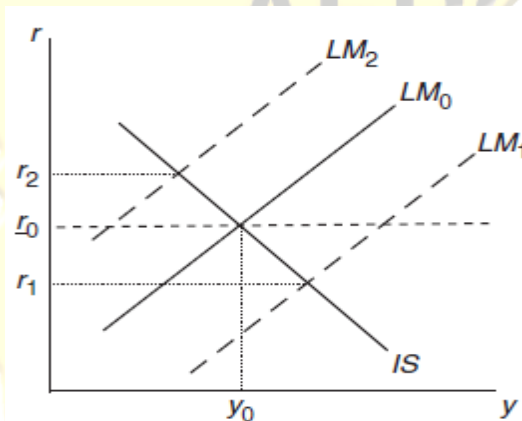


Figure 5.7



This is so because the exogenous shift in the LM curve from LM_0 to LM_1 leads the central bank to undertake an accommodative money supply decrease sufficient to shift this curve back to LM_0 . Hence, in spite of any exogenous changes in money demand, aggregate demand would remain at y_0 (and the interest rate at r_0). Hence, comparing the implications from Figures 5.5 and 5.7, 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 conclusion poses a problem for the policy maker since both types of shocks occur in the real world. Therefore, 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. This is not easy to determine for the future, nor need the same pattern of shocks necessarily occur over time. Further, since both types of shock do occur, each policy will reduce or eliminate the impact of some types of shocks but not of others. While many central banks had, for a few years during the late 1970s and sometimes in the early 1980s, favoured monetary targeting, the common practice currently is to set interest rates. This implies, in the context of the preceding analysis, that the dominant sources of shocks are expected to be in the monetary sector.

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

The preceding subsection presents the diagrammatic IS–LM analysis of the central bank’s choice between monetary targeting and interest rate targeting, if it wants to minimize the fluctuations in aggregate demand, and that chapter should be reviewed as an introduction to the following mathematical one. That analysis and its following mathematical version were adapted from Poole (1970) and cited in Handa (2009). Fischer (1990) provides a more extensive discussion and review of the relevant analyses relating instruments to targets of monetary policy. Poole had assumed that the price level was constant. While this was quite a common assumption in the 1960s, it is no longer considered to be realistic or common in modern macroeconomic analysis. Further, taking the price level as constant, Poole assumed that the central bank’s objective was to minimize the variance of real output. Since the following analysis does not assume a constant price level and the central bank can only affect output through aggregate demand and expenditures, it makes the assumption that the central bank wants to minimize the variance of aggregate demand.

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 M_s except for uncontrollable disturbance terms μ_t and η_t , so that:

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

$$\text{LM: } (M/p)_t = -m_1 R_r + m_2 y_t^d + \eta_t$$

where:

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



$$m^d = m^d(y, R, FW_0) = m^y + (FW_0 - mRR)$$

and

m = real money balances

m^y = real transactions balances

$(FW_0 - mRR)$ = speculative/portfolio demand for real balances

mRR = portfolio demand for bonds

R = nominal interest rate

FW_0 = real financial wealth

This IS–LM model needs to be supplemented by a relationship between r_t and R_t . 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, R_t and r_t can be treated as identical in the IS–LM model.

Hence, replacing R_t by r_t in the LM equation, the model becomes:

$$IS: y_t^d = -\alpha_r + \mu_t \dots\dots\dots(1)$$

$$LM: (M/p)_t = -m_1 r_t + m_2 y_t^d + \eta_t \dots\dots\dots(2)$$

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

$$\text{minimize } E(y_t^d)^2$$

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 ($\mu = \eta = 0$) 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:

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

Since $E\mu = E\eta = 0$, $E(y_t^d) = \frac{(\alpha_r M/P)}{\alpha_r m_2 + m_1}$. 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:

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

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,

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

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:

$$E^r (y^d)^2 = \sigma_\mu^2 \dots \dots \dots (6)$$

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:

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

Which simplifies to:

$$\sigma_\eta^2 < \sigma_\mu^2 (m_2^2 + \frac{2m_2 m_1}{\alpha_r}) \dots \dots \dots (8)$$

Hence, if there are only money market shocks but no commodity market shocks (i.e. $\sigma_\eta = 0$), 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. $\sigma_\mu = 0$), 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.

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.

For the commodity market, if we were to assume that the instability of commodity demand arises only because of the instability of investment (though consumption and net exports can also be volatile), $\sigma\mu$ occurs because of the volatility of investment demand. These assumptions provide the commonly used, but simplified, statement of the preceding condition as: monetary targeting is preferable if investment is more volatile than money demand, but interest rate targeting is preferable if money demand is more volatile than investment.

The preceding analysis ignores several aspects of the economy. Regarding the money supply, the central bank does not directly control the money supply. It controls the monetary base, which provides rather imperfect control over the money supply for most economies. Further, the money supply and money demand functions may be unstable, so that their parameters shift over time, with the shifts being unpredictable at the decision time. Regarding the interest rates, the central bank can set its discount rate and manage the overnight loan rate for reserves, but these need not, depending on the structure of the financial markets, provide precise control over market rates or over their differentials. Further, the forms of the IS and LM equations used in the preceding analysis are fairly simple ones and ignore such elements as expectations and factors, such as the exchange rate and net exports, relevant to the open economy.

Problems with the use of interest rates in managing the economy

The observed interest rates are equilibrium rates, so that changes in them could reflect either changes in demand or in supply conditions or both. Therefore, a rise in the interest rates may be due to an increase in the demand for loanable funds or a decrease in their supply, but the central bank may wish to take offsetting action in only one of these cases. For example, interest rates rise



during an upturn in the business cycle. The central bank may not wish the upturn to be curbed by a decreased supply of funds but also may not wish to offset the stabilization effect of interest rates due to an increase in their demand. But changes in the equilibrium interest rates do not by themselves provide adequate information as to the causes of their rise and therefore as to the policy actions that should be undertaken. Consequently, central banks in practice supplement information on interest rates with other information on demand and supply conditions before making their policy decisions.

A problem with using interest rates as an operational target is that the central bank can determine the general level of interest rates but not equally well control the differentials among them. Examples of these differentials are the loan-deposit spread of commercial banks, and the spread between deposit rates and mortgage rates, if the latter are variable. Spreads depend upon market forces and can be quite insensitive or invariant to the central bank's discount rate. Financial intermediation in the economy is more closely a function of such differentials than of the level of interest rates, so that the ability of the central bank to influence the degree of financial intermediation through its discount rate and the overnight loan rate for reserves becomes diluted. Among other problems is the lag in the impact of changes in the interest rate on aggregate demand in the economy. Among the reasons for such lags are the costs of adjustment of economic variables such as the capital stock and planned consumption expenditures, and the indirect income effects of changes in interest rates. There are two aspects of this lag: its length and variability. The former is often assessed at about six quarters to two years in the United States, Britain and Canada. While there is agreement that there is some variability in the length of the lag, there is no consensus on whether it is so long that changes in interest rates, intended to be stabilizing, can prove to be destabilizing. Within the lag, the impact effect (within the same quarter) of interest rate changes on real aggregate demand is estimated to be quite low, while the long-run effect is now believed to be very significant.

The actual use of interest rates for stabilization has often been found to be “too little, too late” – though this is usually a result of uncertainty about the need for and the lags in the effects of monetary policy. This results in its cautious use, no matter what operational or indicator variable is used. Given the duration of lags and the uncertainty at any time about the position of the economy in the business cycle, past experience does indicate that central banks often change the interest rates later and in smaller steps than really needed. An initial change is, therefore, often followed by many more in the same direction over several quarters.

Inflation Targeting Monetary Policy Framework

Targeting the price level

Before we walk you through the inflation targeting monetary policy framework, let's take a moment to review the diagrammatic approach to price level and inflation rate as targets (i.e.,



targeting the price level instead of interest rate or monetary aggregate as seen previously). Current discussions of monetary policy often refer to inflation or price targeting as the goal of monetary policy. A stable price level or a low inflation rate is sometimes proposed as the ultimate goal of monetary policy. For this, 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. Further, 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.

For the following analyses of the price level and the inflation rate as the monetary authorities' target, we leave aside the comparison of monetary versus interest rates as targets and focus on aggregate demand as the variable in the control of the monetary authority, and assume that it will adopt the appropriate instrument to achieve the desired level of aggregate demand. Further, since our analysis is short run, we use a positively sloping short-run aggregate supply curve rather than a vertical long-run one.

Figure 5.8 assumes that there is a positive demand shock such that the AD curve shifts to AD1. If the monetary authorities stabilized prices at P_0 , output would remain unchanged at y_0 . 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.

Figure 5.9 shows the effects of 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 P_0 to P_1 and a decrease in output from y_0 to y_1 . 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, however, decrease output from y_0 at P_0 to y_1 at P_1 due to the supply shock and then to y_1 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.

Figure 5.8

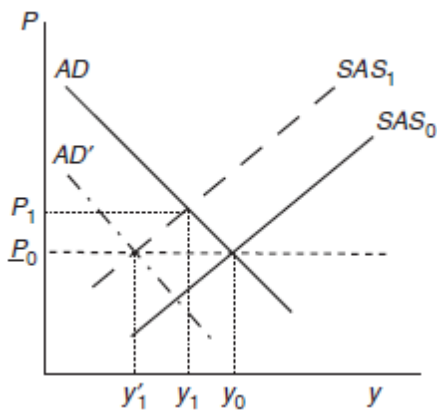
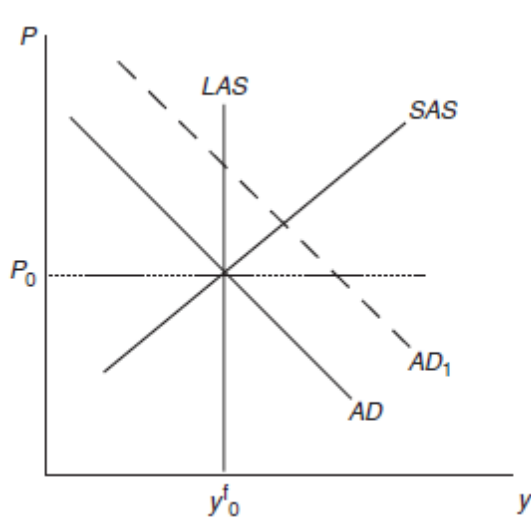


Figure 5.9

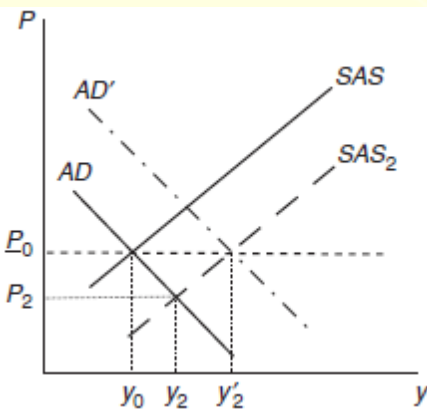


Figure 5.10

Similarly, suppose that the aggregate supply shock had been a positive one, as shown in Figure 5.10. This would shift the SAS curve to the right from SAS₀ to SAS₂, resulting in the increase in output from y_0 to y_2 and the decrease in prices from P_0 to P_2 . The central bank could increase aggregate demand to stabilize the price level at P_0 , but this would mean an expansionary monetary policy which shifts the AD curve to AD₁ and further increases output to y_2 . 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. I shall leave it to you to adapt the analysis to the case of a vertical long-run supply curve.

Inflation Targeting Policy Framework

Inflation targeting, which simply involves a central bank raising or lowering interest rates to anchor inflation expectations in order to achieve a given inflation target, has been recognized mostly in developed world as a more effective way of maintaining low and stable inflation. The conventional wisdom is that raising interest rates usually cools the economy to rein in inflation. The issue is that there is no long-term trade-off between inflation and output and that price stability stimulates growth.

The recognition that price stability should be the primary long-run goal of monetary policy and that a nominal anchor is a valuable tool in helping to achieve this goal has led to a monetary policy strategy known as inflation targeting (Mishkin 2014). 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.

New Zealand was the first country to formally adopt inflation targeting in 1990, followed by Canada in 1991, the United Kingdom in 1992, Sweden and Finland in 1993, and Australia and Spain in 1994. Israel, Chile, and Brazil, among other countries, have also adopted a form of inflation targeting. In Africa, only a few countries including South Africa and Ghana have adopted inflation targeting (At the end of this section, I shall present a detailed review of Ghana's inflation targeting experience 10 years after its adoption).



Given the rising consensus among economists and policymakers that there is no long-term trade-off between inflation and output and that price stability is consistent with high economic growth, many central bankers have adopted a framework for monetary policy known as Inflation Targeting. Although all inflation targeters have customized their approach distinctively, certain general empirical generalizations and preconditions for success (as shown in the Box 1 below) can be made.

Box 1: Pre-Conditions for Effective Inflation Targeting Framework

Institutional independence	The central bank must have full legal autonomy, and be free from fiscal and/or political pressures that could create conflicts with the inflation objective.
Well-developed analytical capabilities and infrastructure.	Data requirements for inflation targeting are more demanding than for alternative regimes and the monetary authorities must have a well-developed capacity to forecast inflation.
Economic structure.	Inflation targeting requires that prices are fully deregulated, that the economy is not be overly sensitive to commodity prices and exchange rates, and that dollarization is minimal.
A healthy financial system.	In order to minimize potential conflicts with financial stabilization objectives, and guarantee effective monetary policy transmission, the banking system should be sound, and capital markets well-developed.

The foremost hallmark of any inflation targeting framework is that the central bank is given an institutional independence and a clear mandate to pursue price stability. In that pursuit, the central bank, (or the fiscal authority, or some combination of both) 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.

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. As established in practice thus far, 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.

Achieving the target was crucial to realizing policy credibility and anchoring expectations of economic agents about monetary policy. Truly, having an autonomous central bank with an overt mandate and quantifiable inflation target is desirable, but it has also diminished the crux of using monetary policy to achieve other essential economic goals. The centrality of the central bank on aggressive inflation targeting is counterproductive in a country characterized with weak fiscal and productive fundamentals⁶.

Several empirical studies into the effectiveness of IT in reducing inflation have been undertaken. Two main contrasting conclusions are drawn from available empirical literature: while some economists agree inflation targeting effects no statistical difference on inflation (Huh, 1996; Bernanke and Mihov, 1998; Lane and van den Heuvel, 1998; Bernanke et al., 1999; Honda, 2000; da Silva and Portugal, 2000; Ball and Sherridan, 2003) others provide evidence that the framework does cause structural break in the inflation rate trend (Almeida and Goodhart, 1996; Batini and Laxton, 1994; Fillion and Leonard, 1997; Choiet et al., 2003; Pe´tursson, 2004; Mishkin, 2007). Mishkin (2007, p. 406) asserted that IT has firmly anchored inflation expectations and inflation beyond the counterfactual (what would be the case under no IT). His assertion supported that of Condon (2006) in the case of Korea.

Bernanke et al., (1999) while favoring inflation targeting, highlighted extensive evidence that the framework's success traded-off national output (i.e. sacrifice ratio) compared to non-targeters. The question of whether IT will succeed in developing nations was addressed by Mishkin and Savastano (2002) who reported that IT will only be successful (and not sacrifice economic growth) if and only if standard initial conditions of central bank operational independence, absence of fiscal and financial dominance, and moderately low inflation are in place. This position was further reinforced by Stiglitz (2008). Stiglitz decried inflation targeting as a crude recipe for developing nations as long as they do not integrate themselves of the international shocks by restructuring their economic fundamentals.

According to Mishkin (2010), 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 lead to output fluctuations, lower economic growth and high unemployment.

⁶ See Bernanke, et. al, 1999 and Epstein, 2000, for detailed surveys of the literature



Advantages of Inflation Targeting

There are a number of benefits associated with inflation targeting: reduction of the time inconsistency problem, increased transparency, increased accountability, consistency with democratic principles, and improved performance.

Reduction of the Time-Inconsistency Problem Because 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. A key advantage of inflation targeting is that it can help focus the political debate on what a central bank can do in the long run—that is, control inflation—rather than what it cannot do, that is, permanently increase economic growth and the number of jobs through expansionary monetary policy. Thus 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.

Increased Transparency: Inflation targeting has the advantage that it is readily understood by the public and is thus highly transparent. Indeed, 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. Although these techniques are also commonly used in countries that have not adopted inflation targeting, inflation-targeting central banks have taken public outreach a step further: Not only do they engage in extended public information campaigns, including the distribution of glossy brochures, but they also publish documents like the Bank of England's Inflation Report. These documents are particularly noteworthy because, unlike the usual dull-looking, formal reports of central banks, they make use of fancy graphics, boxes, and other eye-catching design elements to engage the public's interest.

The channels of communication just discussed are used by central banks in inflation-targeting countries to explain the following concepts to the general public, financial market participants, and politicians: (1) the goals and limitations of monetary policy, including the rationale for inflation targets; (2) the numerical values of the inflation targets and how they were determined; (3) how the inflation targets are to be achieved, given current economic conditions; and (4) reasons for any deviations from the targets. These communications have improved private sector planning by reducing uncertainty about monetary policy, interest rates, and inflation; they have promoted public debate of monetary policy, in part by educating the public about what a central bank can and cannot achieve; and they have helped clarify the responsibilities of the central bank and of politicians in the conduct of monetary policy.



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. The strongest case of accountability of a central bank in an inflation-targeting regime is in New Zealand, where the government has the right to dismiss the Reserve Bank's governor if the inflation targets are breached, even for one quarter. In other inflation-targeting countries, the central bank's accountability is less formalized. Nevertheless, the transparency of policy associated with inflation targeting has tended to make the central bank highly accountable to the public and the government. Sustained success in the conduct of monetary policy as measured against a preannounced and well-defined inflation target can be instrumental in building public support for a central bank's independence and for its policies. This building of public support and accountability occurs even in the absence of a rigidly defined and legalistic standard of performance evaluation and punishment.

Consistency with Democratic Principles: Not only is accountability valuable in its own right, but it also 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. However, under inflation targeting as it generally has been practiced, the central bank has complete control over operational decisions and so can be held accountable for achieving its assigned objectives. Improved Performance The performance of inflation-targeting regimes has been quite good. Inflation-targeting countries seem to have significantly reduced both the rate of inflation and inflation expectations beyond what likely would have occurred in the absence of inflation targets. Furthermore, once lowered, inflation in these countries has stayed low; following disinflation, the inflation rate in inflation-targeting countries has not bounced back up during subsequent cyclical expansions of the economy.

Disadvantages of Inflation Targeting

Critics of inflation targeting cite four disadvantages of this monetary policy strategy: delayed signalling, too much rigidity, the potential for increased output fluctuations, and low economic growth. We look at each in turn and examine the validity of these criticisms. Delayed Signalling 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 behaviour that limits policymakers from systematically engaging in policies with undesirable long-run consequences. Such policies avoid the time-inconsistency problem and would be best described as “constrained discretion,” a term coined by Ben Bernanke and the author of this book.

Indeed, inflation targeting can be described exactly in this way. Inflation targeting, as actually practiced, is far from rigid and is better described as “flexible inflation targeting.” First, inflation targeting does not prescribe simple and mechanical instructions on how the central bank should conduct monetary policy. Rather, it requires the central bank to use all available information to determine which policy actions are appropriate to achieve the inflation target. Unlike simple policy rules, inflation targeting never requires the central bank to focus solely on one key variable. Second, inflation targeting, as practiced, contains a substantial degree of policy discretion.

Inflation targets have been modified depending on economic circumstances, as we have seen. Moreover, central banks under inflation-targeting regimes have left themselves considerable scope to respond to output growth and fluctuations through several devices.

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. All the inflation targeters have set their inflation targets above zero.³ For example, New Zealand, Canada, the United Kingdom, and Sweden currently set the midpoints of their inflation targets at 2%, while Australia sets its midpoint at 2.5%.

Inflation targeting also does not ignore traditional stabilization goals. Central bankers in inflation-targeting countries continue to express their concern about fluctuations in output and employment, and the ability to accommodate short-run stabilization goals to some degree is built into all inflation-targeting regimes. All inflation-targeting countries have been willing to minimize output declines by gradually lowering medium-term inflation targets toward the long-run goal.

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. A conservative conclusion is that once low inflation is achieved, inflation targeting is not harmful to the real economy. Given the strong economic growth after disinflation in many countries (such as New Zealand) that have adopted inflation targets, a case can be made that inflation targeting promotes real economic growth, in addition to controlling inflation.



Empirical Study: A case of Inflation Targeting Policy Framework in Ghana

The functional autonomy of the Bank of Ghana (BoG) in adopting inflation targeting through the Monetary Policy Committee (MPC) to conduct monetary policy in a manner that ensures price stability, while supporting other macroeconomic goals is guaranteed under the Bank of Ghana Act, 2002 (Act 612) but it was not until 2007 that the Bank officially adopted an inflation targeting framework for the conduct of monetary policy. Prior to its adoption, the Bank of Ghana operated largely a direct controlled system of monetary framework, known as the monetary aggregate regime with money growth as the nominal anchor in arresting inflation.

However, a decade after the adoption of IT, Ghana's experience under the framework has sparked debate over its effectiveness in ensuring a low and stable price levels and in particular, lowering interest rates as it tends to over emphasize inflation at the expense of other monetary and macroeconomic goals, like growth and employment.

The large fiscal expansions coupled with unfavourable trade balances which often lead to high inflation pressures and weakening of the domestic currency, particularly in periods immediately after election years, had meant that the Bank of Ghana had had to adjust the monetary policy rate (MPR) upward in many occasions in order to subdue the resultant inflationary pressures without recourse to the negative effect on growth. This has culminated into high interest rates, which is among the highest in Africa.

For instance, the MPR had been increased from 13.5 percent in 2010 to 26 percent by the end of 2015 and stayed there until January 2017. Although inflation, since March 2016, had consistently been fallen from a high of 19.2 percent to 13.3 percent in February, 2017, the MPR remained resolute at the 26 percent until it was marginally reduced to 25.5 percent in January and 23.5 in March this year. This situation has created a wide spread between inflation and the MPR, as well as, between the average lending rate and inflation rate over a long period of time. The question on the minds of many economists and civil societies is why the monetary policy rate and lending rates have not fallen in like manner with inflation, even though inflation is on a persistent decline.

Inflation targeting as a monetary framework combined with salient characteristics of emerging economies especially Ghana raises important policy concerns. This is because several studies have shown that certain characteristics of emerging markets do not support inflation targeting framework.

Emerging market economies are often characterized by a lack of credibility and limited access to international markets, pronounced adverse effects of exchange rate volatility on trade, fiscal dominance, high liability dollarization, and higher pass-through from the exchange rate to

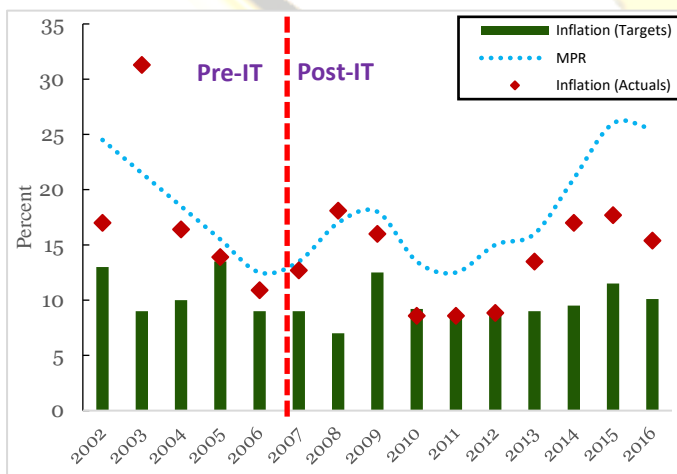
inflation. These characteristics can be a threat to inflation targeting framework for developing economies like Ghana.

It is against this background that this paper explores the effect of inflation targeting on inflation and interest rates in Ghana. It argues that inflation targeting in the midst of fiscal indiscipline/persistent over expenditures and weak productive structures, as well as, low export capacity that exposes the country to exchange rate fluctuations will not be effective and rather results in high interest rates. It further points out that with the country characterized by high fiscal dominance and volatile exchange rates coupled with, a very weak productive, institutional and operational capacity, unlike most inflation targeters across the globe, inflation targeting is perhaps not for a developing country like Ghana.

Like most performance measurement criteria, the success of any IT regime is evaluated by comparing inflation targets with outcomes. By this, I intend to examine the magnitude of spread between targets and recorded inflation rates compared to periods preceding inflation targeting. In figure 1.1 below presents a time series plot of targeted inflation rates and the end year outturns.

Although, inflation has been relatively stable after the adoption of inflation targeting in Ghana, the country has not been able to achieve its target of 8% with +/- 2% deviation. Figure 1.1 shows the trend of inflation and its gap from target rate from 2002 to 2016 (inflation targeting periods). As previously mentioned, 2007 is the year the BoG formally adopted the inflation targeting framework and so years prior to this year is considered as pre-IT era and years starting from 2007 are post-IT era.

Figure 1: Ghana: Inflation Targets versus Actuals. 2002-2016



Sources: Author's with data from the Bank of Ghana and Ghana Statistical Service

With the exception of 2003 where pre-IT inflation recorded end of year headline inflation of 31.3 percent with the worst deviation from target of 22.3 percent in recent past, the average deviation between 2000 and 2006 is 3.18 percent (including 2003 is 7.0%).

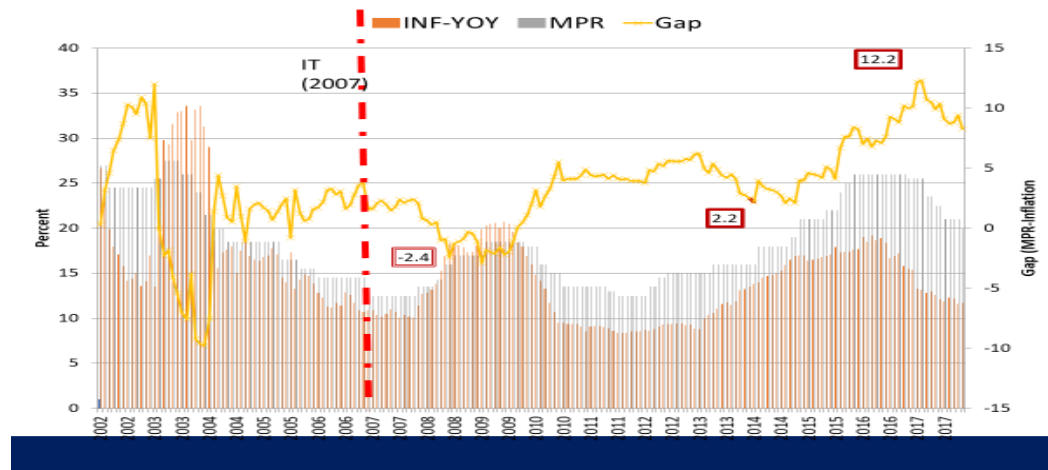
While post-IT inflation has generally been low, the average deviation from the target is not too significantly different from the pre-IT era. The average deviation from the target between 2007 and 2016 is about 4.11 percent. Although this is lower than the pre-IT average of 7 percent, when 2003 outturn is taken out the equation, the difference is just about one percentage point.

Figure 1 further shows that the BOG, since 2007 (i.e., about 10 year-period), has missed its target more than two-third (7 out of 10) of the time. This is in contrast with other inflation targeters across the globe. While inflation targeters in developing countries have typically missed their targets about $\frac{1}{2}$ the time, those in industrial countries have missed their targets just about $\frac{1}{3}$ of the time. The situation in Ghana to weaken monetary policy effectiveness as it carries severe credibility and reputational costs that could land the central bank in the time inconsistency problem with the attendant risks of further target misses⁷.

Moreover, the large fiscal expansions coupled with unfavourable trade balances which often lead to high inflation pressures and weakening of the domestic currency, particularly in periods immediately after election years, had meant that the Bank of Ghana had had to adjust the monetary policy rate (MPR) upward in many occasions in order to subdue the resultant inflationary pressures without recourse to the negative effect on growth. This has culminated into high interest rates, which is among the highest in Africa and has created widening gap between inflation and MPR as well as other interest rates such as the interbank rates and the lending. For example, analysis of the available data shows that in 2009 the gap between the MPR and inflation was less than two percent. By January 2017, the gap had risen to 12.2 percent (Figure 2).

⁷ The time inconsistency problem of monetary policy occurs if policymakers use discretionary policy without committing to a behavioral rule, there is a higher probability that actual inflation will be higher than targeted, leading private agents loose trust in the CB and often setting higher inflation expectations (Mishkin 2010).

Figure 2: The gap between MPR and inflation



Source: Author's computation with from the Bank of Ghana

Concluding Remarks

Getting monetary policy right is crucial to the health of the economy and the wellbeing of its people. As such, monetary policy should not only seek to achieve stable prices, but also seek to affect real economic outcomes such as growth and employment in order to improve the welfare of its citizens.

This paper has explored the effect of inflation targeting on interest rates in Ghana. It argues that inflation targeting in the midst of fiscal indiscipline/persistent over expenditures and weak productive structures, as well as, low export capacity that exposes the country to exchange rate fluctuations will not be effective and rather results in high interest rates. It further points out that with the country characterized by high fiscal dominance and volatile exchange rates coupled with, a very weak productive, institutional and operational capacity, unlike most inflation targeters across the globe, inflation targeting is perhaps not for a developing country like Ghana. It observes that besides the inflation target framework resulting in high interest rates in the country, the numerous target misses it had experienced since its adoption could result in reputational and credibility damages for the central bank which would be very costly to remedy.

The Bank's over fixation on inflation targeting to the neglect of other essential macroeconomic indicators and economic growth remains a concern. It should be noted that the conduct of monetary policy in Ghana must not only be directed at accommodating fiscal slippages and exchange rate volatility that pose inflationary threats. Given the current monetary policy sphere



where the central bank's preoccupation is to manage inflation expectations without undertaking real monetary policy actions or balance of risk to growth. Both theory and evidence indicate that in an economy like that of Ghana monetary policy can affect not just prices but also output, employment and other important aspects of non-financial economic activity.

Culled from Osei-Assibey (2017), "Inflation Targeting under weak Macroeconomic Fundamentals: Does Ghana need a Monetary Policy Re-direction? Legislative Alert, Vol. 24 No.1 April 2017, a publication of The Institute of Economic Affairs, Accra

1.5.3 Monetary Transmission Mechanism of Monetary Policy

In this section, I shall explain the ways in which monetary policy affects aggregate demand and the economy, which are referred to as transmission mechanisms of monetary policy. We are particularly interested in the impact that monetary policy has on the nominal income of the economy and, through this, on the level of output and the rate of inflation. The series of links between the monetary policy change and the changes in output, employment, and inflation are known as the transmission mechanism of monetary policy. This can be broken up into two elements — the impact of monetary policy changes on aggregate demand; and the effect of

changes in aggregate demand on output, employment, and prices. In this section, we consider the first of these. We have seen that a monetary policy change may take one of three forms:

a change in the short-term rate of interest at which the central bank is willing to lend to the banking sector in order to relieve any shortages of liquidity within the monetary system (interest rate control);

a change in the monetary base in the expectation that this will alter the money supply, or its rate of growth (monetary base control);

changes in the regulations that apply to banks in an attempt to influence the rate of growth of their lending (direct controls).

However, central banks and other monetary authorities, now use only the first of these. Therefore, because of this predominance of interest rate control in modern monetary policy, we begin by examining the interest-rate channels because they are the key monetary transmission mechanism of the AD/AS model.

Interest-Rate Channels

Interest rate control and the transmission mechanism

The interest rate control (endogenous money) approach to the transmission mechanism in six steps (Goodhart, 2002):

1. The central bank determines the short-term interest rate
2. The private sector determines the volume of borrowing it wishes to undertake from the banking sector at the current set of interest rates.
3. Banks adjust their own relative interest rates, marketable assets, and interbank and wholesale borrowing to meet the credit demands upon them
4. 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
5. 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
6. In order to sustain the level of interest rates set under Step 1, the central bank uses open market operations to satisfy the banks' demand for reserves established under step 5.

The traditional view of the monetary transmission mechanism can be characterized by the following schematic, which shows the effect of an easing of monetary policy accomplished by lowering the real interest rate:



$$r \downarrow \Rightarrow I \uparrow \Rightarrow Y^{\text{ad}} \uparrow$$

(1)

This schematic shows that an easing of monetary policy 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 (Y^{ad}). Although Keynes originally emphasized this channel as operating through businesses'

decisions about investment spending, the search for new monetary transmission mechanisms led economists to recognize that consumers' decisions about housing and consumer durable expenditure (spending by consumers on durable items such as automobiles and refrigerators) also are investment decisions. Thus the interest-rate of monetary transmission outlined in Equation 1 applies equally to consumer spending, and in this case I represents investments in residential housing and consumer durable expenditure.

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. How is it that a change in the short-term nominal interest rate induced by a central bank results in a corresponding change in the real interest rate on both short- and long-term bonds?

We have already seen that the answer lies in the phenomenon of sticky prices—the fact that the aggregate price level adjusts slowly over time, so that expansionary monetary policy, which lowers the short-term nominal interest rate, also lowers the short-term real interest rate. The expectations hypothesis of the term structure (which we will discuss later in this course) which states that the long-term interest rate is an average of expected future short-term interest rates, suggests that a lower real short-term interest rate, as long as it is expected to persist, leads to a fall in the real long-term interest rate. These lower real interest rates then lead to increases in business fixed investment, residential housing investment, inventory investment, and consumer durable expenditure, all of which produce the rise in aggregate demand.

The fact that the real interest rate rather than the nominal rate affects spending suggests an important mechanism through which monetary policy can stimulate the economy, even if nominal interest rates hit a floor of zero during a deflationary episode. With nominal interest rates at a floor of zero, a commitment to future expansionary monetary policy can raise expected inflation ($_e$), thereby lowering the real interest rate ($r = i - _e$) even when the nominal interest rate is fixed at zero and stimulating spending through the interest-rate channel:

$$\pi^e \uparrow \Rightarrow r \downarrow \Rightarrow I \uparrow \Rightarrow Y^{ad} \uparrow$$

(2)

This mechanism thus indicates that monetary policy can still be effective even when nominal interest rates have already been driven down to zero by the monetary authorities. Indeed, this mechanism explains why the Federal Reserve in the USA resorted in December 2008 to the nonconventional monetary policy of committing to keep the federal funds rate at zero for an extended period of time. By so doing, the Fed was trying to keep inflation expectations from falling in order to make sure that real interest rates remained low, so as to stimulate the economy. In addition, the commitment to keep interest rates low for an extended period of time would help lower long-term interest rates, which would also induce greater spending.

Some economists, such as John Taylor of Stanford University, take the position that strong empirical evidence exists for substantial interest-rate effects on consumer and investment spending through the real cost of borrowing, making the interest-rate monetary transmission mechanism a strong one. His position is highly controversial, and many researchers, including Ben Bernanke, former chair of the Fed, and Mark Gertler of New York University, believe that the empirical evidence does not support strong interest-rate effects that operate through the real cost of borrowing. Indeed, these researchers see the empirical failure of traditional interest-rate monetary transmission mechanisms as having provided the stimulus for the search for other transmission mechanisms of monetary policy.

These other transmission mechanisms fall into two basic categories: those operating through asset prices other than interest rates, and those operating through asymmetric information effects on credit markets (the credit view).

Other Asset Price Channels

One drawback of the aggregate demand analysis in previous chapters 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 receive substantial attention as channels for monetary policy effects: foreign exchange rates and the prices of equities (stocks).

Exchange Rate Effects on Net Exports With the growing internationalization of economies throughout the world and the advent of flexible exchange rates, more attention has been paid to how monetary policy affects exchange rates, which in turn affect net exports and aggregate demand. The foreign exchange rate channel also involves interest-rate effects because, as we



Will see later, 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 (Y^{ad}). The schematic for the monetary transmission mechanism that operates through the exchange rate is

$$r \downarrow \Rightarrow E \downarrow \Rightarrow NX \uparrow \Rightarrow Y^{ad} \uparrow \quad (3)$$

Tobin's q Theory Nobel Prize winner James Tobin developed a theory, referred to as Tobin's q theory, that 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.

Conversely, when q is low, firms will not purchase new investment goods because the market value of firms is low relative to the cost of capital. If companies want to acquire capital when q is low, they can buy another firm cheaply and acquire old capital instead. Investment spending, the purchase of new investment goods, will then be very low. Tobin's q theory gives a good explanation for the extremely low rate of investment spending during the Great Depression. In that period, stock prices collapsed, and by 1933, stocks were worth only one-tenth of their value in late 1929; q fell to unprecedentedly low levels.

The crux of this discussion is that a link exists between Tobin's q and investment spending. But how might monetary policy affect stock prices? Quite simply, 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 (P_s) will lead to a higher q and thus higher investment spending I , we can write the following transmission mechanism of monetary policy:

$$r \downarrow \Rightarrow P_s \uparrow \Rightarrow q \uparrow \Rightarrow I \uparrow \Rightarrow Y^{ad} \uparrow \quad (4)$$



Wealth Effects In their search for new monetary transmission mechanisms, researchers also looked at how consumers' balance sheets might affect their spending decisions. Franco Modigliani was the first to take this tack, using his famous life cycle hypothesis of consumption. Consumption is spending by consumers on nondurable goods and services. It differs from consumer expenditure in that it does not include spending on consumer durables. The basic premise of 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, as we have seen, monetary easing can lead to a rise in stock prices, we now have another monetary transmission mechanism:

$$r \downarrow \Rightarrow P_s \uparrow \Rightarrow \text{wealth} \uparrow \Rightarrow \text{consumption} \uparrow \Rightarrow Y^{\text{ad}} \uparrow \quad (5)$$

Modigliani's research found this relationship to be an extremely powerful mechanism that adds substantially to the potency of monetary policy. The wealth and Tobin's q channels allow for a general definition of equity, so they can also be applied to the housing market, where housing is equity. An increase in home prices, which raises their prices relative to replacement cost, leads to a rise in Tobin's q for housing, thereby stimulating its production. Similarly, housing prices are extremely important components of wealth, so rises in these prices increase wealth, thereby increasing consumption. Monetary expansion, which raises housing prices through the Tobin's q and wealth mechanisms described here, thus leads to a rise in aggregate demand.

Credit View

Dissatisfaction with the conventional story that interest-rate effects explain the impact of monetary policy on spending on durable assets has led to a new explanation that is based on the concept of asymmetric information, a problem that leads to financial frictions in financial markets. This explanation, referred to as the credit view, proposes that two types of monetary transmission channels arise as a result of financial frictions in credit markets: those that operate through effects on bank lending, and those that operate through effects on firms' and households' balance sheets.



Bank Lending Channel The concept of the bank lending channel is based on the analysis, which demonstrated that banks play a special role in the financial system because they are especially well suited to solving asymmetric information problems in credit markets. Because of banks' special role, certain borrowers will not have access to the credit markets unless they borrow from banks. As long as there is no perfect substitutability of retail bank deposits with other sources of funds, the bank lending channel of monetary transmission operates as follows: 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. Schematically, the monetary policy effect is written as follows:

$$\text{Bank reserves} \uparrow \Rightarrow \text{bank deposits} \uparrow \Rightarrow \text{bank loans} \uparrow \Rightarrow I \uparrow \Rightarrow Y^{\text{ad}} \uparrow$$

(6)

An important implication of the credit view is that monetary policy will have a greater effect on expenditure by smaller firms, which are more dependent on bank loans, than it will on large firms, which can get funds directly through the stock and bond markets (and not only through banks).

Although this mechanism has been confirmed by researchers, doubts about the influence of the bank lending channel have been raised in the literature, and there are reasons to suspect that the bank lending channel in the United States may not be as powerful as it once was. The first reason this channel is less powerful than it once was is that current U.S. regulations no longer impose restrictions on banks that hinder their ability to raise funds. Prior to the mid-1980s, certificates of deposit (CDs) were subjected to reserve requirements and Regulation Q deposit rate ceilings, which made it hard for banks to replace deposits that flowed out of the banking system during a monetary contraction. With these regulatory restrictions abolished, banks can more easily respond to a decline in bank reserves and a loss of retail deposits by issuing CDs at market interest rates that do not have to be backed up by required reserves.

Second, the worldwide decline of the traditional bank lending business has rendered the bank lending channel less potent. Nonetheless, many economists believe that the bank lending channel played an important role in the slow recovery of the United States from the 2007–2009 recession,

Balance Sheet Channel Even though the bank lending channel may be declining in importance, it is by no means clear that this is the case for the other credit channel, the balance sheet channel. Like the bank lending channel, the balance sheet channel arises from the presence of financial frictions in credit markets. We know that the lower the net worth of business firms, the more severe the adverse selection and moral hazard problems in lending to these firms become. Lower net worth means that lenders in effect have less collateral for their loans, so their potential losses from adverse selection are higher. A decline in firms' net worth, which raises the adverse selection



problem, thus leads to decreased lending to finance investment spending. The lower net worth of businesses also increases the moral hazard problem because it means that owners have a lower equity stake in their firms, giving them more incentive to engage in risky investment projects. When borrowers take on more risky investment projects, it is more likely that lenders will not be paid back, and so a decrease in businesses' net worth leads to a reduction in lending and hence in investment spending.

Monetary policy can affect firms' balance sheets in several ways. Easing of monetary policy, which causes a rise in stock prices (P_s) along the lines described earlier, raises the net worth of firms and so leads to higher investment spending (I) and higher aggregate demand (Y^{ad}) because of the decrease in adverse selection and moral hazard problems. This leads to the following schematic for this particular balance sheet channel of monetary transmission:

$$r \downarrow \Rightarrow P_s \uparrow \Rightarrow \text{firms' net worth} \uparrow \Rightarrow \text{adverse selection} \downarrow, \\ \text{moral hazard} \downarrow \Rightarrow \text{lending} \uparrow \Rightarrow I \uparrow \Rightarrow Y^{ad} \uparrow$$

(7)

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. The following schematic describes this alternative balance sheet channel:

$$i \downarrow \Rightarrow \text{firms' cash flow} \uparrow \Rightarrow \text{adverse selection} \downarrow, \\ \text{moral hazard} \downarrow \Rightarrow \text{lending} \uparrow \Rightarrow I \uparrow \Rightarrow Y^{ad} \uparrow$$

(8)

An important feature of this transmission mechanism is that nominal interest rates affect firms' cash flow. Thus this interest-rate mechanism differs from the traditional interest-rate mechanism discussed earlier in which the real interest rate affects investment. Furthermore, the short-term interest rate plays a special role in this transmission mechanism because interest payments on short-term (rather than long-term) debt typically have the greatest impact on the cash flow of households and firms.



A related transmission mechanism involving adverse selection is the credit rationing phenomenon. Through this mechanism, expansionary monetary policy that lowers interest rates can stimulate aggregate demand. Credit rationing occurs when borrowers are denied loans even though they are willing to pay a higher interest rate. The loans are denied because individuals and firms with the riskiest investment projects are exactly the ones who are willing to pay the highest interest rates

because, if the high-risk investment succeeds, they will be the primary beneficiaries. Thus higher interest rates increase the adverse selection problem, and lower interest rates reduce it. When expansionary monetary policy lowers interest rates, risk-prone borrowers make up a smaller fraction of those demanding loans, and so lenders are more willing to lend, raising both investment and aggregate demand, along the lines of parts of the schematic given in Equation 8.

Unanticipated Price Level Channel A third balance sheet channel operates through monetary policy effects on the general price level. Because in industrialized countries debt payments are contractually fixed in nominal terms, an unanticipated rise in the price level lowers the value of firms' liabilities in real terms (decreases the burden of the debt) but should not lower the real value of the firms' assets. An easing of monetary policy, which raises inflation and hence leads to an unanticipated rise in the price level (P), therefore raises real net worth, which lowers adverse selection and moral hazard problems, thereby leading to a rise in investment spending and aggregate demand, as in the following schematic:

$$\begin{aligned} r \downarrow &\Rightarrow \pi \uparrow \Rightarrow \text{unanticipated } P \uparrow \Rightarrow \text{firms' real net worth } \uparrow \\ &\Rightarrow \text{adverse selection } \downarrow, \text{ moral hazard } \downarrow \Rightarrow \text{lending } \uparrow \Rightarrow I \uparrow \Rightarrow Y^{\text{ad}} \uparrow \end{aligned} \quad (9)$$

The view that unanticipated movements in the price level affect aggregate demand has a long tradition in economics: It is the key feature in the debt-deflation view of the Great Depression.

Household Liquidity Effects Although most literature on the credit channel focuses on spending by businesses, the credit view should apply equally well to consumer spending, particularly spending on consumer durables and housing. Declines in bank lending induced by a monetary contraction should cause corresponding declines in durable and housing purchases by consumers who do not have access to other sources of credit. Similarly, increases in interest rates should cause deteriorations in household balance sheets, because consumers' cash flow is adversely affected.

The balance sheet channel also operates through liquidity effects on consumer durable and housing expenditures. These effects were found to be important factors during the Great Depression. In the liquidity effects view, balance sheet effects work through their impact on consumers' desire to spend rather than on lenders' desire to lend. Because of asymmetric information regarding their quality, consumer durables and housing are very illiquid assets. If, as a result of a severe income shock, consumers needed to sell their consumer durables or housing immediately to raise money,

they would expect to suffer a big financial loss because they would not be able to get the full value of these assets in a distress sale. In contrast, if consumers held financial assets (such as money in the bank, stocks, or bonds), they could sell them quickly and easily for their full market value and raise the cash. Hence, if consumers expect that they are likely to find themselves in financial distress, they will prefer to hold fewer illiquid consumer durable and housing assets and a greater amount of liquid financial assets.

A consumer's balance sheet should be an important influence on his or her estimate of the likelihood of future suffering from financial distress. Specifically, when consumers have a large amount of financial assets relative to their debts, their estimate of the probability of financial distress is low, and they are more willing to purchase consumer durables or housing. When stock prices rise, the value of financial assets increases as well; consumer durable expenditure will also rise because consumers have a more secure financial position and therefore a lower estimate of the likelihood of future financial distress. This leads to another transmission mechanism for monetary policy, one that operates through the link between money and stock prices:

$$\begin{aligned}
 r \downarrow &\Rightarrow P_s \uparrow \Rightarrow \text{value of households' financial assets} \uparrow \\
 &\quad \Rightarrow \text{likelihood of financial distress} \downarrow \\
 &\Rightarrow \text{consumer durable and housing expenditure} \uparrow \Rightarrow Y^{ad} \uparrow
 \end{aligned}
 \tag{10}$$

The illiquidity of consumer durable and housing assets provides another reason why a monetary easing, which lowers interest rates and thereby increases cash flow to consumers, leads to a rise in spending on consumer durables and housing. An increase in consumer cash flow decreases the likelihood of financial distress, which increases the desire of consumers to hold durable goods and housing, thus increasing spending on these items and hence increasing aggregate demand. The only difference between this view of cash flow effects and that outlined in Equation 8 is that in this view, it is not the willingness of lenders to lend to consumers that causes expenditure to rise, but the willingness of consumers to spend.

We can conclude from this section that:

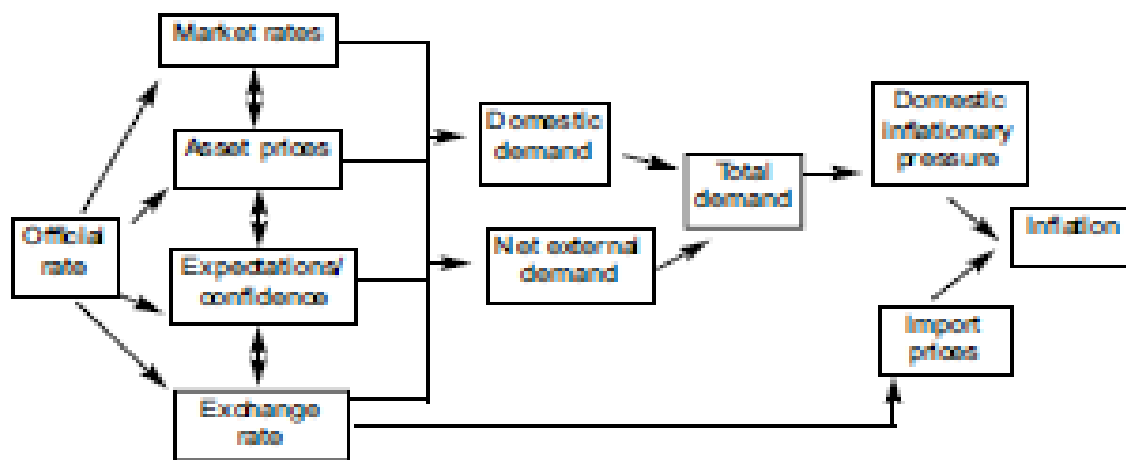
monetary policy influences aggregate demand in a variety of ways;

the relationship between interest rate changes and changes in aggregate demand might be quite powerful;

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

nonetheless, the relationship between interest rates and aggregate demand is complex

interest rate changes affect the distribution of income as well as the level of aggregate demand.



Source: Adapted from Bain and Howells (2003)

1.5.4 Interest Rates and Monetary Policy (Taylor's Rule)

Taylor rule

Many central banks, especially in financially developed economies, nowadays choose to use the interest rate, rather than the money supply, as the primary monetary policy instrument, while leaving the money supply endogenous to the economy. Alvarez et al. (2001) summarize the current consensus on monetary policy as: 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.



Alvarez et al. (2001, p. 219).

Few central banks openly admit to following a specific rule, though several empirical studies have shown that they act as if they do so. Among these, the use of the interest rate as the operating monetary policy instrument is often espoused in the form of a Taylor rule (Taylor, 1993, 1999), which is:

$$r^T_t = r_0 + \alpha(y_t - y^f) + \beta(\pi_t - \pi^T) \quad \alpha, \beta > 0 \quad (1)$$

where r^T is the real interest rate target of the central banks for financial markets, y is real output, y^f is full-employment output, π is the actual inflation rate, π^T is the inflation rate desired by the central bank, and the subscript t refers to period t . π^T is called the target inflation rate. Similarly, y^f is the target output level. $(y_t - y^f)$ is (minus of) the output gap.

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. Taylor used $\alpha = 0.5$ and $\beta = 0.5$, without estimating their values. The usual practice now is to specify the Taylor rule with unspecified values for these parameters, and to estimate them for the country and period being studied. Their relative ratio should reflect the country's central bank's responses, over the sample period, to the output gap and the deviation of inflation from its desired level.

Since central banks set the nominal rather than the real interest rate, the Taylor rule is also often written as:

$$R^T_t = \pi_t + r_0 + \alpha(y_t - y^f) + \beta(\pi_t - \pi^T) \quad \alpha, \beta > 0 \quad (2)$$

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. By implication, under the Taylor rule, monetary policy is not used to respond to shocks to the macroeconomy that do not affect the



output gap and the deviation of inflation from its desired level, so that this rule limits the goals of the central bank to the output gap and inflation.

The principle that the monetary authorities should raise nominal interest rates by more than the increase in the inflation rate has been named the Taylor principle, and it is critical to the success of monetary policy. Suppose that the Taylor principle is not followed and that the rise in nominal rates is less than the rise in the inflation rate, so that real interest rates fall when inflation rises. Serious instability then results, because a rise in inflation leads to an effective easing of monetary policy, which then leads to even higher inflation in the future. Indeed, this scenario characterizes

the monetary policy of the 1970s, which led to a loss of the nominal anchor and the era of the so-called “Great Inflation,” when inflation rates climbed to double-digit levels. Fortunately, since 1979, the Taylor principle has become a feature of monetary policy, with much happier outcomes on both the inflation and aggregate output fronts.

Implicit in the Taylor rule are the following propositions about the usual links between the interest rate, output and inflation:

An increase in the real interest rate reduces aggregate demand, which reduces inflation, so that the real interest rate and inflation are negatively related.

There is a close positive relationship between output and inflation. Given the structure of most economies, there is usually a low positive inflation rate (say, π_{nairu}) when output is at its full-employment level; inflation rises above π_{nairu} as output rises above its full-employment level and falls below π_{nairu} as output falls below that level

The preceding version of the Taylor rule is a contemporaneous one, in which the current interest rate varies with the current output gap and the “inflation gap,” with the latter defined as $(\pi_t - \pi_T)$. There are at least three other versions of the Taylor rule in the literature. These include a backward-looking (forward-looking) rule in which the current interest rate is set on the basis of past (future) values of the output and inflation gaps. A fourth version derives the Taylor rule from the optimization of a loss function of the central bank. These versions are spelled out in Chapter 15 on the Keynesian paradigm since its current variant (the new Keynesian model) incorporates the Taylor rule.

Note that in the long run $y_t = y_f$ and $\pi_t = \pi_T$, $r_t = r_0$, so that r_0 has to equal the long-run real interest rate of the economy. Otherwise, the divergence between the real interest rate set by the central bank and the economy’s real interest rate would cause long-run disequilibrium in the financial markets of the economy, with consequences for the markets for commodities and labour, so that neither y_f nor π_T would be achieved.



In terms of empirical evidence, some form of the Taylor rule has often done quite well as the central bank's explicit or implicit reaction function for developed, free market economies (Sims, 2001). To cite just one empirical study, Clarida et al. (1998) estimate the monetary policy rules for France, Germany, Italy, Japan, the UK and the USA. Using a forward looking version of Taylor's rule, they report that the central banks of Germany, Japan and the USA can be implicitly taken to have followed inflation targeting and output stabilization functions.³⁰

An issue actively pursued in further research on the Taylor rule has been whether or not asset prices and exchange rates should be included in this rule. The argument in favour of their inclusion is that shifts in them can change aggregate demand. However, some part of these shifts are often the result of changes in output and inflation, so that only the impact of their residual shifts on inflation and output would need to be offset through monetary policy. Doing so yields extended forms of the Taylor rule.

Many empirical studies report that using some form of an augmented Taylor rule, such as incorporating changes in wealth or house prices or exchange rates, leads to greater stabilization of the economy. However, none of these extended forms has come into general usage in macroeconomic modeling, so we choose not to present them or incorporate them into the analysis of this chapter. The Taylor rule is re-examined

Integration of the interest rate as the operating monetary target into the macroeconomic model

Our desire in the following analysis is to develop a macroeconomic model that has the simplicity of the IS–LM one and is comparable with it. In the IS–LM model, the central bank holds the money supply constant. The corresponding assumption for the interest rate as the monetary policy instrument is that the central bank holds the interest rate constant. Therefore, for the following analysis, we adopt the assumption that the central bank sets the real interest rate at a fixed level, r^T , which we designate as the “target rate,” and formulate the macroeconomic model under this assumption. This model can be used to analyze the impact of changes in this interest rate, irrespective of whether the changes are made on a discretionary basis or according to a rule such as the Taylor rule.

The assumption made on monetary policy is that the central bank successfully targets and sets the economy's real interest rate r at r^T . That is, under this simple targeting policy,

$$r = r^T_0 \tag{4}$$

Plotting this interest rate in the (r, y) space of the IS diagram, we have a horizontal line at the target real interest rate. This is shown in Figure 5.11 by the “interest rate target curve” labelled IRT. An

alternative to the above assumption of a simple fixed interest rate rule is a simple feedback rule such as:

$$r = r_0 + \lambda_y y^d + \lambda_P P \quad \lambda_y, \lambda_P > 0 \quad (5)$$

(2) can also be modified to a Taylor-type rule but with targeting of price level, rather than inflation, as in:

$$r^T_t = r_0 + \alpha(y_t - y^f) + \beta(P_t - P^T) \quad \alpha, \beta > 0 \quad (6)$$

In (5) and (6), an increase in aggregate demand causes the central bank to raise the interest rate, so that r and y^d are positively related, giving the IRT curve a positive slope, as shown by the IRT curves in Figure 12. An increase in P would not shift the IRT curve under (4) but would shift those in (5) and (6) upward, from IRT_0 to IRT_1 , indicating an increase in r at any given level of y^d .

Note that, as shown later, under interest rate targeting of whatever type, the 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 in (4), the LM curve becomes horizontal at the set interest rate because the central bank supplies money perfectly elastically to the economy. However, the horizontal nature of the LM curve in this case does not mean that the economy is in the liquidity trap.

Figure 5.11

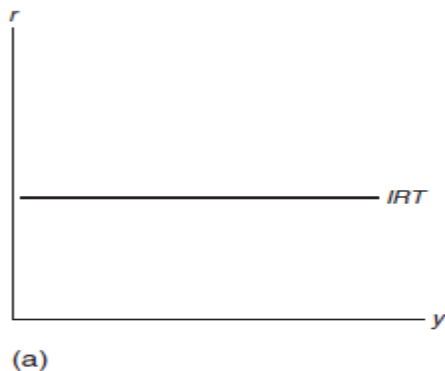
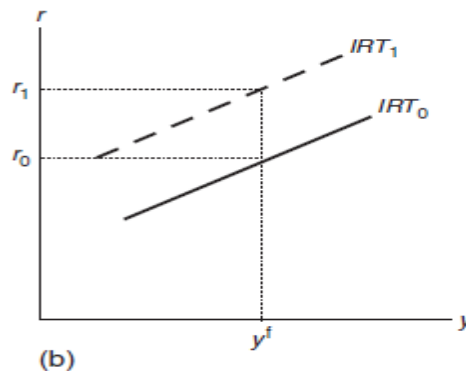


Figure 5.12



Although we have a choice of interest rate rules for monetary policy, we will proceed with its simplest version, which is given in (4). While some form of the Taylor rule seems to do quite well empirically for depicting central bank behaviour on average and in hindsight, in practice, the adjustment of interest rates by the central bank at any given time does not happen automatically according to a pre-specified rule and involves considerable discretion and hesitation. Further,



central bank preferences on the weights put on the output and inflation gaps tend to shift over time, as they have done in the USA over the past three decades with the changes in the chairman of the Federal Reserve System (Clarida et al.,2000). Furthermore, even the assessment of the actual output gap and the current and future course of inflation is usually cloudy, to say the least, and often in dispute. Hence, it seems preferable to present the basic benchmark analysis, intended for general understanding of the macroeconomy, on the general nature of the monetary policy instrument rather than on leave it to the interested reader to derive the aggregate demand functions under (5) and (6) – or one of the other forms of the Taylor rule, some more of which are specified in

1.5.5 Theories of Central Bank Independence and Time Consistency of Policies

This section focuses on the analytical treatment of three major issues: independence of the central bank and time consistency of policies. Assuming a potential for trade-offs among goals, this chapter examines the determination of the choices made and the potential for conflicts among the monetary and fiscal authorities. This discussion leads to the examination of the independence of central banks from governments and legislatures.

I shall also introduce you to the superiority of intertemporal optimization policies to myopic ones, which can have an inflationary bias. Intertemporal optimization over time provides two types of policy approaches. One of these is the time-consistent one in which the policy path for the current and future periods is derived only once and followed for all future periods. The second approach allows reoptimization every period with an unchanging objective function.

In cases of such conflicts, the ability of the central bank to pursue its own choices becomes important and is discussed under the heading of the independence of the central bank. The other two major issues addressed in this section are those of the time consistency and credibility of policies. The time consistency of monetary policies deals with the question of whether the central bank should determine its policies for the future periods within its horizon and stick to them, or should retain discretion to reformulate its policies as time passes. Discretionary policies can be arbitrary ones, be derived from one-period (“myopic”) optimization or be based on continual intertemporal reoptimization as each period passes.

Choosing Among Multiple Goals

As discussed in the last chapter, economic theory and central bank beliefs prior to the 1980s had indicated that several goals could be addressed through monetary policy. For the analysis of such a possibility, this section assumes that the central bank has a multiplicity of goals. Focusing only

on the primary goals, the instruments available for achieving the multiple goals are severely limited in number and scope so that not all the goals can be attained through the use of monetary policy. Therefore, the central bank has to make a choice among its desired goals or combinations of them.

Assume that the central bank's preferences over the goal variables are consistent and transitive, so that there exists an ordinal utility function over the goal variables. For diagrammatic analysis, the indifference curves between any given pair of these variables can be derived from this utility function.

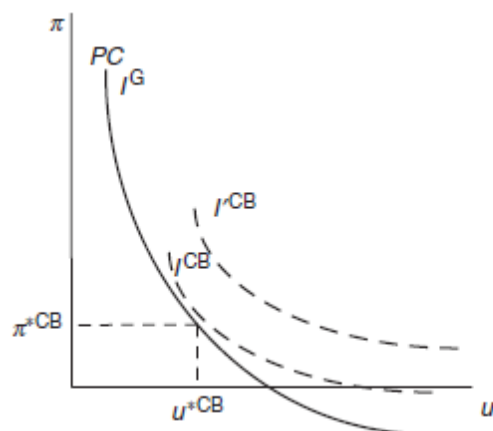
Choosing between inflation and unemployment

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 of the form:

$$U = U(\pi, u) \quad (1)$$

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 trade-off curves between the rates of inflation have the usual convex shape, as shown in Figure 5.13 by the curves I_{CB} and I'_{CB} . A host of such curves exist, with a curve passing through every point in the quadrant.

Figure 5.13





Note that since being on a lower curve is preferred to being on a higher one, the central bank will want to be on the lowest attainable indifference curve.

A common variant of the above objective function is:

$$U = U(\pi - \pi^*, y - y_f) \quad U_{\pi\#}, U_{y\#} < 0 \quad (2)$$

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 . Since the central bank's choices are limited by constraints imposed by the economy on the values of π and y that can be attained, the central bank's decision problem is optimization of utility subject to these constraints.

The preceding discussion has been in terms of a general utility function. Current monetary and macroeconomic theory prefers to use an intertemporal, as against a myopic (one period) utility function.

General analysis of the choice among goals when the economy allows a trade-off

The preceding 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:

$$U = U(x_1, \dots, x_n) \quad (3)$$

At this stage, we assume that the central bank's choice is subject to only one constraint, which has the form:

$$f(x_1, \dots, x_n; z, \Psi) = 0 \quad (4)$$

where:

x_i = i th goal variable

z = vector of instruments available to the central bank

Ψ = vector of exogenous variables.



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. $U(\cdot)$ 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, and so on. Equation (4) should properly specify the actual form of the constraint. However, this form is usually not known, so that the form of the constraint used by the central bank is that perceived by it and is based on its knowledge of the structure of the economy and the political and social environment. However, under imperfect information on the economy, the relevant constraint perceived by the central bank may not necessarily or even usually be the actual one imposed by the economy.¹ The central bank is taken to maximize (3) subject to (4) in order to determine its optimal choices among the goals.

The basic objections to the use of a preference function are to its requirements of consistency and transitivity in making choices. The central bank’s decisions are made by a host of individuals and its major choices, if consciously made, are by a group. Such group decisions in a democratic framework need not necessarily be consistent and transitive, even at a point in time, let alone over time. Further, the policy makers in the central bank change over time, so that its preferences are likely to shift over time. Hence, one must be cautious in explaining the choices among goals made by the central bank within a static utility function and its implied set of indifference curves, especially when there has been a change in its management.

In spite of these objections, the preceding analysis furnishes considerable insights into the problem of choice among alternative goals. Empirical and descriptive studies using data up to the 1980s indicate considerable validity for this analysis and show that the central banks often manipulated their policy instruments, such as the monetary base and interest rates, in a systematic fashion to address their chosen goal levels.

Choices under the economy’s supply constraint

There are several forms of the economy’s supply constraint relating u and π . Of these, the Phillips curve (see in Section 5) was proposed in 1958 by A.W. Phillips and soon began to be treated as the economy’s constraint between inflation and unemployment. Its general form was:

$$u = f(\pi) \quad f' < 0 \quad (5)$$



This constraint allows the central bank to trade between higher inflation and lower unemployment. Optimization of the utility function (1) subject to (5) yields the optimal values of π and u , with higher inflation rates yielding lower unemployment. While most Keynesians of the 1960s and 1970s accepted some form of (5) as the economy's constraint and explained central banks' monetary policy under it, many economists, especially neoclassical ones, believed that the economy had a vertical Phillips curve for the long run. Their arguments were subsequently refined by Friedman and Lucas who asserted that the proper form of the economy's constraint was the Friedman–Lucas aggregate supply curve, also known as the expectations-augmented Phillips curve. This constraint, under the assumption of rational expectations, is of the form:

$$(u - u_n) = f(\pi - E\pi) \quad f' < 0 \quad (6)$$

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. This constraint belongs to the modern classical approach. According to it, unemployment can only be made to deviate from its natural rate through unanticipated inflation, which, given rational expectations, requires a random monetary policy. Therefore, there is no trade-off 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. Many central banks adopted this economic framework in the 1990s and some economists advocated that price stability or a low rate of inflation should be the central bank's only goal variable. Further, in the 1990s, many central banks came to believe that higher rates of inflation have little to contribute in terms of higher output, while they could lead to escalating inflation and lower output. At the same time, negative rates of inflation are considered inimical to full employment because of their potential for causing a recession.

Given these beliefs, the utility-maximizing goal rate of inflation would be zero, or a low positive inflation rate.

As pointed out earlier, some economists choose to work with the objective function:

$$U = U(\pi - \pi^*, y - y_f) \quad U_{\pi^*}, U_{y_f} < 0 \quad (7)$$

where $\pi^* = \pi - \pi^*$, $y_f = y - y_f$, so that π^* and y_f are the respective gaps between the actual and the desired values of π and y . 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 π^* and y_f , 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.

However, for imperfect competition and price rigidities, the new Keynesians propose a different form of the supply constraint to (6), so that their policy recommendations would differ from the above. This form is known as the new Keynesian Phillips curve. The preceding discussion of the Phillips curve, its expectations-augmented version and the new Keynesian Phillips curve illustrates that the accurate form of the economy's constraint is usually not known. There are continual disputes among economists even about its general form, less alone the specific one with numerically specified values of the parameters.

Conflicts among policy makers: theoretical analysis

Another application of the utility approach is to the choices exercised by several (at least two) policy makers over the same set of goal variables. 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:

For policy maker A:

$$\text{Maximize } U_A = U_A(x_1, \dots, x_n) \quad (8)$$

subject to A's perceived constraint:

$$f_A(x_1, \dots, x_n; z, \Psi) = 0 \quad (10)$$

For policy maker B:

$$\text{Maximize } U_B = U_B(x_1, \dots, x_n) \quad (11)$$

subject to B's perceived constraint:

$$f_B(x_1, \dots, x_n; z, \Psi) = 0$$

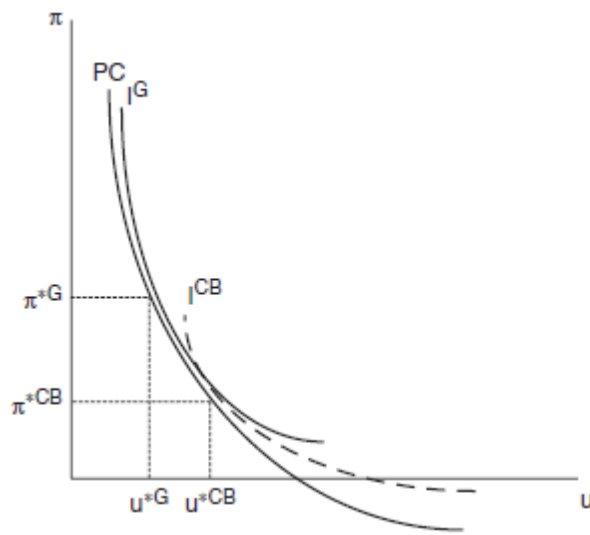


The superscripts A and B refer to the policy maker. Since both the utility functions and the perceived constraints can differ, the optimal values of the goals for x_{1A}, \dots, x_{nA} will differ from x_{1B}, \dots, x_{nB} , so that working at cross purposes can be a common phenomenon, rather than a 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 trade-offs 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.

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. The latter depends on the public for electoral support and generally tends to attach greater undesirability to increases in unemployment relative to increases in inflation than does the central bank which is usually more vitally concerned with inflation. 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 (Figure 12.2) 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.

This is illustrated in Figure 5.13 in which the central bank's indifference curves are shown by ICB, the government's by IG, and the economy's (common) constraint is shown by PC. The central bank's optimal choice is for (π^*_{CB}, u^*_{CB}) and the government's is for (π^*_G, u^*_G) , implying a more expansive stance by the government for the economy relative to that by the central bank. There therefore exists in this case a conflict between the central bank and the government on the desired rates of inflation and unemployment for the economy. If each tries to achieve its goals through the policy at its command, neither will achieve their own goals. Over time, the political process may bring about a narrow "consensus range" within which the differences between the central bank and the government over the desired goals are mild and accommodation is made easily. But a sharp change in the course of the economy outside such a range, or a sharp change in the objective functions of one of the parties to the process, as after an election that brings a new political party with a different ideology to power, may provoke an open conflict between the policy makers which takes time to resolve.

Figure 5.14



The potential for conflicts between two independent policy makers leads to strategic considerations where each “player” tries to outsmart the other. The theoretical analysis appropriate to such interactions belongs to game theory. Such analysis is outside the scope of this book. A review of it is provided in Blackburn and Christensen (1989).

Independence of the Central Bank

As shown by the preceding analysis and examples, 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. However, it is more often about intermediate targets, such as the desirable levels of interest rates or exchange rates, or because of the introduction of other ancillary objectives such as the costs of servicing the public debt or financing fiscal deficits.

While the potential for conflict can be avoided by the subordination of the central bank to the government, its independence usually ensures lower inflation rates. The USA Fed is now one of the most independent central banks in the world. In practice, the Bank of Canada has retained its



independence, though there is close consultation between the Governor and the Minister of Finance on inflation targets and policy changes. The British experiments with its central bank's independence have varied over time. While the Bank of England was historically a quasi-private bank, independent of the government, the dominance of the government over the Bank of England was legislated by the Bank Act of 1946, which nationalized its ownership. It also allocated the choice over the goals and targets of monetary policy to the Chancellor of the Exchequer, representing the government, leaving the Bank of England with a consultative and implemental role.

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. In the view of many observers, politicians in a democratic society are short-sighted 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. For example, we saw earlier that high money growth can lead initially to a drop in interest rates but might cause an increase later, as inflation heats up. Would a

Federal Reserve in the USA under the control of Congress or the president be more likely to pursue a policy of excessive money growth when interest rates are high, even though such a policy would eventually lead to inflation and even higher interest rates in the future? The advocates of an independent Federal Reserve say yes. They believe that a politically insulated Fed is more likely to be concerned with long-run objectives and thus more likely to defend a sound dollar and a stable price level.

A variation on the preceding argument is that the political process in America could lead to a political business cycle, in which just before an election, expansionary policies are pursued to lower unemployment and interest rates. After the election, the bad effects of these policies—high inflation and high interest rates—come home to roost, requiring contractionary policies that politicians hope the public will forget before the next election. There is some evidence that such a political business cycle exists in the United States, and a Federal Reserve under the control of Congress or the president might make the cycle even more pronounced.

Another argument for central bank independence is that control of monetary policy is too important to be left to politicians, a group that has repeatedly demonstrated a lack of expertise at making hard decisions on issues of great economic importance, such as reducing the budget deficit or reforming the banking system.



Both the CB and politicians are agents of the public (the principals), and both politicians and the CB have incentives to act in their own interest rather than in the interest of the public. The argument supporting Federal Reserve independence is that the principal–agent problem is worse for politicians than for the Fed because politicians have fewer incentives to act in the public interest.

Indeed, some politicians prefer an independent Fed because it can be used as a public “whipping boy” to take some of the heat off their backs. It is possible that a politician who in private opposes an inflationary monetary policy will be forced to support such a policy in public for fear of not being re-elected. An independent Fed can pursue policies that are politically unpopular yet ultimately in the public interest.

The Case Against Independence

Proponents of a Fed under the control of the president or Congress argue that it is undemocratic to have monetary policy (which affects almost everyone in the economy) controlled by an elite group responsible to no one. The current lack of accountability in CBs has serious consequences: If the Fed performs badly, no provision is in place for replacing members (as there is with politicians). True, the CB needs to pursue long-run objectives, but elected officials of Congress vote on long-run issues also (foreign policy, for example). If we push the argument further that policy is always performed better by elite groups like the Fed, we end up with such conclusions as “the Joint Chiefs of Staff should determine military budgets” or “the IRS should set tax policies with no oversight by the president or Congress.” Would you advocate this degree of independence for the Joint Chiefs or the IRS?

The public holds the president and Congress 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.

Another argument against Federal Reserve independence is that, historically, an independent Fed has not always used its freedom successfully. The Fed failed miserably in its stated role as lender of last resort during the Great Depression, and its independence certainly didn’t prevent it from pursuing an overly expansionary monetary policy in the 1960s and 1970s that contributed to rapid inflation in this period.



Development Strategies in LDCs, Financing Fiscal Deficits and Central Bank Independence

The issue of central bank independence takes on another dimension in countries that incur large and persistent deficits but do not possess adequate capital markets to finance them through new issues of public debt, and need the central bank to do so through an expansion of the monetary base. This often happens during wars, even in the developed economies, but has occurred most noticeably in recent decades in the LDCs.

LDCs tend to have low output per capita and are not able to raise adequate tax revenue for their desired levels of public expenditures. The latter are in many countries swollen by their plans for public development projects or the deficits of their public sector undertakings.

Further, their domestic financial markets are under-developed and cannot support much, if any, government borrowing, and their ability to borrow abroad is also severely limited. As a result, many LDCs resort to increases in the monetary base, either directly or indirectly through the compulsory sale of government bonds to the central bank. This process requires the subservience of the central bank and its policies to the fiscal needs of the government, and destroys the central bank's independent control over monetary policy.

Whether such an arrangement is advantageous to the economy is in considerable doubt. On the positive side is the financing of public projects that would otherwise not have been financed, or provision for social objectives such as health, education and alleviation of poverty. On the negative side is the subordination of increases in the monetary base to budget deficits, with the consequent loss in control by the central bank over monetary policy and over aggregate demand and inflation in the economy. From the perspective of price stability, this loss of independent control of the monetary base by the central bank severely limits its capacity to control inflation. Many empirical studies have documented that countries with independent central banks, which are not necessarily obliged to finance the budget deficits, tend to have lower rates of inflation. Another negative aspect of this arrangement is that the borrowing for the public projects thus financed is not done in competitive markets at market determined rates. Hence, allocative efficiency suffers and private projects that could be more efficient and could have been undertaken are crowded out. These efficiency losses could be considerable and, in the opinion of many economists, have contributed to the low growth of those LDCs that resorted heavily in the past to the financing of governmental deficits by increases in the monetary base.

While few central banks in developing countries were effectively independent of the government prior to the 1990s, the economic arguments and evidence supporting independence have since then led many developing countries to grant much greater independence to their central banks.



Time Consistency of Policies

The proper design of monetary policies⁴ over time requires that the central bank have an intertemporal objective function to rank alternative policies and know the economy's constraints, as well as possess knowledge of the current and future responses of the economy to its policies and how it intends to set its policies in the future.

A time-consistent policy path is one that is derived from optimizing an intertemporal objective function subject to the appropriate constraints describing the behaviour of the economy, with the optimal policy path over time derived once-for-all and followed as time passes. The latter requires a commitment to pursue the derived set of policies, both in the current and future periods, so that the central bank would have to resist the temptation and the political pressures to deviate from this path. Hence, time consistency of policies is related to the issues of the independence of the central bank and of a commitment regime under which the central bank will maintain a pre-set future policy path.

To illustrate, suppose that the central bank does want to pursue time-consistent policies with the long-term goal of price stability, while the government has the objective of getting re-elected which, given a short-run Phillips curve trade-off between inflation and unemployment, is enhanced by short-term inflationary monetary policies. The central bank is more likely to resist pressure from the government if it is independent of the political process. Therefore, the independence of the central bank from the government and the legislature improves its ability to pursue time-consistent policies. This reasoning is now widely accepted, so that, as pointed out earlier, the central banks of most developed countries and of many emerging ones now possess a high degree of independence of the government.

Time-consistent policies are generally compared with discretionary policies. Discretionary policies allow the central bank discretion to deviate or not from the pre-set policy path. Under them, the central bank retains the right to pursue policies as it thinks fit at the time the policies are pursued. The set of policy types is:

1 Purely arbitrary policies.

2 Myopic (one period) policies. These are derived from myopic (short-term, usually one period) optimization with short-term goals subject to the constraints for the current period only and with expectations taken as exogenously given. Further, under this procedure, the policy maker does not give any advance commitment, even on maintaining the objective function, on its future policies.



3 (Intertemporal) reoptimization policies. These policies are derived from intertemporal reoptimization each period for that period and future ones, with an unchanged intertemporal objective function, which is maximized subject to the long-run or multiperiod constraints specified by the structure of the economy. Under this procedure, the policy maker gives a commitment to maintain the same intertemporal objective function over time, but the relevant constraints can shift with the passage of time. The optimal policy is followed only for the optimizing period, since the following period's policy will be the outcome of that period's optimization process. Policies of this type are labelled "reoptimization policies" in this chapter and are the outcome of a dynamic reoptimization process performed each period, but the optimal policy is followed for the optimizing period only.

4 (Intertemporal) time-consistent policies. These policies are derived from once-for-all intertemporal optimization, with an intertemporal objective function over goals, maximized subject to the long-run or multi-period constraints specified by the structure of the economy. The policy path, once derived, is followed in the initial (i.e. optimization period) and all future periods, so that the optimization exercise is done only in the initial period. If the initial period has already passed, optimization is not undertaken in the current period. There is clearly an implicit or explicit commitment to stick to the policy path derived in the initial period. Compared with the reoptimization procedure, which requires reoptimization each period, time-consistent policies are derived from just one optimization. Note also that the time consistent optimal policy path (i.e. under once-for-all optimization) does not imply unchanged or identical policies for each period since the period constraints can differ, as, for instance, because of foreseen business cycle fluctuations.

Policies of types 1 to 3 are usually classified as discretionary since the policy maker does not make a prior commitment to following pre-announced policies for future periods. However, note that "reoptimization policies" are not arbitrary or myopic, and are discretionary only in the very limited sense that the policy maker changes the policy pursued from one period to the next only if the intertemporal reoptimization, with an unchanged objective function, implies such a change. Contributions in the 1970s and 1980s on the proper design of policies showed that policies conducted on an arbitrary or myopic basis generally result in poor long-term outcomes. In particular, relying on a one-period Phillips curve trade-off between output or unemployment and inflation, expansionary policies to boost output above its sustainable level would not keep output on average above its long-run level but would generate inflation, possibly accelerating inflation, on a continuing basis. This result is known as the inflationary bias of myopic, discretionary policies. Over time, this realization would sooner or later lead to the reversal of such policies, so that they would be "time inconsistent."



Time-consistent and reoptimization policies are clearly preferable to arbitrary policies. From the perspective of sustainable long-run goals, they are also preferable to myopic policies. However, it is not clear whether time-consistent policies are also superior to reoptimization policies. Offhand, the intuitive presumption is that the reoptimization policy procedure is preferable since it maintains continuous policy flexibility and since, with reoptimization at the beginning of each period, it eliminates from decision-making what is gone and past – a procedure common in economics. However, this intuitive presumption was called into question by Kydland and Prescott (1977). The discussion below is based on their analysis on the optimality of time-consistent policies relative to reoptimization policies.

1.5.6 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 bank⁸. A significant problem for most students in the more formal versions of the New Keynesian model is the assumption that both households (in the IS equation) and price-setting firms (in the Phillips curve) are forward looking. Our approach focuses just on a forward-looking Central Bank (in the Monetary or Taylor Rule) but does not incorporate forward-looking behaviour in either the IS curve or the Phillips curve.

In this section, we set out the Carlin–Soskice (C-S) simplified version of the 3-equation model to show how the central bank’s problem-solving can be illustrated algebraically and in a diagram.

We set out to answer the following questions:

How the CB responds to shocks to the economy?

What is it the CB trying to achieve? (CB’s preferences or reaction function)

What prevents the CB to achieve its target? (CB’s constraints)

How does the CB translate its objectives into monetary policy? (Monetary rule)

Note that there are two approaches to this – mathematical and diagrammatical approaches. We will start with the mathematical approach by using the active rule-based monetary policy (MP): best response interest \bar{r} to achieve inflation target. The following are the steps in deriving CB Monetary Rule (MR) to shock :

⁸This section is based on a section of Carlin and Soskice (2005).



Define the central bank's preferences in terms of deviations from inflation target and equilibrium output.

Define the central bank's constraints from the supply side, i.e. the Phillips Curve (PC)

Derive the best response monetary rule in the output-inflation space, which gives the MR curve.

Once the optimal output-inflation combination is determined using the MR, the central bank uses the IS curve to implement its choice (by setting the interest rate).

The 3 equations are the IS equation $y_1 = A - \alpha r_0$ 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

$$\pi_1 = \pi_0 + \alpha (y_1 - y_e),$$

where π is the rate of inflation and y_e , 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.

We shall see that in order to make its interest rate decision, an optimizing central bank must take into account the lag in the effect of a change in the interest rate on output — the so-called policy lag — and any lag in the Phillips curve from a change in output to inflation. The key lags in the system relevant to the central bank's interest rate decision are shown in Figure 5.15. In the IS curve, the choice of interest rate in period zero r_0 will only affect output next period y_1 as it takes time for interest rate changes to feed through to expenditure decisions. In the Phillips curve, this period's inflation π_1 is affected by the current output gap $y_1 - y_e$ and by last period's inflation

π_0 . The latter assumption of inflation persistence can be justified in terms of lags in wage- and or price-setting or by reference to backward-looking expectations.

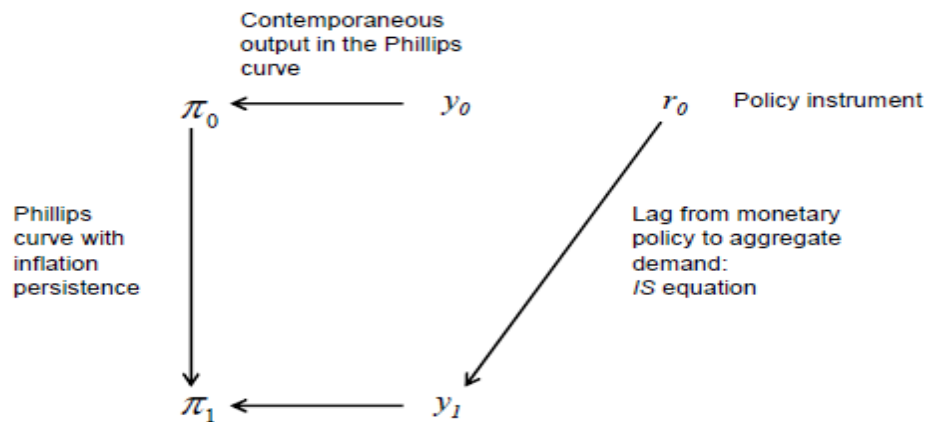
The central bank minimizes a loss function, where the government requires it to keep next period's inflation close to the target whilst avoiding large output fluctuations:

$$L = (y_1 - y_e)^2 + \beta(\pi_1 - \pi^T)^2.$$

(Central Bank loss function)

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 π_1 and y_1 that feature in the central bank's loss function: by choosing r_0 , the central bank determines y_1 , and y_1 in turn determines π_1

Figure 5.16: The lag structure in the C–S 3-equation model



This is illustrated in Fig 5.16. The critical parameter in the central bank’s loss function is

β : $\beta > 1$ will characterize a central bank that places less weight on output fluctuations than on deviations in inflation, and vice versa. A more inflation-averse central bank is characterized by a higher β .

The central bank optimizes by minimizing its loss function subject to the Phillips curve:

$$\pi_1 = \pi_0 + \alpha(y_1 - y_e). \quad (\text{Inertial Phillips curve: PC equation})$$

By substituting the Phillips curve equation into the loss function and differentiating with respect to y_1 (which, as we have seen in Fig. 5.16, the central bank can choose by setting r_0), we have:

$$\frac{\partial L}{\partial y_1} = (y_1 - y_e) + \alpha\beta(\pi_0 + \alpha(y_1 - y_e) - \pi^T) = 0.$$



Substituting the Phillips curve back into this equation gives:

$$(y_1 - y_e) = -\alpha\beta(\pi_1 - \pi^T). \quad (\text{Monetary rule: MR-AD equation})$$

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.

Here is the logic of the central bank’s position in period 0: it knows π_0 and hence it can work out via the Phillips curve (since $\pi_1 = \pi_0 + \alpha(y_1 - y_e)$) what level of y_1 it has to get to — by setting the appropriate r_0 in the current period — for this equilibrium relation to hold. We shall see that there is a natural geometric way of highlighting this logic.

We can either talk in terms of the Monetary Rule or alternatively 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, r_S , that the central bank should set now in response to a deviation of the current inflation rate from target. To find out the interest rate that the central bank should set in the current period, as well as to derive r_S we need to use the IS equation. 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 make use here of the Fisher equation, $i \approx r + \pi^E$. The IS equation incorporates the lagged effect of the interest rate on output:

As a simple case, let $\alpha = \beta = 1$, so that

$$(r_0 - r_S) = 0.5 (\pi_0 - \pi^T).$$



$$y_1 = A - ar_0. \quad (IS \text{ equation})$$

A key concept is the stabilising interest rate r_S , which is the interest rate that produces equilibrium output. This is defined by

$$y_\epsilon = A - ar_S.$$

So subtracting this from the *IS* equation we can rewrite the *IS* equation in output gap form as:

$$y_1 - y_\epsilon = -a(r_0 - r_S). \quad (IS \text{ equation, output gap form})$$

If we substitute for π_1 using the Phillips curve in the *MR-AD* equation, we get

$$\begin{aligned} \pi_0 + \alpha(y_1 - y_\epsilon) - \pi^T &= -\frac{1}{\alpha\beta}(y_1 - y_\epsilon) \\ \pi_0 - \pi^T &= -\left(\alpha + \frac{1}{\alpha\beta}\right)(y_1 - y_\epsilon) \end{aligned}$$

and if we now substitute for $(y_1 - y_\epsilon)$ using the *IS* equation, we get

$$(r_0 - r_S) = \frac{1}{a\left(\alpha + \frac{1}{\alpha\beta}\right)} (\pi_0 - \pi^T). \quad (\text{Interest-rate rule, } IR \text{ equation})$$

As a simple case, let $a = \alpha = \beta = 1$, so that

$$(r_0 - r_S) = 0.5 (\pi_0 - \pi^T).$$

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. We therefore have a 3-equation model with an optimizing central bank in which *IS* shocks affect output. As we shall see next, the *MR-AD* equation is the preferred formulation of policy behaviour in the graphical illustration of the model. We return to the relationship between the *MR-AD* equation and the Taylor Rule.

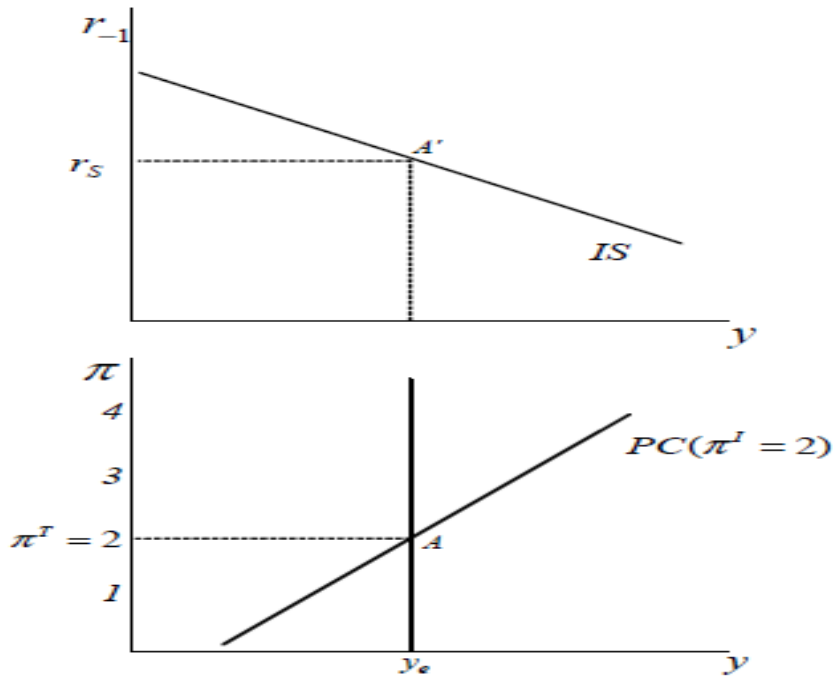
Diagram: the example of an IS shock

We shall now explain how the 3-equation model can be set out in a diagram. A graphical approach is useful in bringing out the economic intuition at the heart of the model. It allows students to work through the forecasting exercise of the central bank and to follow the adjustment process as the optimal monetary policy is implemented.

The first step is to present two of the equations of the 3-equation model. In the lower part of Fig. 2, the vertical Phillips curve at the equilibrium output level, y_e , is shown. We think of labour and product markets as being imperfectly competitive so that the equilibrium output level is where both wage- and price-setters make no attempt to change the prevailing real wage or relative prices. Each Phillips curve is indexed by the pre-existing or inertial rate of inflation, $\pi_I = \pi - 1$. As shown in Figure 5.17, the economy is in a constant inflation equilibrium at the output level of y_e ; inflation is constant at the target rate of π_T . Figure 5.17 shows the IS equation in the upper panel: the stabilizing interest rate, r_S , will produce a level of aggregate demand equal to equilibrium output, y_e . We now need to combine the three elements: IS curve, Phillips curve and the Central Bank's loss function to show how the central bank formulates monetary policy. To see the graphical derivation of the monetary rule equation (labelled MR-AD), it is useful to begin with an example.

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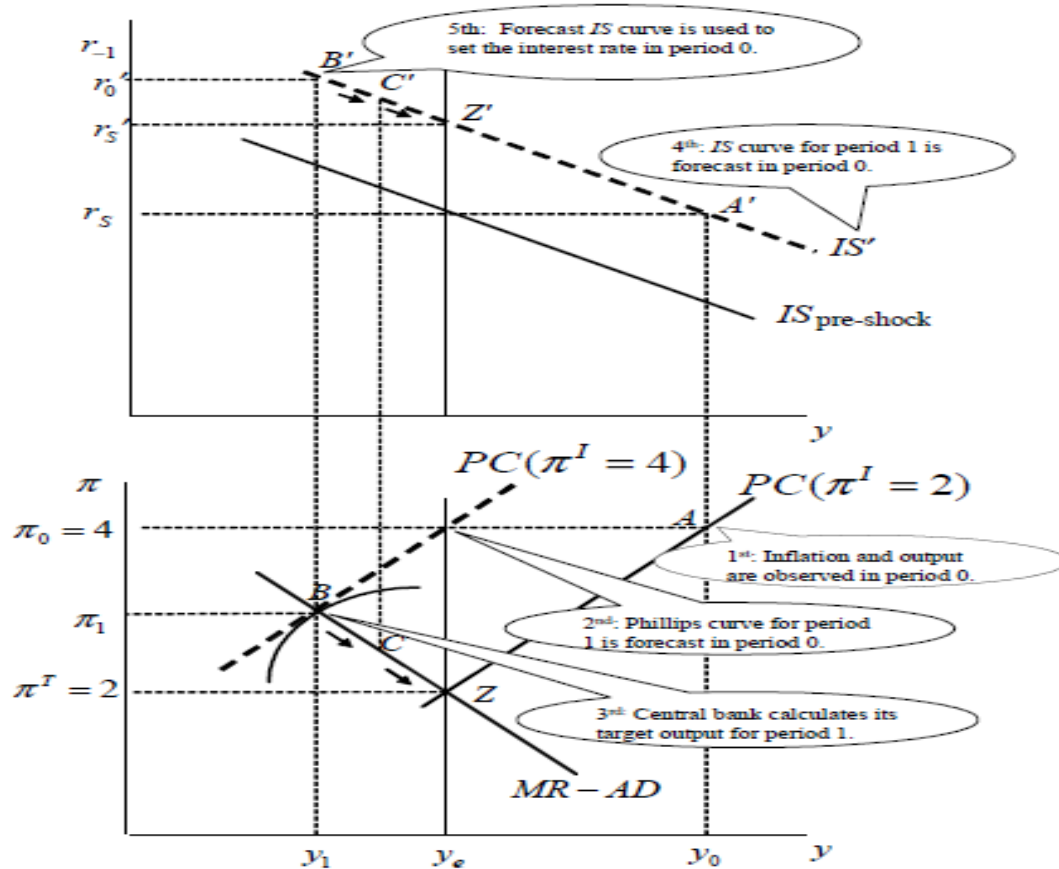
Figure 5.17



In Figure 5.18, we assume that as a consequence of an IS shock the economy is initially at point A with output above equilibrium, i.e. $y > y_e$, and inflation of Figure 1.18: IS and PC curves 4% above the 2% target. The central bank's job is to set the interest rate, r_0 , in response to this new information about economic conditions. In order to do this, it must first make a forecast of the Phillips curve next period, since this will show the menu of output inflation pairs that it can choose from by setting the interest rate now. Given that inflation is inertial, its forecast of the Phillips curve in period one will be $PC(\pi^I = 4\%)$ as shown by the dashed line in the Phillips curve diagram. The only points on this Phillips curve with inflation below 4% entail lower output. Hence, disinflation will be costly.

How does the central bank make its choice from the combinations of inflation and output along the forecast Phillips curve ($PC(\pi^I = 4\%)$)? Its choice will depend on its preferences: the higher is β the more averse it is to inflation and the more it will want to reduce inflation by choosing a larger output gap. We show in the appendix how the central bank's loss function can be represented graphically by Figure 5.18: How the central bank decides on the interest rate

Figure 5.18



loss circles or ellipses. In Figure 5.18, the central bank will choose point B at the tangency between its 'indifference curve' and the forecast Phillips curve: this implies that its desired output level in period one is y_1 . In other words, y_1 is the central bank's aggregate demand target for period 1 as implied by the monetary rule. The MR-AD line joins point B and the zero loss point at Z where inflation is at target and output is at equilibrium. The fourth step is for the central bank to forecast the IS curve for period one. In the example in Figure 19 the forecast IS curve is shown by the dashed line. With this IS curve, if an interest rate of r'_0 is set now, the level of output in period one will be y_1 as desired.

To complete the example, we trace through the adjustment process. Following the increase in the interest rate, output falls to y_1 and inflation falls. The central bank forecasts the new Phillips curve,



which goes through point C in the Phillips diagram and it will follow the same steps to adjust the interest rate downwards so as to guide the economy along the IS curve from C' to Z'. Eventually, the objective of inflation at $\pi_T = 2\%$ is achieved and the economy is at equilibrium unemployment, where it will remain until a new shock or policy change arises. The MR-AD line shows the optimal inflation-output choices of the central bank, given the Phillips curve constraint that it faces.

An important pedagogical question is the name to give the monetary rule equation when we show it in the πy -diagram. What it tells the central bank at $t = 0$ is the output level that it needs to achieve in $t = 1$ if it is to minimize the loss function, given the forecast Phillips curve. Since we are explaining the model from the central bank's viewpoint at $t = 0$, what we want to convey is that the downward sloping line in the πy -diagram shows the aggregate demand target at $t = 1$ implied by the monetary rule. We therefore use the label MR-AD⁹.

The MR-AD curve is shown in the Phillips rather than in the IS diagram because the essence of the monetary rule is to identify the central bank's best policy response to any shock. Both the central bank's preferences shown graphically by the indifference curve (part of the loss circle or ellipse) and the trade-off it faces between output and inflation appear in the Phillips diagram. Once the central bank has calculated its desired output response by using the forecast Phillips curve, it is straightforward to go to the IS diagram and discover what interest rate must be set in order to achieve this level of aggregate demand.

Using the Graphical Model

We now look briefly at different shocks so as to illustrate the role the following six elements play in their transmission and hence in the deliberations of policy-makers

in the central bank:

the inflation target, π_T

⁹ It would be misleading to label it AD thus implying that it is the *actual* AD curve in $\pi_1 y_1$ -space because the actual AD curve will include any aggregate demand shock in $t = 1$. If aggregate demand shocks in $t = 1$ are included, the curve ceases to be the curve on which the central bank bases its monetary policy in $t = 0$. On the other hand if an aggregate demand shock in $t = 1$ is excluded — so that the central bank can base monetary policy on the curve — then it is misleading to call it the AD schedule; students would not unreasonably be surprised if an AD schedule did not shift in response to an AD shock.



the central bank's preferences, β

the slope of the Phillips curve, α

the interest sensitivity of aggregate demand, a

the equilibrium level of output, y_e

the stabilizing interest rate, r_S .

A temporary aggregate demand shock is a one-period shift in the IS curve, whereas a permanent aggregate demand shock shifts the IS curve and hence r_S , the stabilizing interest rate, permanently. An inflation shock is a temporary (one period) shift in the short-run Phillips curve. This is sometimes referred to as a temporary aggregate supply shock. An aggregate supply shock refers to a permanent shift in the equilibrium level of output, y_e . This shifts the vertical Phillips curve.

IS shock: temporary or permanent?

In Figure 5.18, we analyzed an IS shock — but was it a temporary or a permanent one? In order for the Central Bank to make its forecast of the IS curve, it has to decide whether the shock that initially caused output to rise to y_0 is temporary or permanent. The terms 'temporary' and 'permanent' should be interpreted from the perspective of the central bank's decision-making horizon. In our example, the central bank took the view that the shock would persist for another period, so it was necessary to raise the interest rate to r'_0 above the new stabilizing interest rate, r'_S .

Had the central bank forecast that the IS would revert to the pre-shock IS, then it would have initially raised the interest rate by less since the stabilizing interest rate would have remained equal to r_S , i.e. its chosen interest rate would have been on the IS pre-shock curve in Figure 19 rather than on the IS' curve. This highlights one of the major forecasting problems faced by the central bank.

Supply shock

One of the key tasks of a basic macroeconomic model is to help illuminate how the main variables are correlated following different kinds of shocks. We can appraise the usefulness of the IS-PC-MR model in this respect by looking at a positive aggregate supply shock and comparing the optimal response of the central bank and hence the output and inflation correlations with those associated with an aggregate demand shock. A supply shock results in a change in equilibrium output and therefore a shift in the vertical Phillips curve. It can arise from changes that affect wage- or price-setting behaviour such as a structural change in wage-setting arrangements, a change in taxation or in unemployment benefits or in the strength of product market competition, which alters the mark-up.

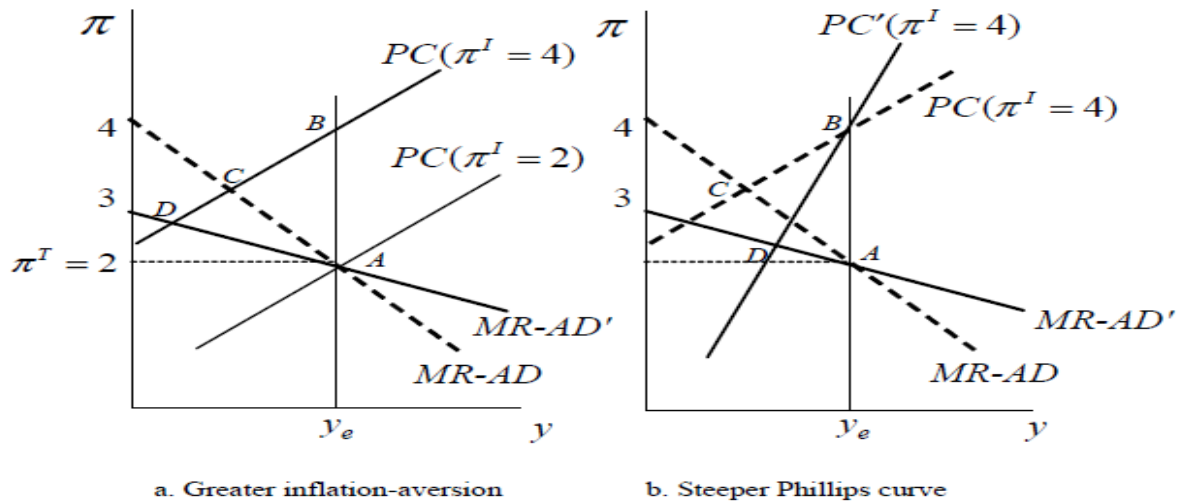
Figure 5.19 shows the analysis of a positive supply-side shock, which raises equilibrium output from y_e to $y'e$. The vertical Phillips curve shifts to the right as does the short-run Phillips curve corresponding to inflation equal to the target (shown by the PC($\pi_I = 2$, $y'e$)). The first consequence of the supply shock is a fall in inflation (from 2% to zero) as the economy goes from A to B. To decide how monetary policy should respond to this, the central bank forecasts the Phillips curve constraint (PC ($\pi_I = 0$, $y'e$)) for next period and chooses its optimal level of output as shown by point C. To raise output to this level, it is necessary to cut the interest rate in period zero to r' as shown in the IS diagram. (Note that the stabilizing interest rate has fallen to $r'S$.) The economy is then guided along the MR-AD' curve to the new equilibrium at Z. The positive supply shock is associated initially with a fall in inflation and a rise in output — in contrast to the initial rise in both output and inflation in response to the aggregate demand shock.

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, $(r_0 - r_S)$ responds to $(\pi_0 - \pi_T)$ and $(y_0 - y_e)$, for example:

$$r_0 - r_S = 0.5 * (\pi_0 - \pi_T) + 0.5 * (y_0 - y_e). \quad \text{(Taylor rule)}$$

Figure 5.19: Inflation shock: the effect of (a) greater inflation aversion of the central bank and (b) a steeper Phillips curve



We have already derived the optimal Taylor-type rule for the 3-equation C–S model:

$$(r_0 - r_S) = \frac{1}{\alpha \left(\alpha + \frac{1}{\alpha\beta} \right)} (\pi_0 - \pi^T), \quad (IR \text{ equation, C-S model})$$

which with $\alpha = \beta = 1$, gives $r_0 - r_S = 0.5 \cdot (\pi_0 - \pi^T)$. Two things are immediately apparent: first, only the inflation and not the output deviation is present in the rule and second, as we have seen in the earlier examples, 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 $\alpha = \beta = 1$, we have a more inflation averse central bank ($\beta > 1$) will raise the interest rate by more; when the IS flatter ($\alpha > 1$), the central bank will raise the interest rate by less; when the Phillips curve is steeper ($\alpha > 1$), the central bank will raise the interest rate by less.

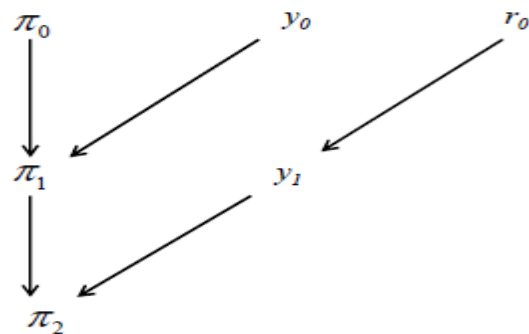
In order to derive a Taylor rule in which both the inflation and output deviations are present, it is necessary to modify the lag structure of the three equation C–S model. Specifically, it is necessary to introduce an additional lag: in the Phillips curve, i.e. the output level y_1 affects inflation a period later, π_2 . This means that it is y_0 and not y_1 that is in the Phillips curve for π_1 . The double lag structure is shown in Figure 5.19 and highlights the fact that a decision taken today by the central

bank to react to a shock will only affect the inflation rate two periods later, i.e. π_2 . When the economy is disturbed in the current period (period zero), the central bank looks ahead to the implications for inflation and sets the interest rate r_0 so as to determine y_1 , which in turn determines the desired value of π_2 . As the diagram illustrates, action by the central bank in the current period has no effect on output or inflation in the current period or on inflation in a year's time.

Given the double lag, the central bank's loss function contains y_1 and π_2 since it is these two variables it can choose through its interest rate decision

$$L = (y_1 - y_\varepsilon)^2 + \beta(\pi_2 - \pi^T)^2$$

Figure 5.20: Double lag structure in the 3-equation model





and the three equations are:

$$\begin{aligned}\pi_1 &= \pi_0 + \alpha(y_0 - y_\epsilon) && \text{(Phillips curve)} \\ y_1 - y_\epsilon &= -\alpha(r_0 - r_S) && \text{(IS)} \\ \pi_2 - \pi^T &= -\frac{1}{\alpha\beta}(y_1 - y_\epsilon). && \text{(MR-AD)}\end{aligned}$$

By repeating the same steps as we used to derive the interest rate rule in section 2, we can derive a Taylor rule:

$$(r_0 - r_S) = \frac{1}{\alpha \left(\alpha + \frac{1}{\alpha\beta} \right)} [(\pi_0 - \pi^T) + \alpha(y_0 - y_\epsilon)].$$

(Interest rate (Taylor) rule in 3-equation (double lag) model)

If $\alpha = \alpha = \beta = 1$, then

$$(r_0 - r_S) = 0.5 (\pi_0 - \pi^T) + 0.5(y_0 - y_\epsilon).$$

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): r_S in the rule should therefore be interpreted as the post-shock stabilizing interest rate.

It is often said that the relative weights on output and inflation in a Taylor Rule reflect the central bank's preferences for reducing inflation as compared to output deviations. However, we have already seen in the single lag version of the model that although the central bank cares about both inflation and output deviations, only the inflation deviation appears in the interest rate rule. Although both the output and inflation deviations are present in the IR equation for the double lag model, the relative weights on inflation and output depend only on α , the slope of the Phillips curve. The relative weights are used only to forecast next period's inflation.

The central bank preferences determine the interest rate response to next period's inflation (as embodied in the slope of the MR curve). Another way to express this result is to say that the output term only appears in the IR equation because of the lag from a change in output to a change in inflation.

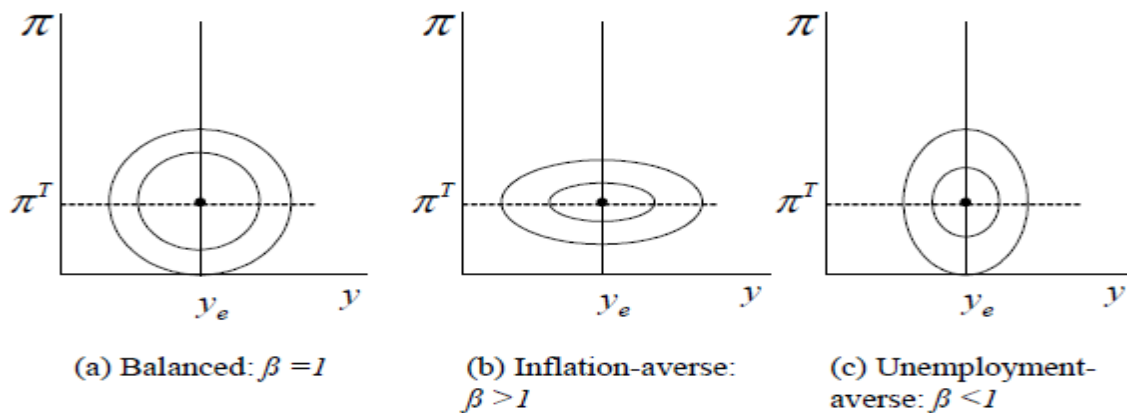
The central bank's loss function: graphical representation

The geometry of the central bank's loss function can be shown in the Phillips curve diagram. The loss function

$$L = (y_1 - y_\epsilon)^2 + \beta(\pi_1 - \pi^T)^2$$

is simple to draw. With $\beta = 1$, each ‘indifference curve’ is a circle with (y_e, π^T) at its centre (see Fig. 10(a)). The loss declines as the circle gets smaller. When $\pi = \pi^T$ and $y = y_e$, the circle shrinks to a single point (called the ‘bliss point’) and the loss is at a minimum at zero. With $\beta = 1$, the central bank is indifferent between inflation 1% above (or below) π^T and output 1% below (or above) y_e . They are on the same loss circle. Only when $\beta = 1$, do we have indifference circles. If $\beta > 1$, the central bank is indifferent between (say) inflation 1% above (or below) π^T and output 2% above (or below) y_e . This makes the indifference curves ellipsoid as in Fig. 10(b). A central bank with less aversion to inflation ($\beta < 1$) will have ellipsoid indifference curves with a vertical rather than a horizontal orientation (Fig. 10(c)). In that case, the indifference curves are steep indicating that the central bank is only willing to trade off a given fall in inflation for a smaller fall in output than in the other two cases.

Figure 10: Central bank loss functions: utility declines with distance from the ‘bliss point’



1.5.7 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 (Kellison, 2009)¹⁰. Thus, interest can be viewed as a form of rent that the borrower pays to the lender to compensate for the loss of use of the capital by the lender while it is loaned to the borrower. More practically, the [interest](#) rate is the percentage of principal charged by the lender for the use of its money. The principal is the amount of money loaned. Since banks borrow money from you (in the form of deposits), they also pay you an interest rate on your money.

In other words, the interest rate is the return on bonds (all non-monetary financial assets), but we have not so far specified explicitly the demand and supply, or the excess demand, functions for bonds. There are two ways of doing so. One is to derive the excess demand for bonds. Bonds in this section comprise a single homogeneous, non-monetary financial asset. Further, to get around issues raised by maturing bonds and to establish a simple relationship between the nominal bond price p_b 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, $p_b = 1/R$.

We shall also study the comparative static and dynamic determination of the macroeconomic interest rate in the closed economy. In terms of the heritage of ideas, the theories that deal specifically with the determination of this interest rate are the traditional classical loanable funds theory and the Keynesian liquidity preference theory. The loanable funds theory asserts that the bond market determines the interest rate, whereas the liquidity preference theory asserts that the money market does so.

Nominal and real rates of interest

The Fisher equation on the interest rate

As explained in the earlier section, the Fisher equation is:

$$(1+re) = (1+R)/(1+\pi_e) \quad (1)$$

¹⁰ Kellison G. Stephen (2009), "The Theory of Interest", 2nd Edition, McGraw-Hill



where R is the nominal interest rate, r is the real interest rate, r_e is the expected real interest rate and π_e is the expected inflation rate. 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:

$$(1+R) = (1+r)(1+\pi_e) \quad (1')$$

At low values of r_e and π_e , $r_e \pi_e \rightarrow 0$, so that the Fisher equation is often simplified to:

$$r_e = R - \pi_e$$

The demand and supply of bonds and interest rate determination

Since R is the nominal return on bonds, its equilibrium value is determined by:

$$b_d(R, \dots) = b_s(R, \dots) \quad (1)$$

where b is the number of (homogeneous) bonds/consols. We have assumed that the demand and supply of bonds depend on the nominal interest rate, among other variables. Both the demand for and supply of bonds have a flow and a stock dimension.

Flows versus stocks

In terms of flows over a specified period of time, the demand for bonds corresponds to the amount of (loanable) funds flowing or coming onto the market for lending at the various rates of interest. Similarly, the supply of bonds corresponds to the demand for (loanable) funds from those wanting to borrow funds during the period. However, the flow of funds that becomes available for loans over the current period is only a small fraction of the total amount of credit outstanding in the economy. This total amount is like a reservoir and is the stock of loanable funds. The stock of



loanable funds supplied at any point in time consists of all outstanding loans plus the net additional flow supply of loanable funds, specified for each rate of interest. In stock terms, the demand for credit is similarly the total amount already borrowed plus the net additional amounts that the borrowers wish to borrow at each rate of interest. In modern economies, a major part of this demand often comes from the existing public debt.

In markets with long-term contracts, some of the borrowers and lenders are already committed to loans made at rates prevailing in the past. In such a case, the proper market for determining the current rate of interest is that in terms of flows: the flow market is the actual operating market for bonds in any given period, with borrowers (sellers of bonds) entering it to borrow and lenders (buyers of bonds) entering it to lend funds. However, note that the pre-existing stock of bonds does exert a strong background influence on the flow demands and supplies since parts of this stock of bonds will be expected by borrowers and lenders to mature sooner or later and, over time, become flows available for renegotiation.

The flow supply of funds can be interpreted as that part of the stock that has come up for renegotiation plus the additions being made currently. The net new supply of funds to the credit market in any period t comes from two sources:

- (i) Current (private) saving in the economy.
- (ii) Excess supply of money made available for loans, with the excess supply resulting from changes in the public's desired balances or in the supply of money.

The supply of money depends on the monetary base and the inside money created by financial intermediaries. The overall supply of funds in period t is the net new supply from the above two sources plus:

- (iii) Funds becoming available from loans that have matured in period t .

The flow demand for loans is from net new borrowers and those who wish to renew existing



loans.

The net new demand for loans comes from:

Current investment in the economy.

Bond-financed government deficits.

The flow demand for loans in period t is from (iv) and (v), plus:

Demand for credit from those whose loans have matured.

Assuming (iii) and (vi) to be equal, the loanable funds theory in flow terms specifies the real demand (f_d) and supply (f_s) functions of loanable funds as:

$$f_s = s(r, \dots) + (\theta \cdot M_0s/P - md(R, \dots)) \quad (2)$$

$$f_d = i(r, \dots) + (g - t) \quad (3)$$

where:

f_s = real flow supply of loanable funds (demand for bonds)

f_d = real flow demand for loanable funds (supply of bonds)

s = real saving

i = real investment

g = real government expenditures

t = real government revenues

M_0s = supply of the nominal monetary base

θ = monetary base to money supply multiplier ($= \partial M_s / \partial M_0$)

md = demand for real balances



P = price level.

We have assumed that the government deficit ($g-t$) is wholly bond-financed and that r and R are related by the Fisher equation. In partial equilibrium analysis, the equilibrium value of the market rate of interest is determined by:

$$s(r, \dots) + (\theta M_0 s/P - md(R, \dots)) = i(r, \dots) + (g - t) \quad (3)$$

Note that the left side of (3) represents the demand for bonds and the right side represents the supply of bonds. (3) is the statement that the interest rate is determined by the equilibrium in the flow part of the bond market.

Long-run determination of the interest rate

Equation (3) specifies the determination of the short-run interest rate and shows that, although the interest rate is determined by the excess demand for loanable funds, it is not independent of the excess demand for money: excess money demand raises the interest rate and excess money supply lowers it. However, money supply and demand enter the determination of the interest rate only if there is disequilibrium in the money market.

In the long run (general equilibrium) the money market would be in equilibrium, so that the excess money demand term on the left side of (3) is zero. Hence, the long-run version of the bond market analysis becomes:

$$s(r, \dots) = i(r, \dots) + (g - t) \quad (4)$$

or:

$$s(r, \dots) = i(r, \dots)$$



where s_n is national saving ($= s+(t-g)$). In the context of the closed economy, (4) is also the statement of equilibrium in the commodity sector of the economy.

Classical heritage: the loanable funds theory of the rate of interest

The traditional classical economists (prior to Keynes) had generally favoured the specification of the overall equilibrium in terms of the bond, money and labour markets, with the labour market determining employment and, through the production function, output; the bond market determining the interest rate, and the market for money determining the price level.

Its theory of the determination of the interest rate (or its inverse, the price of bonds for bonds specified as consols which have fixed coupon payments payable perpetually) was known as the loanable funds theory. It asserted that the interest rate was determined in the bond market by equilibrium between the demand and supply of “loanable funds,” which was its synonym for the current term “bonds.” Given the discussion so far in this chapter, we can distinguish the following three aspects of the loanable funds theory:

Partial equilibrium (short-run) determination of the interest rate.

General equilibrium (long-run) determination of the interest rate.

Dynamic movement of the interest rate.

The traditional classical economists did not have a distinction (until the advent of Fisher’s equation) between the real and nominal interest rate, so that they normally referred to the market interest rate R as the determinant of investment and saving. Following their pattern of analysis, we will specify the investment function in the following as $i(R)$, rather than our usual $i(r)$. They also did not have a government sector with outstanding bond-financed budget deficits. Further, the role of financial intermediaries and the monetary base in the money creation process were not fully understood.

Given these simplifications, the demand and supply functions of the loanable funds



theory were:

$$P_f^s = P_s(R, y) + [M_s - M_d]$$

$$P_f^d = P_i(R)$$

Therefore, the short-run (i.e. partial equilibrium) determination of the interest rate according to the loanable funds theory was specified by:

$$s(R, y) + (1/P)[M_s - M_d] = i(R) \quad (5)$$

so that:

$$R = \phi(P, y; (M - M_d)) \quad (6)$$

which allows both the commodity market and the money market shifts to change the interest rate.

The long-run version of the loanable funds theory assumed general equilibrium in the economy. Therefore, for this version, $M - M_d = 0$, so that the long-run loanable funds theory became:

$$i(R) = s(R, y)$$

Further, long-run equilibrium in the commodity and labour markets ensures that output will be at the full-employment level (y_f), so that (7) becomes:



$$i(R) = s(R, yf) \quad (8)$$

That is, the long-run interest rate is determined by the equality of investment and saving at full-employment output, so that its main determinants are the propensity to save, the production capacity of the economy, and investment. In particular, this interest rate is not altered by shifts in the demand or supply of money.

For the dynamic movement of the interest rate when there is disequilibrium in the economy, the loanable funds theory asserted that the interest rate is determined by the excess demand or supply of loanable funds: it falls (while the bond price rises) if there is an excess demand for loanable funds, and rises (while the bond price falls) if there is an excess supply of loanable funds. Therefore, this theory's assertion for dynamic adjustments in the interest rate is:

$$R = f(Ebd) \frac{\partial R}{\partial (Ebd)} < 0 \quad (9)$$

Note that, since changes in the money supply and demand alter the excess demand for bonds, they will also affect the dynamic path of the interest rate.

To conclude on the relevance of the excess money supply in changing the nominal interest rate, only the long-run version of the loanable funds theory asserted its irrelevance for the determination of the interest rate. However, this long-run version, which is the statement that the interest rate is determined by saving at full employment and investment, is the one usually remembered as the statement of the loanable funds theory. Adapting the loanable funds theory to the modern economy requires the introduction of the government sector, the central bank and the financial sector into the component functions of this theory.

Loanable funds theory in the modern classical approach

In recent years, the modern version of the classical paradigm has reasserted continuous market clearance for the labour markets, as for the other markets, and with its assumption of rational expectations has further asserted the possibility of disequilibrium (due to expectational errors) in any market as at best a very transitory state. That is, with the labour and money markets clearing



continuously, there would exist full employment in the economy and the excess demand in the money market would be zero. Consequently, for the modern classical school, the theory of interest reverts to the long-run version of the traditional loanable funds theory, with the difference that it is now intended to be not only the long-run theory but also the short-run theory of the rate of interest as far as systematic or anticipated changes in the money supply are concerned.¹⁴ However, such a short-run theory could still diverge from its long-run version because of random influences operating on the economy in the short run. These cannot be anticipated under rational expectations and would cause a divergence of the short-run interest rate from its long-run level.

The modern classical version of the loanable funds theory, therefore, extends and differs from the traditional classical one in various ways. Among the differences are:

The role of financial intermediaries, as discussed earlier.

The addition of Fisher's equation connecting the real and nominal interest rates in perfect capital markets.

The distinction in the modern version between the anticipated and unanticipated values of the relevant variables, among which are the money supply, the other determinants of aggregate demand and the rate of inflation. Anticipated money supply increases cause anticipated inflation without changing the real interest rate and, therefore, increase the nominal rate by the anticipated rate of inflation, as specified by the Fisher equation. Unanticipated money supply growth lowers the real rate and will lower the market rate of interest.

Ricardian equivalence, which makes national saving independent of the (anticipated) fiscal deficit and therefore removes such deficits from the determinants of the demand and supply of loanable funds. In this case, anticipated deficits would not affect the interest rate.

In the short run, the traditional classical economists allowed deviations from full employment under the impact of money supply changes and the impact of these changes on saving. The modern classical economists allow such a deviation for only unanticipated money supply changes.

Therefore, the short-run deviations of output from its full employment level under the impact of anticipated money supply changes could, in the short run, affect the interest rate under the traditional version of the loanable funds theory but not under its modern version.



Note that outside the confines of long-run general equilibrium analysis, the interest rate is not merely the reward for postponing consumption, it is also the return on lending, which is the act of parting with liquidity, i.e. not holding money. The latter was a major contention of Keynes and is a fundamental part of Keynesian beliefs.

Keynesian heritage: the liquidity preference theory of the interest rate

Keynes's General Theory (1936) challenged the loanable funds theory on the grounds that the interest rate was not the reward for saving but was rather an inducement to part with liquidity. He summarized his views in the statement:

[Once the individual has made his decision on consumption versus saving out of his income], there is a further decision which awaits him, namely, in what form he will hold the command over future consumption which he has reserved, whether out of his current income or from previous savings. Does he want to hold it in the form of immediate, liquid command (i.e. in money or its equivalent)? Or is he prepared to part with immediate command for a specified or indefinite period....

It should be obvious that the rate of interest cannot be a return to saving or waiting as such. For if a man hoards his savings in cash, he earns no interest, though he saves just as much as before. On the contrary,..., the rate of interest is the reward for parting with liquidity for a specified period.... Thus the rate of interest at any time, being the reward for parting with liquidity, is a measure of the unwillingness of those who possess money to part with their liquid control over it. The rate of interest is not the "price" which brings into equilibrium the demand for resources to invest with the readiness to abstain from present consumption.

It is the "price" which equilibrates the desire to hold wealth in the form of cash with the available quantity of cash....If this explanation is correct, the quantity of money is the other factor, which, in conjunction with liquidity preference, determines the actual rate

of interest in given circumstances.(Keynes, 1936, pp. 166–8).

First, consider Keynes's argument in terms of its general notion that the interest rate is the reward for parting with liquidity. This is definitely true in a world with uncertainty. Savers have a choice as to the form in which to hold their savings. They may hold these in a monetary form or lend it.



If the level of the interest rate determines their division of savings into money balances versus loans, the interest rate can be called the reward for parting with liquidity in the process of lending. However, if the interest rate also influences the level of savings, then it may also be called a reward for postponing consumption. Both cases apply in the real world.

Now consider Keynes's argument formally in terms of the equilibrium relationship of the monetary sector. Keynes's money market equilibrium relationship for an exogenously given money supply

M is:

$$M = kPy + L(R) \quad (10)$$

Equation (10) determines R if it is assumed that P and y are exogenously given. This is not true of the Keynesian model and is not true for Keynes's own ideas in general. In his theory, output, interest and prices were determined simultaneously so that R is not determined merely by (10): it is also influenced by the saving and investment decisions of the expenditure sector as well as by the labour market structure. Hence, the interest rate is not merely the reward for parting with liquidity, even though that may seem to be the most proximate or closely related cause.

Dynamics of the liquidity preference theory

According to Keynes's liquidity preference theory, the dynamic movements of the interest rate are determined by the excess demand for money. Hence, it was asserted that:

$$R = f(\text{Emd}) \quad \partial R / \partial (\text{Emd}) > 0 \quad (11)$$

so that:



$$\partial R / \partial (M_d - M_s) > 0$$

(12)

The argument behind this assertion runs as follows. According to Keynes an excess demand for money by individuals would make them sell bonds in order to obtain the extra money balances they want. These bond sales will lower bond prices, which will raise the interest rate.

Theory of Portfolio Choice

All the determining factors we have just discussed can be assembled into the theory of portfolio choice, which tells us how much of an asset people will want to hold in their portfolios. It states that, holding all other factors constant:

The quantity demanded of an asset is positively related to wealth.

The quantity demanded of an asset is positively related to its expected return relative to alternative assets.

The quantity demanded of an asset is negatively related to the risk of its returns relative to alternative assets.

The quantity demanded of an asset is positively related to its liquidity relative to alternative assets.

Supply and Demand in the Bond Market:

Our first approach to the analysis of interest-rate determination looks at supply and demand in the bond market so that we can better understand how the prices of bonds are determined. Thanks to our knowledge earlier of how interest rates are measured, we know that each bond price is associated with a particular level of the interest rate. Specifically, the negative relationship between bond prices and interest rates means that when a bond's price rises, its interest rate falls, and vice versa.

The first step in our analysis is to obtain a bond demand curve, which shows the relationship between the quantity demanded and the price when all other economic variables are held constant (that is, values of other variables are taken as given). You may recall from previous economics



courses that the assumption that all other economic variables are held constant is called *ceteris paribus*, which means “other things being equal” in Latin.

Demand Curve:

To clarify and simplify our analysis, let’s consider the demand for one-year discount bonds, which make no coupon payments but pay the owner the \$1,000 face value in a year. If the holding period is one year, then, as we saw in Chapter 4, the return on the bonds is known absolutely and is equal to the interest rate as measured by the yield to maturity. This means that the expected return on this bond is equal to the interest rate i , which, using Equation 6 in Chapter 4, is

$$i = R_e = (F - P)/P$$

where i = interest rate = yield to maturity

R_e = expected return

F = face value of the discount bond

P = initial purchase price of the discount bond

This formula shows that a particular value of the interest rate corresponds to each bond price. If the bond sells for \$950, the interest rate and expected return are

$$(\$1,000 - \$950)/\$950 = 0.053 = 5.3\%$$

At this 5.3% interest rate and expected return corresponding to a bond price of \$950, let us assume that the quantity of bonds demanded is \$100 billion, which is plotted as point A in Figure 5.21.

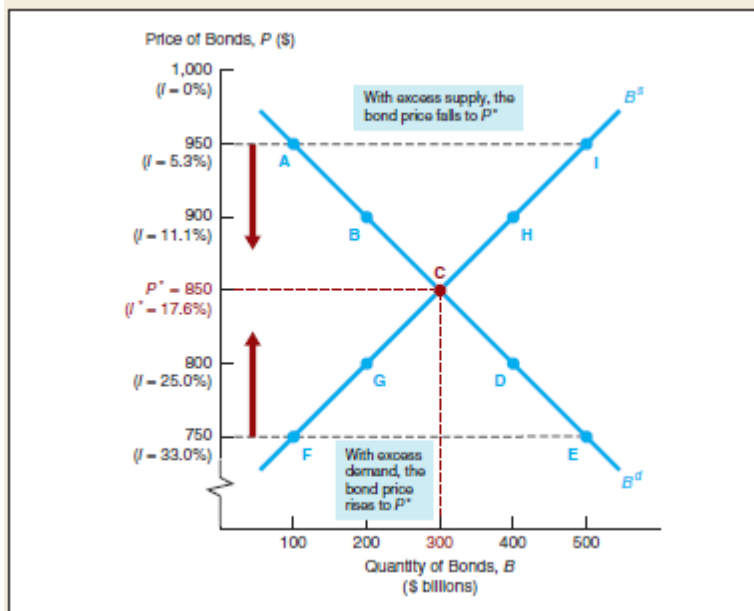
At a price of \$900, the interest rate and expected return are

$$(\$1,000 - \$900)/\$900 = 0.111 = 11.1\%$$

Because the expected return is higher, with all other economic variables (such as income, expected returns on other assets, risk, and liquidity) held constant, the quantity demanded of these bonds will be higher, as predicted by portfolio theory. Point B in Figure 5.21 shows that the quantity of bonds demanded at the price of \$900 has risen

to \$200 billion. Continuing with this reasoning, we see that if the bond price is \$850 (interest rate and expected return = 17.6%), the quantity of bonds demanded (point C)

Figure 5.21



will be greater than at point B. Similarly, at the even lower prices of \$800 (interest rate = 25%) and \$750 (interest rate = 33.3%), the quantity of bonds demanded will be even higher (points D and E). The curve Bd, which connects these points, is the demand curve for bonds. It has the usual downward slope, indicating that at lower prices of the bond (everything else being equal), the quantity demanded is higher.

Supply Curve:

An important assumption behind the demand curve for bonds in Figure 5.21 is that all other economic variables besides the bond's price and interest rate are held constant. We use the same assumption in deriving a supply curve, which shows the relationship between the quantity supplied and the price when all other economic variables are held constant.

In Figure 5.21, when the price of the bonds is \$750 (interest rate = 33.3%), point F shows that the quantity of bonds supplied is \$100 billion for the example we are considering. If the price is \$800, the interest rate is the lower rate of 25%. Because at this Although our analysis indicates that the demand curve is downward-sloping, it does not imply that the curve is a straight line. For ease of exposition, however, we will draw demand curves and supply curves as straight lines. interest rate it is now less costly to borrow by issuing bonds, firms will be willing to borrow more through bond



issues, and the quantity of bonds supplied is at the higher level of \$200 billion (point G). An even higher price of \$850, corresponding to a lower rate of 17.6%, results in a larger quantity of bonds supplied of \$300 billion (point C). Higher prices of \$900 and \$950 result in even lower interest rates and even greater quantities of bonds supplied (points H and I). The Bs curve, which connects these points, is the supply curve for bonds. It has the usual upward slope found in supply curves, indicating that as the price increases (everything else being equal), the quantity supplied increases.

Market Equilibrium:

In economics, market equilibrium occurs when the amount that people are willing to buy (demand) equals the amount that people are willing to sell (supply) at a given price. In the bond market, this is achieved when the quantity of bonds demanded equals the quantity of bonds supplied:

$$B_d = B_s \quad (1)$$

In Figure 5.21, equilibrium occurs at point C, where the demand and supply curves intersect at a bond price of \$850 (interest rate of 17.6%) and a quantity of bonds of \$300 billion. The price of $P^* = 850$, where the quantity demanded equals the quantity supplied, is called the equilibrium or market-clearing price. Similarly, the interest rate of $i^* = 17.6\%$ that corresponds to this price is called the equilibrium or market-clearing interest rate.

The concepts of market equilibrium and equilibrium price or interest rate are useful because the market tends to head toward them. We can see this in Figure 5.21 by first looking at what happens when we have a bond price that is above the equilibrium price. When the price of bonds is set too high, at, say, \$950, the quantity of bonds supplied at point I is greater than the quantity of bonds demanded at point A. A situation like this, in which the quantity of bonds supplied exceeds the quantity of bonds demanded, is called a condition of excess supply. Because people want to sell more bonds than others want to buy, the price of the bonds will fall, as shown by the downward arrow in the figure at the bond price of \$950. As long as the bond price remains above the equilibrium price, an excess supply of bonds will continue to be available, and the price of bonds will continue to fall. This decline will stop only when the price has reached the equilibrium price of \$850, the price at which the excess supply of bonds has been eliminated.

Now let us look at what happens when the price of bonds is below the equilibrium price. If the price of the bonds is set too low, at, say, \$750, the quantity demanded at point E is greater than the quantity supplied at point F. This is called a condition of excess demand. People now want to buy more bonds than others are willing to sell, so the price of bonds will be driven up, as illustrated by the upward arrow in the figure at the bond price of \$750. Only when the excess demand for bonds is eliminated by the bond price rising to the equilibrium level of \$850 is there no further tendency for the price to rise.

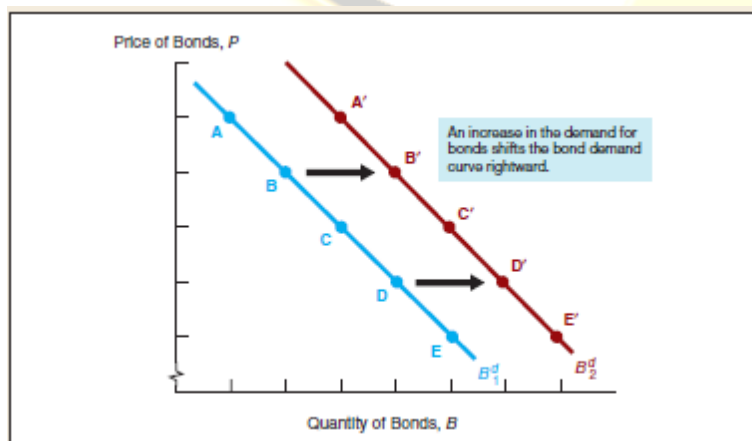
We can see that the concept of equilibrium price is a useful one because it indicates where the market will settle. Because each price on the vertical axis of Figure 5.21 corresponds to a particular value of the interest rate, the same diagram also shows that the interest rate will head toward the equilibrium interest rate of 17.6%. When the price of the bond is above the equilibrium price, and an excess supply of bonds results. The price of the bond then falls, leading to a rise in the interest rate toward the equilibrium level. Similarly, when the interest rate is above the equilibrium level, as it is when it is at 33.3%, an excess demand for bonds occurs, and the bond price rises, driving the interest rate back down to the equilibrium level of 17.6%.

Shifts in the Demand for Bonds

The theory of portfolio choice, which we developed at the beginning of the chapter, provides a framework for deciding which factors will cause the demand curve for bonds to shift. These factors include changes in the following four parameters:

1. Wealth
2. Expected returns on bonds relative to alternative assets
3. Risk of bonds relative to alternative assets
4. Liquidity of bonds relative to alternative assets

To see how a change in each of these factors (holding all other factors constant) can shift the demand curve, let's look at some examples. (As a study aid, Table 1 summarizes the effects of changes in these factors on the bond demand curve.)





Wealth When the economy is growing rapidly in a business cycle expansion and wealth is increasing, the quantity of bonds demanded at each bond price (or interest rate) increases, as shown in Figure 5.22. To see how this works, consider point B on the initial demand curve for bonds, Bd1. With higher wealth, the quantity of bonds demanded at the same price must rise, to point B1. Similarly, for point D, the higher wealth causes the quantity demanded at the same bond price to rise to point D1. Continuing with this reasoning for every point on the initial demand curve Bd, we can see that the demand curve shifts to the right from Bd1 to Bd2, as indicated by the arrows.

We can conclude that in a business cycle expansion with growing wealth, the demand for bonds rises and the demand curve for bonds shifts to the right. Applying the same reasoning, in a recession, when income and wealth are falling, the demand for bonds falls and the demand curve for bonds shifts to the left. Another factor that affects wealth is the public's propensity to save. If households save more, wealth increases and, as we have seen, the demand for bonds rises and the demand curve for bonds shifts to the right. Conversely, if people save less, wealth and the demand for bonds fall, and the demand curve shifts to the left.

Expected Returns For a one-year discount bond and a one-year holding period, the expected return and the interest rate are identical, so nothing other than today's interest rate affects the expected return. For bonds with maturities of greater than one year, the expected return may differ from the interest rate. For example, Table 1, that a rise in the interest rate on a long-term bond from 10% to 20% would lead to a sharp decline in price and a very large negative return. Hence, if people began to think that interest rates would be higher next year than they had originally anticipated, the expected return today on long-term bonds would fall, and the quantity demanded would fall at each interest rate. Higher expected future interest rates lower the expected return for long-term bonds, decrease the demand, and shift the demand curve to the left.

By contrast, an expectation of lower future interest rates would mean that long-term bond prices would be expected to rise more than originally anticipated, and the resulting higher expected return today would raise the quantity demanded at each bond price and interest rate. Lower expected future interest rates increase the demand for long-term bonds and shift the demand curve to the right (as in Figure 5.22). Changes in expected returns on other assets can also shift the demand curve for bonds. If people suddenly become more optimistic about the stock market and begin to expect higher stock prices in the future, both expected capital gains and expected returns on stocks will rise. With the expected return on bonds held constant, the expected return on bonds today relative to stocks will fall, lowering the demand for bonds and shifting the demand curve to the left. An increase in expected return on alternative assets lowers the demand for bonds and shifts the demand curve to the left.



A change in expected inflation is likely to alter expected returns on physical assets (also called real assets), such as automobiles and houses, which affect the demand for bonds. An increase in expected inflation from, say, 5% to 10% will lead to higher prices on cars and houses in the future and hence higher nominal capital gains. The resulting rise in the expected returns today on these real assets will lead to a fall in the expected return on bonds relative to the expected return on real assets today and thus cause the demand for bonds to fall. Alternatively, we can think of the rise in expected inflation as lowering the real interest rate on bonds, and thus the resulting decline in the relative expected return on bonds will cause the demand for bonds to fall. An increase in the expected rate of inflation lowers the expected return on bonds, causing their demand to decline and the demand curve to shift to the left.

Risk: If prices in the bond market become more volatile, the risk associated with bonds increases, and bonds become a less attractive asset. An increase in the riskiness of bonds causes the demand for bonds to fall and the demand curve to shift to the left. Conversely, an increase in the volatility of prices in another asset market, such as the stock market, would make bonds more attractive. An increase in the riskiness of alternative assets causes the demand for bonds to rise and the demand curve to shift to the right (as in Figure 5.22).

Liquidity If more people started trading in the bond market, and as a result it became easier to sell bonds quickly, the increase in their liquidity would cause the quantity of bonds demanded at each interest rate to rise. Increased liquidity of bonds results in an increased demand for bonds, and the demand curve shifts to the right (see Figure 5.22). for bonds falls, and the demand curve shifts to the left. shifts the demand curve to the left. The reduction of brokerage commissions for trading common stocks that occurred when the fixed-rate commission structure was abolished in 1975, for example, increased the liquidity of stocks relative to bonds, and the resulting lower demand for bonds shifted the demand curve to the left.

Shifts in the Supply of Bonds

Certain factors can cause the supply curve for bonds to shift. Among these factors are:

1. Expected profitability of investment opportunities
2. Expected inflation
3. Government budget deficits



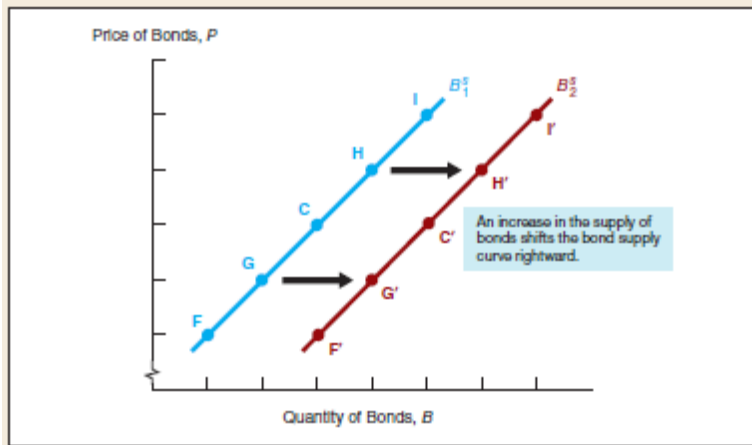
We will look at how the supply curve shifts when each of these factors changes (all others remaining constant). (As a study aid, Table 3 summarizes the effects of changes in these factors on the bond supply curve.)

Expected Profitability of Investment Opportunities When opportunities for profitable plant and equipment investments are plentiful, firms are more willing to borrow to finance these investments. When the economy is growing rapidly, as in a business cycle expansion, investment opportunities that are expected to be profitable abound, and the quantity of bonds supplied at any given bond price increases. Therefore, in a business cycle expansion, the supply of bonds increases and the supply curve shifts to the right. Likewise, in a recession, when far fewer profitable investment opportunities are expected, the supply of bonds falls and the supply curve shifts to the left.

Expected Inflation The real cost of borrowing is most accurately measured by the real interest rate, which equals the (nominal) interest rate minus the expected inflation rate. For a given interest rate (and bond price), when expected inflation increases, the real cost of borrowing falls; hence, the quantity of bonds supplied increases at any given bond price. An increase in expected inflation causes the supply of bonds to increase and the supply curve to shift to the right (see Figure 5.23) and a decrease in expected inflation causes the supply of bonds to decrease and the supply curve to shift to the left.

Government Budget Deficits The activities of the government can influence the supply of bonds in several ways. The U.S. Treasury issues bonds to finance government deficits, caused by gaps between the government's expenditures and its revenues. When these deficits are large, the Treasury sells more bonds, and the quantity of bonds supplied at each bond price increases. Higher government deficits increase the supply of bonds and shift the supply curve to the right (see Figure 5.23). On the other hand, government surpluses, as occurred in the late 1990s, decrease the supply of bonds and shift the supply curve to the left.

Figure 5.23



An increase in the supply of bonds shifts the bond supply curve rightward.

Figure 3

The Risk Structure of Interest Rate

In this subsection we're going to figure out, as best we can, why yields on different types of bonds differ. The analysis will help us to understand a couple of stylized facts derived from the history of interest rates and [Figure 5.24 "The risk structure of interest rates in the United States, 1919–2010"](#) and [Figure 5.25 "The term structure of interest rates in the United States, 1960–2010"](#):

Figure 5.24 The risk structure of interest rates in the United States, 1919–2010

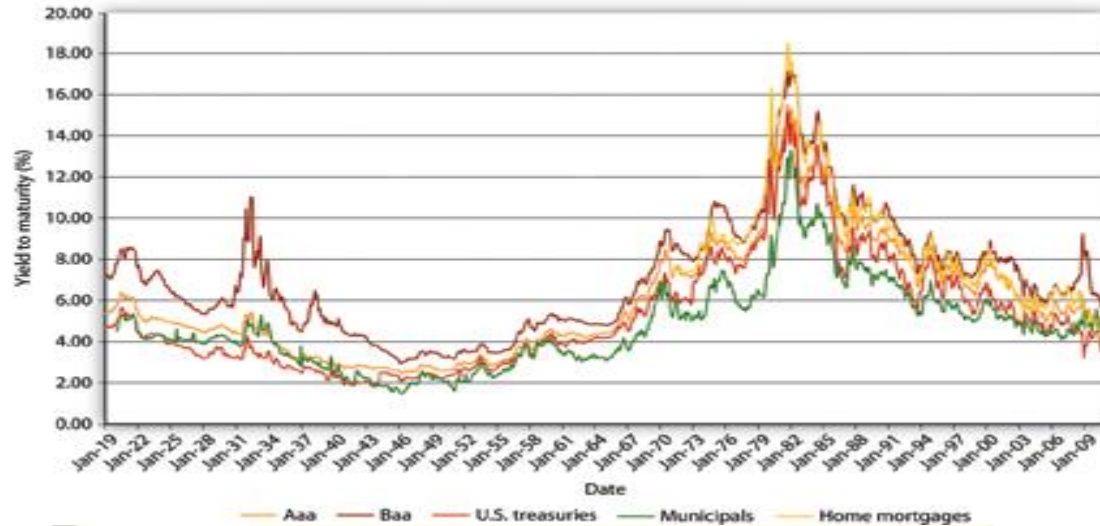


Figure 5.25 The term structure of interest rates in the United States, 1960–2010



Why the yields on Baa corporate bonds are always higher than the yields on Aaa corporate bonds, which in turn are higher than those on Treasury bonds (issued by the federal government), which for a long time have been higher still than those on munis (bonds issued by municipalities, like state and local governments)

Why the yields on corporate Baa bonds bucked the trend of lower rates in the early 1930s and why, at one time, municipal bonds yielded more than Treasuries



Why bonds issued by the same economic entity (the U.S. government) with different maturities generally, but not always, have different yields and why the rank ordering changes over time

[Figure 5.24 "The risk structure of interest rates in the United States, 1919–2010"](#), which holds maturity constant, is the easiest to understand because we've already discussed the major concepts. We'll tackle it, and what economists call the risk structure of interest rates, first. Investors care mostly about three things: risk, return, and liquidity. Because the bonds in [Figure 5.25 "The risk structure of interest rates in the United States, 1919–2010"](#) are all long-term bonds, their expected relative returns might appear at first glance to be identical. Investors know, however, that bonds issued by different economic entities have very different probabilities of defaulting. Specifically, they know the following:

Many governments like the U.S. government has never defaulted on its bonds and is extremely unlikely to do so because even if its much-vaunted political stability were to be shattered and its efficient tax administration (that wonderful institution, the Internal Revenue Service [IRS]) were to stumble, it could always meet its nominal obligations by creating money. (That might create inflation, as it has at times in the past. Nevertheless, except for a special type of bond called TIPS, the government and other bond issuers promise to pay a nominal value, not a real [inflation-adjusted] sum, so the government does not technically default when it pays its obligations by printing money.)

Municipalities have defaulted on their bonds in the past and could do so again in the future because, although they have the power to tax, they do not have the power to create money at will. (Although in the past, most recently during the Great Depression, some issued money-like, let us call them extra-legal bills of credit, or chits.) Nevertheless, the risk of default on municipal bonds (aka munis) is often quite low, especially for revenue bonds, upon which specific taxes and fees are pledged for interest payments.

Interest earned on munis is exempt from most forms of income taxation, while interest earned on Treasuries and corporate bonds is fully taxable.

Corporations are more likely to default on their bonds than governments are because they must rely on business conditions and management acumen. They have no power to tax and only a limited ability to create the less-liquid forms of money, a power that decreases in proportion to their need! (I'm thinking of gift cards, declining balance debit cards, trade credit, and so forth.) Some corporations are more likely to default on their bonds than others. Several credit-rating agencies, including Moody's and Standard and Poor's, assess the probability of default and assign grades to each bond. There is quite a bit of grade inflation built in (the highest grade being not A or even A+ but Aaa), the agencies are rife with conflicts of interest, and the market usually senses problems before the agencies do. Nevertheless, bond ratings are a standard proxy for default risk because, as [Figure 5.25 "Default rates on bonds rated by Moody's from 1983 to 1999"](#) shows, lower-rated



bonds are indeed more likely to default than higher-rated ones. Like Treasuries, corporate bonds are fully taxable.

The most liquid bond markets are usually those for Treasuries. The liquidity of corporate and municipal bonds is usually a function of the size of the issuer and the amount of bonds outstanding. So the bonds of the state of New Jersey might be more liquid than those of a small corporation, but less liquid than the bonds of, say, General Electric.

Figure 5.26 Default rates on bonds rated by Moody's from 1983 to 1999

Moody's Rating	One-Year Default Rate from 1983 to 1999 (%)	20-Year Default Rate from 1920–1999 (%)
Aaa	0.0	< 5
Aa1	0.0	< 10
Aa2	0.0	< 10
Aa3	0.1	< 10
A1	0.0	< 10
A2	0.0	< 10
A3	0.0	< 10
Baa1	0.0	c. 15
Baa2	0.1	c. 15
Baa3	0.3	c. 15
Ba1	0.6	c. 30
Ba2	0.5	c. 30
Ba3	2.5	c. 30
B1	3.5	c. 45
B2	6.9	c. 45
B3	12.2	c. 45



Equipped with this knowledge, we can easily understand the reasons for the rank ordering in [Figure 5.23 "The risk structure of interest rates in the United States, 1919–2010"](#). [Figure 5.26 "Default rates on bonds rated by Moody's from 1983 to 1999"](#), by the way, should not be taken as evidence that credit rating agencies provide investors with useful information. Before 1970 or so, they sold ratings to investors and generally did a good job of ranking risks in a competitive market for ratings. Thereafter, however, they formed a government-sanctioned oligopoly and began to charge issuers for ratings. The resulting conflict of interest degraded the quality of ratings to the point that the big three rating agencies failed to predict the crises of 1997–98 in Southeast Asia and 2008 in the United States and Europe. Today, few investors still take their ratings seriously, as evidenced by the fact that Treasury bond prices actually increased after U.S. government bonds were downgraded by credit rating agency Standard and Poor's in August 2011. Corporate Baa bonds have the highest yields because they have the highest default risk (of those graphed), and the markets for their bonds are generally not very liquid. Corporate Aaa bonds are next because they are relatively safer (less default risk) than Baa bonds and they may be relatively liquid, too. U.S. Treasuries are extremely safe and the markets for them are extremely liquid, so their yields are lower than those of corporate bonds. In other words, investors do not need as high a yield to own Treasuries as they need to own corporates. Another way to put this is that investors place a positive risk premium (to be more precise, a credit or default risk, liquidity, and tax premium) on corporate bonds.

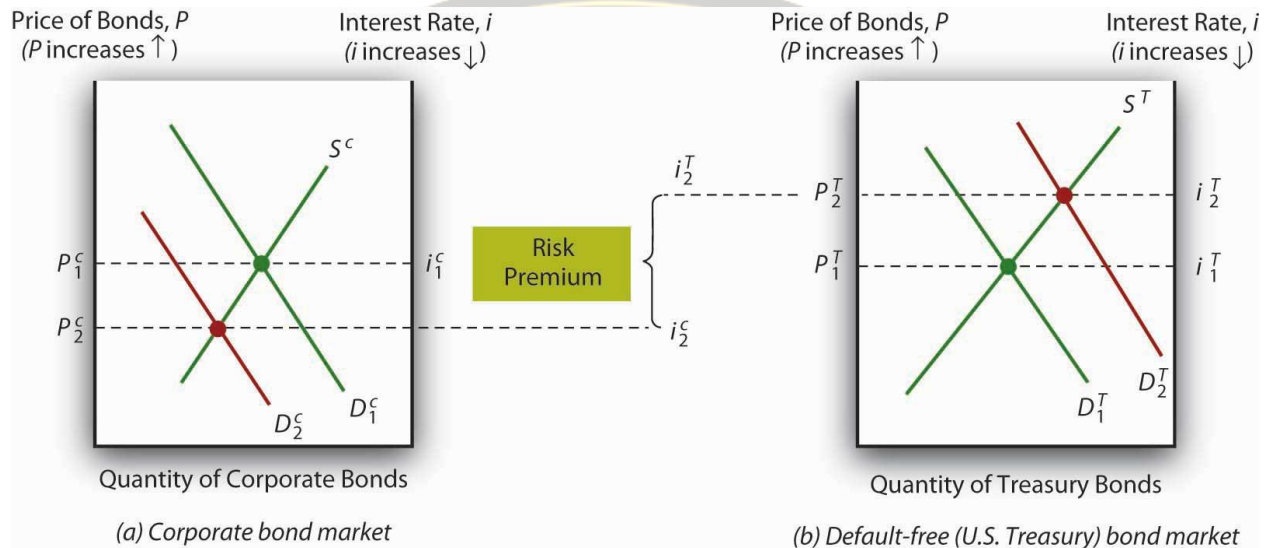
They would have higher yields and hence would be above the Baa line because they would have a higher default risk, the same tax treatment, and perhaps less liquidity.

The low yield on munis is best explained by their tax exemptions. Before income taxes became important, the yield on munis was higher than that of Treasuries, as we would expect given that Treasuries are more liquid and less likely to default. During World War II, investors, especially wealthy individuals, eager for tax-exempt income and convinced that the fiscal problems faced by many municipalities during the depression were over, purchased large quantities of municipal bonds, driving their prices up (and their yields down). Almost all the time since, tax considerations, which are considerable given our highest income brackets exceed 30 percent, have overcome the relatively high default risk and illiquidity of municipal bonds, rendering them more valuable than Treasuries, *ceteris paribus*.

Risk, after-tax returns, and liquidity also help to explain changes in spreads, the difference between yields of bonds of different types (the distance between the lines). The big spike in Baa bond yields in the early 1930s, the darkest days of the Great Depression, was due to one simple cause: companies with Baa bond ratings were going belly-up left and right, leaving bondholders hanging. As [Figure 5.27](#) shows, companies that issued Aaa bonds, municipalities, and possibly even the federal government were also more likely to default in that desperate period, but they were not nearly as likely to as weaker companies. Yields on their bonds therefore increased, but only a little, so the spread between Baa corporates and other bonds increased considerably in those troubled

years. In better times, the spreads narrowed, only to widen again during the so-called Roosevelt Recession of 1937–1938.

Figure 5.27 The flight to quality (Treasuries) and from risk (corporate securities)



During crises, spreads can quickly soar because investors sell riskier assets, like Baa bonds, driving their prices down, and simultaneously buy safe ones, like Treasuries, driving their prices up. This so-called flight to quality is represented in [Figure 5.27](#).

The Term Structure of Interest Rates

As noted earlier, two of the major reasons for the variations among interest rates are the differences in the term to maturity and the differences in risk. To explain the former, we shall be based this section on a section in Handa (2009, Pg. 690-700). To discuss the term structure of interest rate, it is important that the riskiness of bonds be held constant across assets of different maturities. This is made possible by confining the comparison to government bonds of different maturities and studying their yield curve. The main theory for explaining the term structure of interest rates is the expectations hypothesis.

The short-run macroeconomic models have a single (bond) rate of interest. However, there is more than one bond interest rate and more than one type of bond in the economy. By definition, the economist's concept of the rate of interest (or yield) on any given asset is the rate of return, including expected capital gains and losses, on that asset over a given period of time. Therefore, there is a rate of interest for each distinct type of asset in the economy. An example of this is provided which has two interest rates, one on bonds and the other on credit.



Assets differ in various aspects or characteristics. Some of the more significant differences consist in their marketability, their risk and their term to maturity. The rates of return on assets are likely to differ, depending upon their characteristics. The macroeconomic mode of focusing on only one rate of interest is quite acceptable if all interest rates are related to each other in fixed proportions or fixed differences. Empirically, they do have a high positive correlation. The relationship between prices and rates of return on assets of differing maturities is brought out by the theories on the term structure of interest rates. These theories and the empirical work based on them are the focus of this section.

Some of the Concepts of the Rate of Interest

The short-term markets for bonds have spot, forward and long rates of interest. The meanings of these terms are as follows.

The (current) spot rate of interest

The (current) spot rate of interest r_t , or written simply as r_t , 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 .

The future spot rate of interest

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 r_{t+i} , so that the left-hand subscript will be implicit. Since r_{t+i} is a future spot rate, its expected value will be designated r_{t+i}^e . Its rational expectation in period t will, then, be written as $E_t r_{t+i}$, or as $E_t r_{t+i}^e$.

The future short rate of interest

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 $t+j$, $j \leq i$, which could be the current period. It will be designated r_{t+j}^i .

The forward short rate of interest

The forward short rate of interest r_{t+i}^f 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 . Note that the superscript f has been inserted to stand for “forward.” The forward rate differs from the future short rate r_{t+i} , where the one-period loan for the period $(t+i)$ is contracted at the beginning of period $t+i$. In incomplete financial markets, r_{t+i}^f may not exist but r_{t+i} would do so as long as there are spot markets. However, r_{t+i}^f , if it exists, will be known in the current period t , whereas r_{t+i} is not likely to be known in t , though expectations on its value can be formed in t .

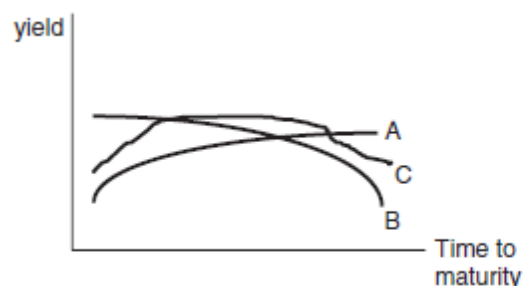
The long rate of interest

The long rate of interest R_{t+i} , $i=0,1, \dots, n$, 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.

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. This variation is shown graphically by plotting the nominal yield r on government bonds on the vertical axis and the time up to maturity on the horizontal axis, as in Figure 5.28. The curve thus plotted is known as the yield curve.

Figure 5.28





The yield curve normally slopes upward from left to right, with the yield rising with term to maturity, as shown by the curve A in Figure 5.8. It can, however, possess any shape. In times of monetary stringency, short-term interest rates can rise and move above the long-term rates, as shown by 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, as shown by curve C. In this case, some intermediate securities have the highest yield, usually because of the expectation that the highest rates of inflation will occur in the intermediate periods. 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. On the former, as explained in several earlier chapters, 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 now the nominal short yield, r^r is the real short yield and π^e 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.

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. However, 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.

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.



There are basically three main theories on the term structure of interest rates. These are:

The expectations hypothesis, first formulated by Irving Fisher. This theory is the relevant one for financially developed markets and is supported by most empirical studies.

The segmented markets theory, with Culbertson as its major proponent.

The preferred habitat hypothesis.

Expectations hypothesis

Irving Fisher in *The Theory of Interest* (1930, pp. 399–451) considered the rate of return or yields on securities that differ only in terms of their maturity. His approach assumes that:

All borrowers and lenders have perfect foresight and know future interest rates and asset prices with certainty, so that there is no risk. An alternative assumption to this is that, 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.

The 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. In such a market, any opportunities for superior profits are instantly eliminated. By comparison, a perfect market assumes perfect competition among traders and efficient markets. Fisher's assumptions specify an efficient market, which need not have perfect competition, so that it need not be a perfect one.

Investors are assumed to maximize their expected utility, subject to the relevant constraints. However, under assumption (i), this is synonymous with the maximization of the expected return to the portfolio. Under assumptions (i) and (ii), a lender wishing to make a loan for n periods will be indifferent between an n -period loan or a succession of n one-period loans only if the overall return were the same in both cases. Under assumption (iii), with all investors acting on this basis, the market yields will be such as to ensure this indifference.

Expectations hypothesis, complete markets and forward rates

Assume that the financial sector has complete markets, so that there exist markets for long loans of all possible maturities, as well as for spot and forward one-period loans. With the current period

as t, the yield (per period) on an (i+1)-period loan was designated as ${}_tR_{t+i}$, while that on a one period loan for the (i+1)th period was ${}_tr_{t+i}$, $i = 0, 1, \dots, n$, where n+1 is the longest maturity available in the market. Hence, ${}_tr_t$ is the (spot) yield on a loan for the first period; ${}_tr_{t+1}$ is the forward yield on a loan for the second period; and so on. An (i+1)-period loan of \$1 will pay the lender $(1 + {}_tR_{t+i})^{i+1}$ at the end of the (i+1)th period. The series of (i+1) loans starting with a principal of \$1 for one-period at a time will pay him $[(1+{}_tr_t) (1+{}_tr_{t+1}) \dots (1+{}_tr_{t+i})]$ at the end of the (i+1)th period.

Under the above three assumptions, the lender will be indifferent between the two types of loans if the total amount repaid to him after n + 1 periods is identical. With all investors exhibiting this behaviour, efficient markets under certainty ensure that:

$$(1 + {}_tR_{t+i})^{i+1} = (1 + {}_tr_t)(1 + {}_tr^f_{t+1})(1 + {}_tr^f_{t+2}) \dots (1 + {}_tr^f_{t+i}) \quad (1)$$

This formula will hold for every $i, i = 0, \dots, n$, where n + 1 is the longest maturity in the market, so that:

$$\begin{aligned} (1 + {}_tR_t) &= (1 + {}_tr_t) \\ (1 + {}_tR_{t+1})^2 &= (1 + {}_tr_t)(1 + {}_tr^f_{t+1}) \\ (1 + {}_tR_{t+2})^3 &= (1 + {}_tr_t)(1 + {}_tr^f_{t+1})(1 + {}_tr^f_{t+2}) \\ &\dots \\ (1 + {}_tR_{t+n})^{n+1} &= (1 + {}_tr_t)(1 + {}_tr^f_{t+1})(1 + {}_tr^f_{t+2}) \dots (1 + {}_tr^f_{t+n}) \end{aligned} \quad (2)$$

Under our assumption of complete markets, the forward rates are known, rather than merely expected, in period t. However, even well-developed financial markets do not have forward markets for all future periods, so that (2) cannot be applied for all maturities

Expectations hypothesis and expected future spot rates

Since there would always be spot markets over time, designate the spot rate expected in period t for the period t +i as ${}_t\text{ret}+i$, where the subscript t on the left side in the presence of the superscript e indicates that the expectations are formed in period t for the spot rate for period t +i. The investor would then have a choice of investing long for t +i periods, with a known long rate ${}_tR_{t+i}$, and investing over time in a sequence of spot markets at the spot rates in those markets. In practice, since these future spot rates can differ from the actual ones, there is a risk in following the latter strategy. The investor will be indifferent between the two strategies if he is risk indifferent and if



their expected return is identical. Hence, in terms of the expected future rates, the expectations hypothesis becomes:

$$(1 + {}_tR_{t+i})^{i+1} = (1 + {}_tr_t)(1 + {}_tr^e_{t+1})(1 + {}_tr^e_{t+2}) \dots (1 + {}_tr^e_{t+i}) \quad (3)$$

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.

Under the rational expectations hypothesis, r_e is replaced by $E_{t+1}r$, so that (3) becomes:

$$(1 + {}_tR_{t+i})^{i+1} = (1 + {}_tr_t)(1 + E_{t+1}r_{t+1})(1 + E_{t+1}r_{t+2}) \dots (1 + E_{t+1}r_{t+i}) \quad (3')$$

If a difference emerges in the markets between the left and the right sides of (1) and (3), profits can be made through arbitrage, which would take place to establish their equality. The rest of this chapter proceeds in terms of (3) or (3') rather than (1). While financial markets, even in developed economies, rarely have a large number of forward markets, they usually do have markets for government securities of many different maturities. 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):

$$\begin{aligned} E_{t+1}r_{t+1} &= (1 + {}_tR_{t+1})^2 / (1 + {}_tr_t) - 1 \\ E_{t+1}r_{t+2} &= (1 + {}_tR_{t+2})^3 / [(1 + {}_tr_t)(1 + E_{t+1}r_{t+2})] - 1 \end{aligned} \quad (4)$$

and so on.

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. Therefore, equation (3) can be used from right to left or from left to right.

Long rates as geometric averages of short rates

According to (3), the long rates are geometric averages of the short rates of interest. 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.

In principle, any pattern of expected future short rates is possible, with the result that some long rates may be less and some greater than the current spot rate, so that the yield curve may have any shape whatever.

The assumptions of the expectations hypothesis may not always hold for all agents in the market, which encompasses both households and firms. However, developed financial economies tend to be competitive and efficient. Therefore, the expectations hypothesis will hold if the credit markets have sufficient numbers of participants who behave according to the assumptions of perfect foresight (or of rational expectations and risk indifference) and zero variable transfer costs between securities and money. These assumptions tend to be valid at least for large financial institutions operating in the developed economies. Hence, the expectations hypothesis should be more or less valid for developed financial markets.

Liquidity preference version of the expectations hypothesis

Both the n -period loan and a series of n one-period loans involve risks, though of different kinds. The n one-period loans involve the possibility that the future spot rates will turn out to be lower than the expected forward rates or the n -period long rate. This is an income loss. But the n -period loan – that is, purchase of a bond maturing after n periods – involves the possibility that the lender may need his funds somewhat sooner and have to sell the bond before it matures. Such a sale may involve a capital loss, especially in the absence of a secondary market for loans. There is also the possibility that more profitable opportunities may turn up and have to be foregone if the funds are already loaned up for a long period.

It is likely that the possibility of a capital loss influences lenders' decisions more than that of the interest loss since the capital loss can usually take on much greater magnitude than the interest loss. Further, if the funds represent precautionary saving, the individual would prefer a more liquid (shorter maturity) to a less liquid (longer maturity) asset. Hicks (1946, pp. 151–82) suggested that lenders wish to avoid the risk of a capital loss by investing for shorter rather than longer periods.

Therefore, 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 behaviour 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:

$$(1 + {}_tR_{t+n})^{n+1} > (1 + {}_tr_t)(1 + {}_tr^e_{t+1}) \dots (1 + {}_tr^e_{t+n}) \quad n \geq 1 \quad (5)$$

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 ${}_t\gamma_{t+n}$, we have:

$$(1 + {}_tR_{t+n})^{n+1} = (1 + {}_tr_t)(1 + {}_tr^e_{t+1}) \dots (1 + {}_tr^e_{t+n}) {}_t\gamma_{t+n}(n; \rho) \quad n \geq 1 \quad (6)$$

where $\partial \gamma_n / \partial n \geq 0$ by virtue of the liquidity premium, and:

γ = liquidity premium

ρ = degree of risk aversion

n = periods to maturity.

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 and, as seen later in this chapter, is made in many empirical studies. It reduces (6) to:

$$(1 + {}_tR_{t+n})^{n+1} = (1 + {}_tr_t)(1 + {}_tr^e_{t+1}) \dots (1 + {}_tr^e_{t+n}) n\gamma \quad n \geq 1 \quad (7)$$

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, moreover, 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.

Estimation of this form requires specification of the determinants of the liquidity premium. Compared with these weak and strong forms of the expectations hypotheses, the original form (3) of this hypothesis without a liquidity premium is known as the pure form of the expectations hypothesis.

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. Hence, there would not be any particular relationship such as (3) or (6) between the long and the short rates, and the yield curve could have any shape whatever. This is the basic element of the segmented markets theory: the market is segmented into a set of independent markets.

Culbertson (1957) stressed this possibility as a major, though not the only, determinant of the term structure of interest rates. Culbertson also argued that the lender rarely knows in advance exactly when he will need his funds again and will prefer to make loans for shorter terms rather than longer ones, the former being the more liquid of the two. If the supply of short-term debt instruments is not sufficient to meet this demand for liquidity at a rate of interest equal to the long-term rate, the short-term rate will be less than the long-term rate. Further, the supply of short-term instruments is generally limited since lenders will not finance long-term investment with short-term borrowing. Therefore, the short-term yield will be less than the long-term yield, *ceteris paribus*.

The segmented markets hypothesis is more likely to be applicable in the absence of developed financial markets, including secondary markets for securities, and sophisticated investors. It may therefore be somewhat more valid for financially underdeveloped markets than for developed ones.

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.

This would be especially so for bonds at the longer end of the maturity spectrum. Therefore, in well-developed financial markets, a high degree of substitutability would exist among different maturities, but without these necessarily becoming perfect substitutes. Hence, 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.

Implications of the term structure hypotheses for monetary policy

The expectations theory and the segmented markets theory have significantly different implications for the management of the public debt and for the operation of monetary policy. The expectations theory implies that the market substitution between bonds of different maturities is so great that a shift from short-term to long-term borrowing by the government will not affect the shape of the yield curve. The segmented markets theory implies that a substantial purchase (sale) of short-term bonds will lower (raise) the short-term interest rates while a sale (purchase) of long-term bonds will raise (lower) the long-term rates, so that such policies can alter the yield curve. The implications of the preferred habitat hypothesis lie between those of the expectations hypothesis and the segmented markets hypothesis, and are closer to one or the other depending upon the stage of development of the financial markets and the characteristics of the economic agents operating in them.

The empirical evidence for economies with well-developed financial markets has so far generally favoured the expectations theory or a version of the preferred habitat hypothesis close to the expectations hypothesis over the segmented markets hypothesis. Intuitively, the credit markets for such economies are not seriously segmented since borrowers and lenders do generally substitute extensively between assets of different maturities. A number of studies for the USA and Canada have substantiated the expectations theory at the general level, though there also exist many empirical studies that reject its more specific formulations.

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 ,

$$r_{jt} = ({}_tP^e_{jt+1} - p_{jt}) + x_{jt} \quad (8)$$

where:

- r_{jt} = expected yield on the j th asset during period t
- p_{jt} = j th asset's price in period t
- ${}_tP^e_{jt+1}$ = j th asset's (expected) price in period $t + 1$, with expectations held in t
- x_{jt} = j th asset's coupon rate in period t .

That is,

$${}_tP^e_{jt+1} = p_{jt} + r_{jt} - x_{jt} \quad (9)$$

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.

1.5.8 Simple Vector Autoregressive (VAR) Models for Analyzing Monetary Policy

Three decades ago, Christopher Sims (1980) provided a new macroeconometric framework that held great promise: vector autoregressions (VARs). A univariate autoregression is a single-equation, single-variable linear model in which the current value of a variable is explained by its own lagged values. A VAR is an n -equation, n -variable linear model in which each variable is in turn explained by its own lagged values, plus current and past values of the remaining $n - 1$ variables. This simple framework provides a systematic way to capture rich dynamics in multiple time series, and the statistical toolkit that came with VARs was easy to use and to interpret. As Sims (1980) and others argued in a series of influential early papers, VARs held out the promise of providing a coherent and credible approach to data description, forecasting, structural inference and policy analysis.

A VAR model has the advantage of response of a variable over time to a disturbance in that variable and other variables in the system. Moreover, it uses only the observed time series



properties of the data to forecast economic variables, with low forecasting errors. There has been a growing number of studies done on the monetary transmission mechanism using the VAR approach to focus on the relationships between monetary policy and variables such as real output, inflation rate, interest rate, credit growth, exchange rate, money and price indices.

Basic VAR as Tool for Monetary Policy Analysis

What, precisely, is the effect of a 100-basis-point hike in the federal funds 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 40 years is due to monetary policy as opposed to external shocks? Many macroeconomists like to think they know the answers to these and similar questions, perhaps with a modest range of uncertainty. In the next two sections, we take a quantitative look at these and related questions using several three-variable VARs estimated using quarterly U.S. data on the rate of price inflation (iit), the unemployment rate (ut) and the interest rate (Re, specifically, the federal funds rate) from 1960:I-2000:IV.2 First, we construct and examine these models as a way to display the VAR toolkit; criticisms are reserved for the next section.

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. Thus, in our example, the VAR involves three equations: current unemployment as a function of past values of unemployment, inflation and the interest rate; inflation as a function of past values of inflation, unemployment and the interest rate; and similarly for the interest rate equation. Each equation can be estimated by ordinary least squares regression. The number of lagged values to include in each equation can be determined by a number of different methods, and we will use four lags in our examples. The error terms in these regressions are the "surprise" movements in the variables after taking its past values into account. If the different variables are correlated with each other—as they typically are in macroeconomic applications—then the error terms in the reduced form model will also be correlated across equations.

A recursive VAR constructs the error terms in each regression equation to be uncorrelated with the error in the preceding equations. This is done by judiciously including some contemporaneous values as regressors. Consider a three-variable VAR, ordered as 1) inflation, 2) the unemployment rate, and 3) the interest rate. In the first equation of the corresponding recursive VAR, inflation is the dependent variable, and the regressors are lagged values of all three variables. In the second equation, the unemployment rate is the dependent variable, and the regressors are lags of all three variables plus the current value of the inflation rate. The interest rate is the dependent variable in

the third equation, and the regressors are lags of all three variables, the current value of the inflation rate plus the current value of the unemployment rate. Estimation of each equation by ordinary least squares produces residuals that are uncorrelated across equations. Evidently, the results depend on the order of the variables: changing the order changes the VAR equations, coefficients, and residuals, and there are $n!$ recursive VARs representing all possible orderings.

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. The number of structural VARs is limited only by the inventiveness of the researcher.

Basic VAR Model

The empirical analysis of the impact of monetary policy on macroeconomic variables is conducted by using vector autoregressive models. This is a tool that is widely used for this purpose. In its basic form, a vector autoregressive model of order k is described by

$$x_t = \mu_t + \sum_{i=1}^k A_i x_{t-i} + u_t, \tag{1}$$

where $x_t = (x_{1t}, x_{2t}, \dots, x_{pt})'$ 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 k 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. Forecast error impulse responses \hat{A}_h are calculated from the moving average representation of the VAR:

$$x_t = \sum_{i=0}^{\infty} \Phi_i u_{t-i}. \tag{2}$$

The underlying assumption that innovations in the different equations are uncorrelated (that is (that Σ_u 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:

$$A_0 x_t = \sum_{i=1}^k A_i^* x_{t-i} + A_0 u_t, \tag{3}$$

where $A_i^* = A_0 A_i, i = 1, \dots, k$. A usual way of identifying the instantaneous relationships is to assume a recursive causal structure. That is, the first variable x_{1t} 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.

Empirical Example

In our three-variable example, we consider two related structural VARs. Each incorporates a different assumption that identifies the causal influence of monetary policy on unemployment, inflation and interest rates. The first relies on a version of the "Taylor rule," in which the Federal Reserve is modelled as setting the interest rate based on past rates of inflation and unemployment. In this system, the CB sets the discount or Fed rate R according to the rule

$$R_t = r^* + 1.5(\bar{\pi}_t - \pi^*) - 1.25(\bar{u}_t - u^*) + \text{lagged values of } R, \pi, u + \varepsilon_t,$$

where r^* is the desired real rate of interest, π and u are the average values of inflation and unemployment rate over the past four quarters, s^* and u^* are the target values of inflation and unemployment, and ε_t is the error in the equation. This relationship becomes the interest rate equation in the structural VAR.

The equation error, ε_t , can be thought of as a monetary policy "shock," since it represents the extent to which actual interest rates deviate from this Taylor rule. This shock can be estimated by a regression with $R_t - 1.5 \bar{\pi}_t + 1.25 \bar{u}_t$ as the dependent variable, and a constant and lags of interest rates, unemployment and inflation on the right-hand side. The Taylor rule is "backward looking" in the sense that the Fed reacts to past information (π and u are averages of the past four quarters of inflation and unemployment), and several researchers have argued that Fed behaviour

is more appropriately described by forward-looking behaviour. Because of this, we consider another variant of the model in which the Fed reacts to forecasts of inflation and unemployment four quarters in the future. This Taylor rule has the same form as the rule above, but with π and u replaced by four-quarter ahead forecasts computed from the reduced form VAR.

Putting the Three-Variable VAR Through Its Paces The different versions of the inflation-unemployment-interest rate VAR are put through their paces by applying them to the four macroeconomic tasks. First, the reduced form VAR and a recursive VAR are used to summarize the co-movements of these three series. Second, the reduced form VAR is used to forecast the variables, and its performance is assessed against some alternative benchmark models. Third, the two different structural VARs are used to estimate the effect of a policy-induced surprise move in the federal funds interest rate on future rates of inflation and unemployment. Finally, we discuss how the structural VAR could be used for policy analysis.

Data Description Standard practice in VAR analysis is to report results from Granger-causality tests, impulse responses and forecast error variance decompositions. These statistics are computed automatically (or nearly so) by many econometrics packages (RATS, Eviews, TSP and others). Because of the complicated dynamics in the VAR, these statistics are more informative than are the estimated VAR regression coefficients or R2 statistics, which typically go unreported. Granger-causality statistics examine whether lagged values of one variable help to predict another variable. For example, if the unemployment rate does not help predict inflation, then the coefficients on the lags of unemployment will all be zero in the reduced-form inflation equation. Panel A of Table 1 summarizes the Granger-causality results for the three-variable VAR. It shows the p-values associated with the statistics for testing whether the relevant sets of coefficients are zero. The unemployment rate helps to predict inflation at the 5 percent significance level (the p-value is 0.02, or 2 percent), but the federal funds interest rate does not (the p-value is 0.27). Inflation does not help to predict the unemployment rate, but the federal funds rate does. Both inflation and the unemployment rates help predict the federal funds interest rate.

VAR Descriptive Statistics for (π , u , R)

<i>A. Granger-Causality Tests</i>					
<i>Dependent Variable in Regression</i>					
<i>Regressor</i>	π	u	R		
π	0.00	0.31	0.00		
u	0.02	0.00	0.00		
R	0.27	0.01	0.00		

<i>B. Variance Decompositions from the Recursive VAR Ordered as π, u, R</i>					
<i>B.i. Variance Decomposition of π</i>					
<i>Forecast Horizon</i>	<i>Forecast Standard Error</i>	<i>Variance Decomposition (Percentage Points)</i>			
		π	u	R	
1	0.96	100	0	0	
4	1.34	88	10	2	
8	1.75	82	17	1	
12	1.97	82	16	2	

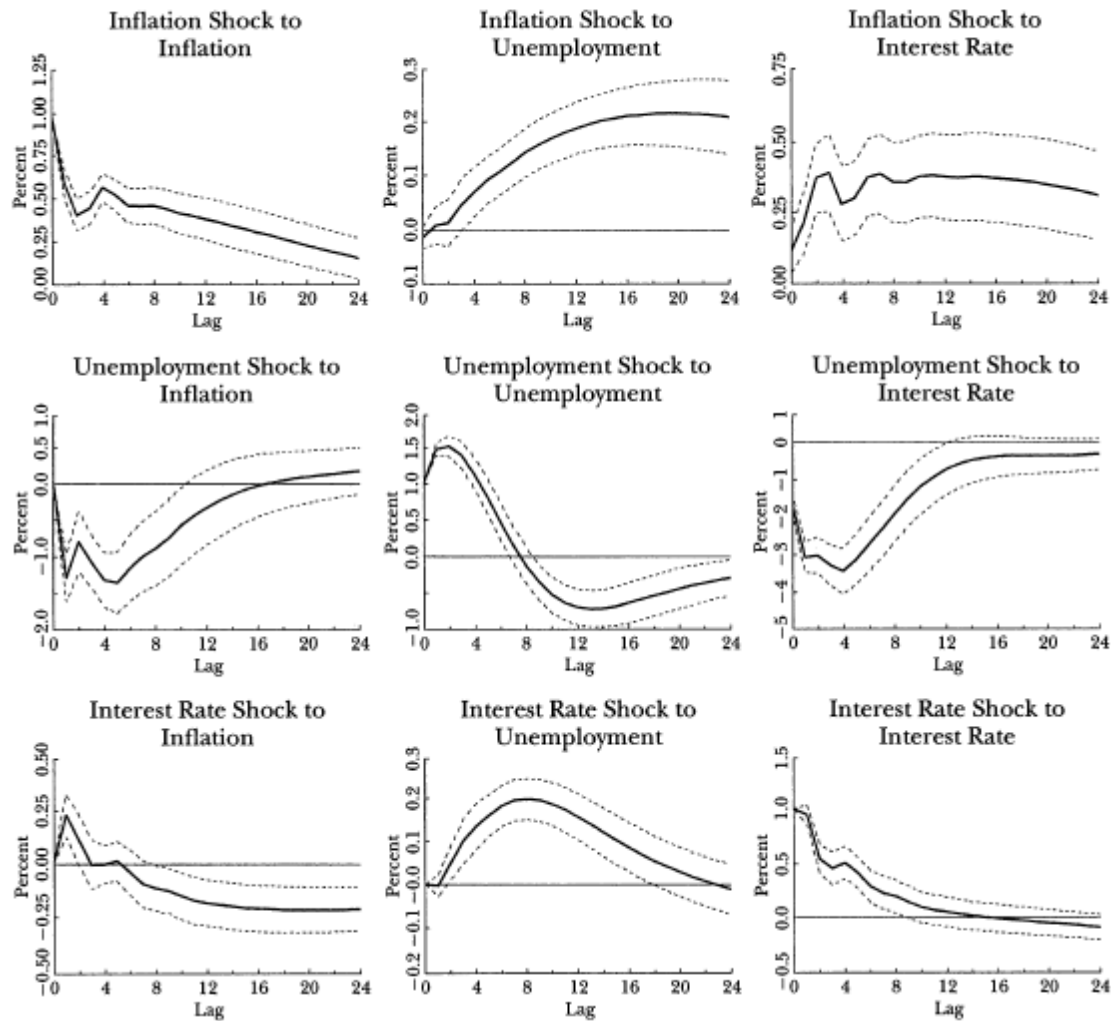


NB: Notes: π denotes the rate of price inflation, u denotes the unemployment rate and R denotes the Federal Funds interest rate. The entries in Panel A show the p -values for F-tests that lags of the variable in the row labelled Regressor do not enter the reduced form equation for the column variable labelled Dependent Variable. The results were computed from a VAR with four lags and a constant term over the 1960:I-2000:IV sample period.

Impulse responses trace out the response of current and future values of each of the variables to a one-unit increase in the current value of one of the VAR errors, assuming that this error returns to zero in subsequent periods and that all other errors are equal to zero. The implied thought experiment of changing one error while holding the others constant makes most sense when the errors are uncorrelated across equations, so impulse responses are typically calculated for recursive and structural VARs. The impulse responses for the recursive VAR, ordered π , u , R , are plotted in Figure 1. The first row shows the effect of an unexpected 1 percentage point increase in inflation on all three variables, as it works through the recursive VAR system with the coefficients estimated from actual data.

The second row shows the effect of an unexpected increase of 1 percentage point in the unemployment rate, and the third row shows the corresponding effect for the interest rate. Also plotted are ± 1 standard error bands, which yield an approximate 66 percent confidence interval for each of the impulse responses. These estimated impulse responses show patterns of persistent common variation. For example, an unexpected rise in inflation slowly fades away over 24 quarters and is associated with a persistent increase in unemployment and interest rates. The forecast error decomposition is the percentage of the variance of the error made in forecasting a variable (say, inflation) due to a specific shock (say, the error term in the unemployment equation) at a given horizon (like two years). Thus, the forecast error decomposition is like a partial R^2 for the forecast error, by forecast horizon. These are shown in Panel B of Table 1 for the recursive VAR. They suggest considerable interaction among the variables. For example, at the 12-quarter horizon, 75 percent of the error in the forecast of the federal funds interest rate is attributed to the inflation and unemployment shocks in the recursive VAR.

Impulse Responses in the Inflation-Unemployment-Interest Rate Recursive VAR



1.5.9 Empirical Studies on Central Banking and Monetary Policy with Emphasis on Africa.

The following empirical papers will be discussed in groups in class:

Aguir A. (2018) Central Bank Credibility, Independence, and Monetary Policy *Journal of Central Banking Theory and Practice*, 2018, 3, pp. 91-110

[Agoba, et al., \(2017\)](#), “Central bank independence and inflation in Africa: The role of financial systems and institutional quality”, [Central Bank Review](#), Pp 131-146



[Ftiti et al., \(2017\)](#), “Time-inconsistency and expansionary business cycle theories: What does matter for the central bank independence–inflation relationship?” [Economic Modelling](#), Vol. 67, Pp 215-227

Cremer, K, and Botha T. (2017), “Assessing nominal GDP targeting in the South African context” [Central Bank Review](#), Vol 17, Pp 1-10

And more

Review and Discussion Questions

Why has the use of changes in reserve requirements as a tool of monetary policy been largely abandoned in Western economies? What were the reasons for the virtual elimination of reserve requirements? Is there a case for their revival and usage as a tool of monetary policy in the context of the country you live in? In LDCs?

How do central banks manage interest rates in your country and one other country of your choice? What consequences for output fluctuations can the central bank expect from targeting interest rates?

The monetary sector has become increasingly unstable in recent years. Does this mean that the monetary authority should stay with the pursuit of interest-rate targets and leave the money supply alone?

Can central banks pursue and achieve multiple goals or must they be confined solely to fighting inflation? What goals are embedded in the Taylor rule? Discuss.

What is the lender-of-last-resort function of the central bank in modern economies? What is its justification? Should commercial bank borrowing from the central bank be a privilege or a right? Discuss.

Explain how the monetary and real factors enter into the determination of the interest rates in the short run and in the long run.

Compare and contrast the liquidity preference and loanable funds theories of the rate of interest. Discuss their implications for monetary policies intended to maintain full employment.



Keynes asserted that there is no such thing as a non-monetary theory of the rate of interest and that the rate of interest is uniquely determined by the demand and supply of money.

Explain Keynes's reasons for this view. Compare this view with those of the traditional classical and modern classical schools.

The yield curve shows the relationship between the yields of high-grade securities that differ only in the term to maturity. Sometimes the curve rises, sometimes it falls and sometimes it is flat. Present the main reasons for these different shapes.

“On the basis of recent empirical studies, the expectations hypothesis with efficient markets and rational expectations does not seem to explain the term structure of interest rates.” Discuss. Present the findings of at least one such study and discuss the potential reasons for this failure.

Can the central bank change the shape of the yield curve through changes in (a) the term structure of government bonds and (b) variations over time in monetary aggregates?

Discuss.

For your country, what is the current shape of the yield curve? Explain this shape.

Assuming that the expectations theory of the yield curve is correct, derive from your data on the yield curve the expected future spot rates for the next twelve months.

If your economy has forward markets for this period, compare the forward short rates with your derived expected future spot rates, and explain the reasons for any differences.



1.6 MONEY IN THE OPEN ECONOMY

Introduction

In this section, I shall focus on the role money plays in determining a country's Balance of Payments and exchange rate. You will soon know that the impact of monetary policy in an open economy depends on the nature of the exchange rate system in operation. This is because in this section, we shall consider the impact of changes in the money stock on nominal income in a fixed exchange rate system and showed that, with fixed exchange rates and mobile capital, monetary policy has only a temporary impact on the level of income and, in the longer run, is completely ineffective. On the other hand, with freely floating exchange rates and mobile capital, monetary policy is more effective than in the closed economy case.

Before we discuss the issues relating to monetary policy in the open economy, I shall walk you through the factors that determine the exchange rate in both the short-run and long run. As you know, the exchange rate plays a vital role in a country's level of foreign trade, which is critical to most free market economies in the world. Mostly, an exchange rate is used as one of the most important determinants of a country's relative level of economic health. Due to its significance in international trade, many researchers have tried to develop models which build relationships between forces that determine the magnitude and movement of the exchange rates. The following are the specific learning objectives for this section:

Learning Objectives

Students should be able to do the following at the end of the class:

Explain and illustrate the factors that affect the exchange rate determination in the short run and long run.

Explain monetary and portfolio approaches to Balance of Payments (BOPs) and exchange rate determination as well as BOPs Determination Approaches

Describe the link between Money and BOP Adjustments

Explain and illustrate the effect of monetary policy under alternative exchange rate regimes

Compare and contrast the arguments for and against monetary policy coordination amongst countries

1.6.1 Short Run and Long Run Determination of Exchange Rate; Portfolio Asset Approach; Balance of Payments (BOP) Determination Approaches

Exchange Rate Determination

The price of one currency in terms of another is called the exchange rate. As you may know, exchange rates in all countries exhibit so much volatility. The exchange rate affects the economy and our daily lives, because when the U.S. dollar, for example, becomes more valuable relative to foreign currencies, foreign goods become cheaper for Americans, and American goods become more expensive for foreigners. When the U.S. dollar falls in value, foreign goods become more expensive for Americans, and American goods become cheaper for foreigners.



Fluctuations in the exchange rate also affect both inflation and output, and are an important concern to monetary policymakers. When the U.S. dollar falls in value, the higher prices of imported goods feed directly into a higher price level and inflation. At the same time, a declining U.S. dollar, which makes domestic goods cheaper for foreigners, increases the demand for domestic goods and leads to higher production and output.

Exchange Rates in the Long Run

Like the price of any good or asset in a free market, exchange rates are determined by the interaction of supply and demand. To simplify our analysis of exchange rates in a free market, we divide it into two parts. First, we examine how exchange rates are determined in the long run; then we use our knowledge of the long-run determinants of exchange rates to help us understand how they are determined in the short run.

Law of One Price

The starting point for understanding how exchange rates are determined is a simple idea called the law of one price: If two countries produce an identical good, and transportation costs and trade barriers are very low, the price of the good should be the same throughout the world, no matter which country produces it. Suppose that American steel costs \$100 per ton and identical Japanese steel costs 10,000 yen per ton. For the law of one price to hold, the exchange rate between the yen and the dollar must be 100 yen per dollar (\$0.01 per yen), so that one ton of American steel sells for 10,000 yen in Japan (the price of Japanese steel) and one ton of Japanese steel sells for \$100 in the United States (the price of U.S. steel). If the exchange rate were 200 yen to the dollar, Japanese steel would sell for \$50 per ton in the United States, or half the price of American steel, and American steel would sell for 20,000 yen per ton in Japan, twice the price of Japanese steel. Because American steel would be more expensive than Japanese steel in both countries and because American steel is identical to Japanese steel, the demand for American steel would go to zero. Given a fixed dollar price for American steel, the resulting excess supply of American steel would be eliminated only if the exchange rate fell to 100 yen per dollar, making the prices of American steel and Japanese steel the same in both countries.

Theory of Purchasing Power Parity

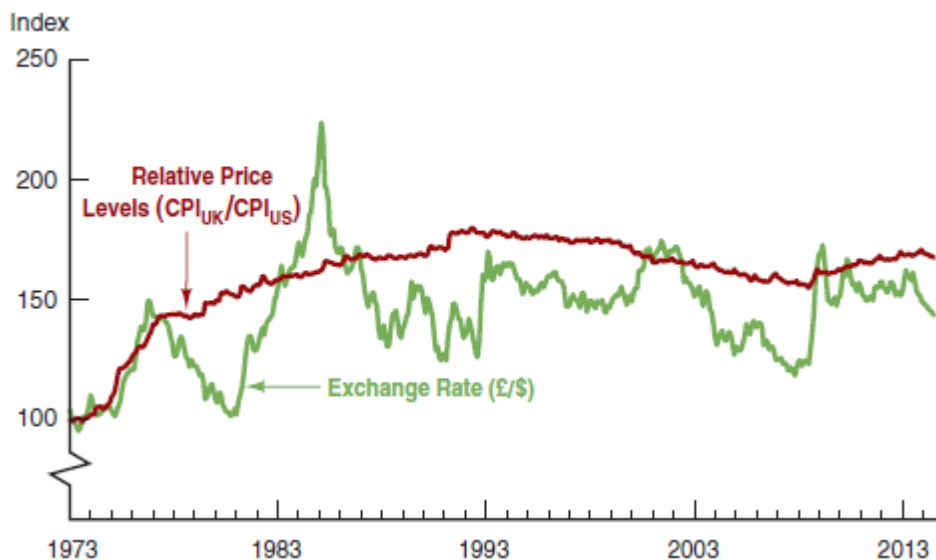
One of the most prominent theories of how exchange rates are determined is the theory of purchasing power parity (PPP). It states that exchange rates between any two currencies will adjust to reflect changes in the price levels of the two countries. The theory of PPP is simply an application of the law of one price to national price levels rather than to individual prices. Suppose that the yen price of Japanese steel rises 10% (to 11,000 yen) relative to the dollar price of American steel (unchanged at \$100). For the law of one price to hold, the exchange rate must rise to 110 yen to the dollar, a 10% appreciation of the dollar. By applying the law of one price to the price levels in the two countries, we get the theory of purchasing power parity, which maintains that if the Japanese price level rises 10% relative to the U.S. price level, the dollar will appreciate by 10%.

Another way of thinking about purchasing power parity is through a concept called the real exchange rate, the rate at which domestic goods can be exchanged for foreign goods. In effect, the

real exchange rate is the price of domestic goods relative to the price of foreign goods denominated in the domestic currency. For example, if a basket of goods in New York costs \$50 while the same basket of goods in Tokyo costs \$75 (because the basket of goods costs 7500 yen and the exchange rate is 100 yen per dollar), then the real exchange rate is 0.66 ($= \$50 / \75). In our example, the real exchange rate is below 1.0, indicating that it is cheaper to buy the basket of goods in the United States than in Japan. The real exchange rate for the U.S. dollar is currently low against many other currencies, and this is why New York is overwhelmed by so many foreign tourists going on shopping sprees. The real exchange rate indicates whether a currency is relatively cheap or not.

The theory of PPP can also be described in terms of the real exchange rate. PPP predicts that the real exchange rate is always equal to 1.0, so that the purchasing power of the dollar is the same as that of other currencies, such as the yen or the euro. As our U.S./Japanese example demonstrates, the theory of PPP suggests that if one country's price level rises relative to another's, its currency should depreciate (and the other country's currency should appreciate). As you can see in Figure 6.1, this prediction is borne out in the long run. From 1973 to 2014, the British price level rose 68% relative to the U.S. price level, and as the theory of PPP predicts, the dollar appreciated against the pound—although by 43%, an amount smaller than the 68% increase Purchasing Power Parity, United States/United Kingdom, 1973–2014 (Index: March 1973 = 100.) Over the whole period shown, the rise in the British price level relative to the U.S. price level is associated with a rise in the value of the dollar, as predicted by PPP. However, the PPP relationship does not hold over shorter periods.

Figure 6.1: Purchasing Power Parity, United States/United Kingdom, 1973–2014



Source: Mishkin (2014)

Yet, as the same figure indicates, PPP theory often has poor predictive power in the short run. From early 1985 to the end of 1987, for example, the British price level rose relative to that of the United States. Instead of appreciating, as predicted by PPP theory, the U.S. dollar actually



depreciated by 40% against the pound. So even though PPP theory provides some guidance as to the long-run movement of exchange rates, it is not perfect and in the short run is a particularly poor predictor. What explains the PPP theory's failure to predict well in the short run?

Criticisms of the Theory of Purchasing Power Parity

The PPP conclusion that exchange rates are determined solely by changes in relative price levels rests on the assumptions that all goods are identical in both countries and that transportation costs and trade barriers are very low. When these assumptions are true, the law of one price states that the relative prices of all these goods (that is, the relative price level between the two countries) will determine the exchange rate. The assumption that goods are identical may not be unreasonable for American and Japanese steel, but is it a reasonable assumption for American and Japanese cars? Is a Toyota the equivalent of a Chevrolet?

Because Toyotas and Chevys are obviously not identical, their prices do not have to be equal. Toyotas can be more expensive relative to Chevys, and both Americans and Japanese will still purchase Toyotas.

Furthermore, PPP theory does not take into account that many goods and services (whose prices are included in a measure of a country's price level) are not traded across borders. Housing, land, and services such as restaurant meals, haircuts, and golf lessons are not traded goods. So even though the prices of these items might rise, leading to a higher price level relative to another country's, the exchange rate would experience little direct effect.

Factors That Affect Exchange Rates in the Long Run

In the long run, four major factors affect the exchange rate: relative price levels, trade barriers, preferences for domestic versus foreign goods, and productivity. We examine how each of these factors affects the exchange rate while holding the other factors constant. The basic reasoning proceeds along the following lines: Anything that increases the demand for domestically produced goods that are traded relative to foreign traded goods tends to appreciate the domestic currency, because domestic goods will continue to sell well even when the value of the domestic currency is higher. Similarly, anything that increases the demand for foreign goods relative to domestic goods tends to depreciate the domestic currency, because domestic goods will continue to sell well only if the value of the domestic currency is lower. In other words, if a factor increases the demand for domestic goods relative to foreign goods, the domestic currency will appreciate; if a factor decreases the relative demand for domestic goods, the domestic currency will depreciate.

Relative Price Levels In line with PPP theory, when prices of American goods rise (holding prices of foreign goods constant), the demand for American goods falls, and the dollar tends to depreciate so that American goods can still sell well. By contrast, if prices of Japanese goods rise, causing the relative prices of American goods to fall, the demand for American goods increases, and the dollar tends to appreciate because American goods will continue to sell well even with a higher value of the domestic currency. In the long run, a rise in a country's price level (relative to the foreign price level) causes its currency to depreciate, and a fall in the country's relative price level causes its currency to appreciate.



Trade Barriers: Barriers to free trade such as tariffs (taxes on imported goods) and quotas (restrictions on the quantity of foreign goods that can be imported) can affect the exchange rate. Suppose the United States increases its tariff or puts a lower quota on Japanese steel. These increases in trade barriers increase the demand for American steel, and the dollar tends to appreciate because American steel will still sell well even with a higher value of the dollar. Increasing trade barriers causes a country's currency to appreciate in the long run.

Preferences for Domestic Versus Foreign Goods: If the Japanese develop an appetite for American goods—say, for Florida oranges and American movies—the increased demand for American goods (exports) tends to appreciate the dollar, because the American goods will continue to sell well even at a higher value of the dollar. Likewise, if Americans decide that they prefer Japanese cars to American cars, the increased demand for Japanese goods (imports) tends to depreciate the dollar. Increased demand for a country's exports causes its currency to appreciate in the long run; conversely, increased demand for imports causes the domestic currency to depreciate.

Productivity: When productivity in a country rises, it tends to rise in domestic sectors that produce traded goods rather than nontraded goods. Higher productivity, therefore, is associated with a decline in the price of domestically produced traded goods relative to foreign traded goods. As a result, the demand for domestic traded goods rises, and the domestic currency tends to appreciate. If, however, a country's productivity lags behind that of other countries, its traded goods become relatively more expensive, and the currency tends to depreciate. In the long run, as a country becomes more productive relative to other countries, its currency appreciates.

Exchange Rate Determination in the Short Run:

A Supply and Demand Analysis:

We have developed a theory of the long-run behavior of exchange rates. However, because factors driving long-run changes in exchange rates move slowly over time, if we are to understand why exchange rates exhibit such large changes (sometimes several percentage points) from day to day, we must develop a supply and demand analysis that explains how current exchange rates (spot exchange rates) are determined in the short run.

The key to understanding the short-run behavior of exchange rates is to recognize that an exchange rate is the price of domestic assets (bank deposits, bonds, equities, and so on, denominated in the domestic currency) in terms of foreign assets (similar assets denominated in the foreign currency). Because the exchange rate is the price of one asset in terms of another, the natural way to investigate the short-run determination of exchange rates is with a supply and demand analysis that uses an asset market approach, which relies heavily on the theory of portfolio choice discussed in Section 5. As you will see, however, the long-run determinants of the exchange rate we have just outlined also play an important part in the short-run asset market approach.

In the past, supply and demand approaches to exchange rate determination emphasized the role of import and export demand. The more modern asset market approach used here emphasizes stocks of assets rather than the flows of exports and imports over short periods, because export and import

transactions are small relative to the amounts of domestic and foreign assets held at any given time. For example, the total value of foreign exchange transactions in the United States each year is well over 25 times greater than the amount of U.S. exports and imports. Thus, over short periods, decisions to hold domestic or foreign assets have a much greater role in exchange rate determination than the demand for exports and imports does.

Supply Curve for Domestic Assets:

We start by discussing the supply curve. In this analysis we treat the United States as the home country, so domestic assets are denominated in dollars. For simplicity, we use euros to stand for any foreign country's currency, so foreign assets are denominated in euros. The quantity of dollar assets supplied is primarily the quantity of bank deposits, bonds, and equities in the United States, and for all practical purposes we can take this amount as fixed with respect to the exchange rate. The quantity supplied at any exchange rate is the same, so the supply curve, S , is vertical, as shown in Figure 6.2.

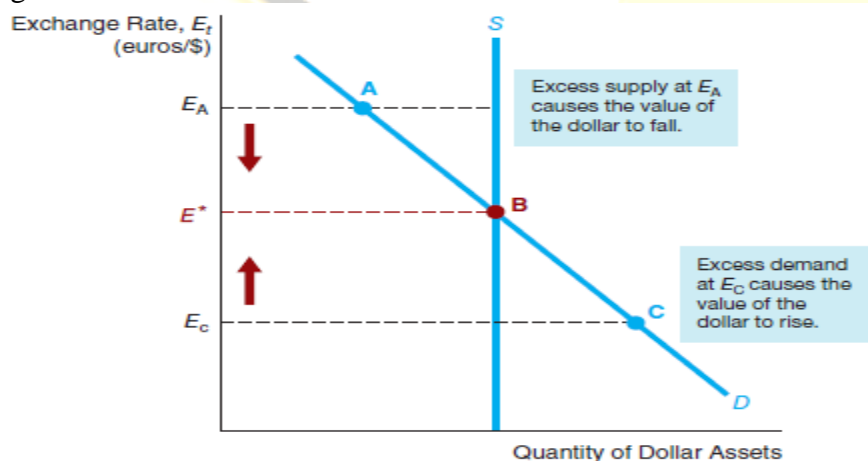
Demand Curve for Domestic Assets:

The demand curve traces out the quantity demanded at each current exchange rate by holding everything else constant, particularly the expected future value of the exchange rate. We write the current exchange rate (the spot exchange rate) as E_t , and the expected exchange rate for the next period as E_{t+1}^e . As suggested by the theory of portfolio choice, the most important determinant of the quantity of domestic (dollar) assets demanded is the relative expected return on domestic assets.

Let us see what happens as the current exchange rate E_t falls.

Suppose we start at point A in Figure 6.2, where the current exchange rate is at E_A . With the future expected value of the exchange rate held constant at E_{t+1}^e , a lower value of the exchange rate—say, at E^* —implies that the dollar is more likely to rise in value, that is, appreciate. The greater the expected rise (appreciation) of the dollar, the higher is the relative expected return on dollar (domestic) assets.

Figure 6.2



According to the theory of portfolio choice, because dollar assets are now more desirable to hold, the quantity of dollar assets demanded will rise, as shown by point B in Figure 6.2. If the current



exchange rate falls even further to EC, there will be an even higher expected appreciation of the dollar, a higher expected return, and therefore an even greater quantity of dollar assets demanded. This effect is shown at point C at Figure 3. The resulting demand curve D, which connects these points, is downward-sloping, indicating that at lower current values of the dollar (everything else being equal), the quantity demanded of dollar assets is higher.

Equilibrium in the Foreign Exchange Market:

As in the usual supply and demand analysis, the market is in equilibrium when the quantity of dollar assets demanded equals the quantity supplied. In Figure 6.2, equilibrium occurs at point B, the intersection of the demand and supply curves. At point B, the exchange rate is E^* . Suppose the exchange rate is at EA, which is higher than the equilibrium exchange rate of E^* . As we can see in Figure 6.2, the quantity of dollar assets supplied is now greater than the quantity demanded, a condition of excess supply. Given that more people want to sell dollar assets than want to buy them, the value of the dollar will fall. As long as the exchange rate remains above the equilibrium exchange rate, an excess supply of dollar assets will continue to be available, and the dollar will fall in value until it reaches the equilibrium exchange rate of E^* .

Similarly, if the exchange rate is less than the equilibrium exchange rate at EC, the quantity of dollar assets demanded will exceed the quantity supplied, a condition of excess demand. Given that more people want to buy dollar assets than want to sell them, the value of the dollar will rise until the excess demand disappears and the value of the dollar is again at the equilibrium exchange rate of E^* .

Explaining Changes in Exchange Rates:

The supply and demand analysis of the foreign exchange market illustrates how and why exchange rates change. We have simplified this analysis by assuming that the amount of dollar assets is fixed: The supply curve is vertical at a given quantity and does not shift. Under this assumption, we need to look at only those factors that shift the demand curve for dollar assets to explain how exchange rates change over time.

Shifts in the Demand for Domestic Assets:

As we have seen, the quantity of domestic (dollar) assets demanded depends on the relative expected return on dollar assets. To see how the demand curve shifts, we need to determine how the quantity demanded changes, holding the current exchange rate, E_t , constant, when other factors change. For insight into the direction in which the demand curve will shift, suppose you are an investor who is considering putting funds into domestic (dollar) assets. When a factor changes, you must decide whether, at a given level of the current exchange rate and holding all other variables constant, you would earn a higher or lower expected return on dollar assets versus foreign assets. This decision will tell you whether you want to hold more or fewer dollar assets and thus whether the quantity demanded will increase or decrease at each level of the exchange rate. The direction of the change in the quantity demanded at each exchange rate indicates which way the demand curve will shift. In other words, if the relative expected return on dollar assets rises, holding the current exchange rate constant, the demand curve will shift to the right. If the relative expected return falls, the demand curve will shift to the left.



Domestic Interest Rate, i_D Suppose that dollar assets pay an interest rate of i_D . When the domestic interest rate on dollar assets i_D rises, holding the current exchange rate E_t and everything else constant, the return on dollar assets increases relative to the return on foreign assets, and so people will want to hold more dollar assets. The quantity of dollar assets demanded increases at every value of the exchange rate, as shown by the rightward shift of the demand curve from D_1 to D_2 in Figure 6.3. The new equilibrium is reached at point 2, the intersection of D_2 and S , and the equilibrium exchange rate rises from E_1 to E_2 . An increase in the domestic interest rate i_D shifts the demand curve for domestic assets D to the right and causes the domestic currency to appreciate (E_c).

Conversely, if i_D falls, the relative expected return on dollar assets falls, the demand curve shifts to the left, and the exchange rate falls. A decrease in the domestic interest rate i_D shifts the demand curve for domestic assets D to the left and causes the domestic currency to depreciate (E_T).

Foreign Interest Rate, i_F Suppose foreign assets pay an interest rate of i_F . When the foreign interest rate i_F rises, holding the current exchange rate and everything else constant, the return on foreign assets rises relative to the return on dollar assets. Thus the relative expected return on dollar assets falls. Now people want to hold fewer dollar assets, and the quantity demanded decreases at every value of the exchange rate. This scenario is shown by the leftward shift of the demand curve from D_1 to D_2 . The new equilibrium is reached at point 2, when the value of the dollar has fallen. Conversely, a decrease in i_F raises the relative expected return on dollar assets, shifts the demand curve to the right, and raises the exchange rate. To summarize, an increase in the foreign interest rate i_F shifts the demand curve D to the left and causes the domestic currency to depreciate; a fall in the foreign interest rate i_F shifts the demand curve D to the right and causes the domestic currency to appreciate.

Changes in the Expected Future Exchange Rate, E_{t+1} Expectations about the future value of the exchange rate play an important role in shifting the current demand curve because the demand for domestic assets, like that for any physical or financial asset, depends on the future resale price. Given the current exchange rate E_t , any factor that causes the expected future exchange rate E_{t+1} to rise increases the expected appreciation of the dollar. The result is a higher relative expected return on dollar assets, which increases the demand for dollar assets at every exchange rate, thereby shifting the demand curve to the right from D_1 to D_2 in Figure 6. The equilibrium exchange rate rises to point 2 at the intersection of the D_2 and S curves. A rise in the expected future exchange rate E_{t+1} shifts the demand curve to the right and causes an appreciation of the domestic currency. According to the same reasoning, a fall in the expected future exchange rate E_{t+1} shifts the demand curve to the left and causes a depreciation of the currency.

Comparing Expected Returns on Domestic and Foreign Assets

As we have done so far, let's treat the United States as the home country, so domestic assets are denominated in dollars. For simplicity, we use euros to stand for any foreign country's currency, so foreign assets are denominated in euros. Suppose that dollar assets pay an interest rate of i_D and do not have any possible capital gains, so that they have an expected return payable in dollars of i_D . Similarly, suppose that foreign assets have an interest rate of i_F and an expected return



payable in the foreign currency, euros, of i^F . To compare the expected returns on dollar assets and foreign assets, investors must convert the returns into the currency unit that they use.

First, let us examine how François the Foreigner compares the returns on dollar assets and foreign assets denominated in his currency, the euro. When he considers the expected return on dollar assets in terms of euros, he recognizes that it does not equal i^D ; instead, the expected return must be adjusted for any expected appreciation or depreciation of the dollar. If François expects the dollar to appreciate by 3%, for example, the expected return on dollar assets in terms of euros would be 3% higher than i^D because the dollar is expected to become worth 3% more in terms of euros.

Thus, if the interest rate on dollar assets is 4%, with an expected 3% appreciation of the dollar, the expected return on dollar assets in terms of euros is 7%: the 4% interest rate plus the 3% expected appreciation of the dollar. Conversely, if the dollar is expected to depreciate by 3% over the year, the expected return on dollar assets in terms of euros will be only 1%: the 4% interest rate minus the 3% expected depreciation of the dollar.

Writing the current exchange rate (the spot exchange rate) as E_t and the expected exchange rate for the next period as $\frac{E_{t+1}^e - E_t}{E_t}$. Our reasoning indicates that the expected return on dollar assets R^D in terms of foreign currency can be written as the sum of the interest rate on dollar assets plus the expected appreciation of the dollar.

$$R^D \text{ in terms of euros} = i^D + \frac{E_{t+1}^e - E_t}{E_t}$$

However, François's expected return on foreign assets R^F in terms of euros is just i^F . Thus, in terms of euros, the relative expected return on dollar assets (that is, the difference between the expected returns on dollar assets and euro assets) is calculated by subtracting i^F from the expression above to yield

$$R^D \text{ in terms of dollars} = i^f - \frac{E_{t+1}^e - E_t}{E_t} \quad (1)$$

As the relative expected return on dollar assets increases, foreigners will want to hold more dollar assets and fewer foreign assets.

Next let us look at the decision to hold dollar assets versus euro assets from Al the American's point of view. Following the same reasoning we used in François's case, we know that the expected return on foreign assets R^F in terms of dollars is the interest rate on foreign assets i^F plus the expected appreciation of the foreign currency, which is equal to minus the expected appreciation of the dollar,

$$\text{Relative } R^D = i^D - \left(i^f - \frac{E_{t+1}^e - E_t}{E_t} \right) = i^D - i^f + \frac{E_{t+1}^e - E_t}{E_t}$$



This equation is the same as Equation 1 describing François's relative expected return on dollar assets (calculated in terms of euros). The key point here is that the relative expected return on dollar assets is the same whether it is calculated by François in terms of euros or by AI in terms of dollars. Thus, as the relative expected return on dollar assets increases, both foreigners and domestic residents respond in exactly the same way—both will want to hold more dollar assets and fewer foreign assets.

Interest Parity Condition

We currently live in a world in which capital mobility exists: Foreigners can easily purchase American assets, and Americans can easily purchase foreign assets. If few impediments to capital mobility are present and we are looking at assets that have similar risk and liquidity—say, foreign and American bank deposits—then it is reasonable to assume that the assets are perfect substitutes (that is, equally desirable). When capital is mobile and assets are perfect substitutes, if the expected return on dollar assets is greater than that on foreign assets, both foreigners and Americans will want to hold only dollar assets and will be unwilling to hold foreign assets. Conversely, if the expected return on foreign assets is higher than that on dollar assets, both foreigners and Americans will not want to hold dollar assets and will want to hold only foreign assets. Therefore, for existing supplies of both dollar assets and foreign assets to be held, it must be the case that no difference exists in their expected returns; that is, the relative expected return in Equation 1 must equal zero. This condition can be rewritten as

$$i^D = \left(i^f - \frac{E_{t+1}^e - E_t}{E_t} \right) \quad (2)$$

This equation, called the interest parity condition, states that the domestic interest rate equals the foreign interest rate minus the expected appreciation of the domestic currency. Equivalently, this condition can be stated in a more intuitive way: The domestic interest rate equals the foreign interest rate plus the expected appreciation of the foreign currency. If the domestic interest rate is higher than the foreign interest rate, there is a positive expected appreciation of the foreign currency, which compensates for the lower foreign interest rate. A domestic interest rate of 5% versus a foreign interest rate of 3% means that the expected appreciation of the foreign currency must be 2% (or, equivalently, that the expected depreciation of the dollar must be 2%).

The interest parity condition can be looked at in several ways. First, recognize that interest parity simply means that the expected returns are the same on both dollar assets and foreign assets. To see this, note that the left side of the interest parity condition (Equation 2) is the expected return on dollar assets, while the right side is the expected return on foreign assets, both calculated in terms of a single currency, the U.S. dollar. Given our assumption that domestic and foreign assets are perfect substitutes (equally desirable), the interest parity condition is an equilibrium condition for the foreign exchange market. Only when the exchange rate is such that expected returns on domestic and foreign assets are equal—that is, when interest parity holds—will investors be



willing to hold both domestic and foreign assets.

With some algebraic manipulation, we can rewrite the interest parity condition in

$$E_t = \left(\frac{E_{t+1}^e}{i^f - i^D + 1} \right)$$

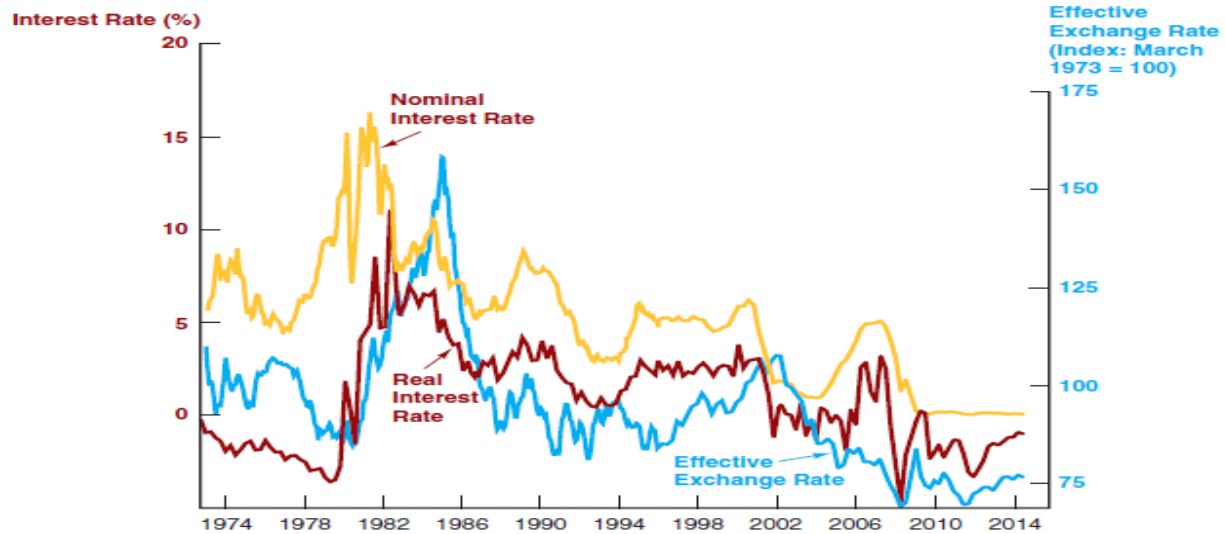
This equation produces exactly the same results that we derived in the supply and demand analysis given in the text: If i^D rises, the value of the denominator decreases and so E_t rises. If i^f rises, the value of the denominator increases and so E_t falls. If E_{t+1}^e rises, the value of the numerator increases and so E_t rises.

Effects of Changes in Interest Rates on the Equilibrium Exchange Rate

Our analysis has revealed the factors that affect the value of the equilibrium exchange rate. Now we use this analysis to take a closer look at the response of the exchange rate to changes in interest rates and money growth. Changes in domestic interest rates i^D are often cited as a major factor affecting exchange rates. For example, we see headlines in the financial press like this one: “Dollar Recovers as Interest Rates Edge Upward.” But is the positive correlation suggested in this headline true in every case?

Not necessarily, because to analyze the effects of interest rate changes, we must carefully distinguish the sources of the changes. The Fisher equation states that a nominal interest rate such as i^D equals the real interest rate plus expected inflation: $i = i^r + \pi^e$. The Fisher equation thus indicates that the interest rate i^D can change for two reasons: Either the real interest rate i^r changes or the expected inflation rate π^e changes. The effect on the exchange rate is quite different, depending on which of these two factors is the source of the change in the nominal interest rate.

Suppose the domestic real interest rate increases, so that the nominal interest rate i^D rises while expected inflation remains unchanged. In this case, it is reasonable to assume that the expected appreciation of the dollar will be unchanged because expected inflation is unchanged. In this case, the increase in i^D increases the relative expected return on dollar assets, raises the quantity of dollar assets demanded at each level of the exchange rate, and shifts the demand curve to the right. We end up with the situation depicted, which analyzes an increase in i^D , holding everything else constant. Our model of the foreign exchange market produces the following result: When domestic real interest rates rise, the domestic currency appreciates.



Why Are Exchange Rates So Volatile?

The high volatility of foreign exchange rates has surprised many people. Thirty or so years ago, economists generally believed that allowing exchange rates to be determined in the free market would not lead to large fluctuations in their values. Recent experience has proved them wrong. If we return to Figure 6.2, we see that exchange rates over the 1990–2014 period have been very volatile. The asset market approach to exchange rate determination that we have outlined in this section gives a straightforward explanation of the volatility of exchange rates. Because expected appreciation of the domestic currency affects the expected return on domestic assets, expectations about the price level, inflation, trade barriers, productivity, import demand, export demand, and the money supply play important roles in determining the exchange rate. When expectations about any of these variables change, as they do—and often, at that—our model indicates that the expected return on domestic assets, and therefore the exchange rate, will be immediately affected.

Because expectations on all of these variables change with just about every bit of news that is reported, it is not surprising that the exchange rate is volatile. Because earlier models of exchange rate behavior focused on goods markets rather than asset markets, they did not emphasize changing expectations as a source of exchange rate movements, and so these earlier models did not predict substantial fluctuations in exchange rates. The failure of earlier models to explain volatility is one reason why they are no longer so popular. The more modern approach developed here emphasizes that the foreign exchange market is like any other asset market in which expectations of the future matter. The foreign exchange market, like other asset markets such as the stock market, displays substantial price volatility, and foreign exchange rates are notoriously hard to forecast.

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.

Open Economy Identities

In an open economy, gross domestic product (GDP) differs from that of a closed economy because there is an additional injection, export expenditure which represents foreign expenditure on domestically produced goods. There is also an additional leakage expenditure on imports which represents domestic expenditure on foreign goods and raises foreign national income.

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 $S = Y_d - C$

$$(X - M) = (S - I) + (T - G)$$

Current account Net savings/Dissavings Government deficit/surplus
of the private sector

This implies that current account deficit depends on either private dissaving and/or a government deficit. By re-arrangement;

$$I + G + X = S + T + M$$

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.

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 ,

$$Y = \frac{1}{s+m} (C_a + I + G + X - M_a) \text{ this can be transformed into difference form to yield;}$$

$$Yd = \frac{1}{s+m} (dC_a + dI + dG + dX - dM_a), \text{ where } d \text{ in front of a variable represents the change in the variable}$$

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

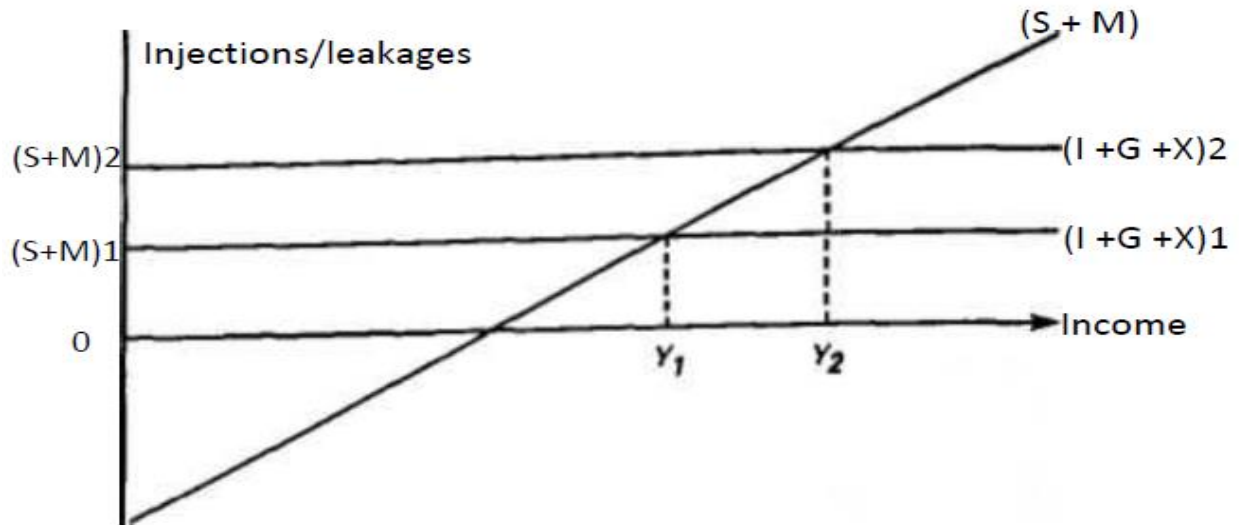
Export multiplier

$$\frac{dy}{dX} = \frac{1}{s+m} > 0$$

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.

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



Earlier in the chapter we discussed the determinants of the exchange rate in the long run: the relative price level, relative trade barriers, import and export demand, and relative productivity. These four factors influence the expected future exchange rate. The theory of purchasing power parity suggests that if a higher American price level relative to the foreign price level is expected to persist, then the dollar will depreciate in the long run. A higher expected relative American price level should thus have a tendency to lower E_{t+1} , lower the relative expected return on dollar assets, shift the demand curve to the left, and lower the current exchange rate.

Similarly, the other long-run determinants of the exchange rate can influence the relative expected return on dollar assets and the current exchange rate. Briefly, the following changes, all of which increase the demand for domestic goods relative to foreign goods, will raise E_{t+1} :

- expectations of a fall in the American price level relative to the foreign price level;
- expectations of higher American trade barriers relative to foreign trade barriers;
- expectations of lower American import demand;
- expectations of higher foreign demand for American exports; and
- expectations of higher American productivity relative to foreign productivity.

By increasing E_{t+1} , all of these changes increase the relative expected return on dollar assets, shift the demand curve to the right, and cause an appreciation of the domestic currency, the dollar.

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

$$Y(s + m) - C_a + M_a - I - G - X = 0$$

$$mY - \frac{m}{s+m} (C_a - M_a + I + G + X) = 0$$

Adding M_a and X to each side, recalling that $M = M_a + mY$ and rearranging yields;

$$CA = X - M = X - M_a - \frac{m}{s+m} (C_a - M_a + I + G + X) \text{ in difference form;}$$

$$dCA = dX - dM_a - \frac{m}{s+m} (dC_a - dM_a + dI + dG + dX)$$

the effects of an increase in government expenditure on the current account balance is given by;

$$\frac{dCA}{dG} = -\frac{m}{s+m} < 0$$

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

Marshall-Lerner Condition

The elasticity approach investigates the relationship between the exchange rate and the balance of payments (current account-trade balance). It assumes that if the BOP is in equilibrium, devaluation can improve the balance of payments. However, for devaluation to function successfully, the total of the price elasticity of domestic and foreign demand for imports has to increase. When a country devalues a currency, it improves the balance of payments under ideal conditions. This ideal condition is known as the Marshall-Lerner condition. The analysis was pioneered by Alfred Marshall (1923) and Abba Lerner (1944), and later extended by Joan Robinson (1937) and Fritz Machlup (1939).

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.

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

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, X_v is the volume of domestic exports, S is the exchange rate, P^* is the foreign price level and M_v is the volume of imports.

By simplification, the domestic and foreign price levels are set at unity; the value of domestic exports ($P X_v$) is given by X; while the foreign currency value of imports ($P^* M_v$) is given by M. Using these simplifications;

$$CA = X - SM$$

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 η_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 η_m - the percentage change in imports over the percentage change in their price as represented by the percentage change in the exchange rate;



$$\eta m = - \frac{dM/M}{dS/S}$$

$$dM = - \frac{\eta m dS M}{S}$$

By substitution;

$$\frac{dCA}{dS} = \frac{\eta x X}{S} + \eta m M - M \text{ by dividing by } M$$

$$\frac{dCA}{dS} \frac{1}{M} = \frac{\eta x X}{S M} + \eta m - 1$$

Assuming a balanced trade, $X/SM = 1$, then by re-arrangement.

$$\frac{dCA}{dS} = M(\eta x + \eta m - 1) - \text{Marshall-Lerner condition}$$

This implies that when the current account is in equilibrium, a devaluation will improve the current account.

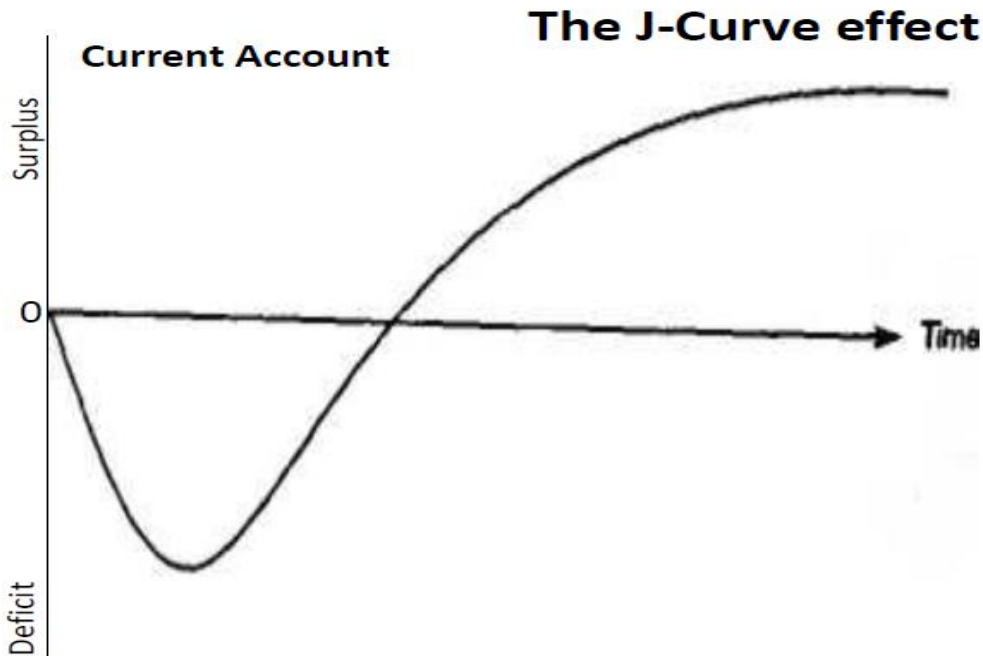
Thus, $dCA/dS > 0$ only if the sum of the foreign elasticity of demand for exports and the home country elasticity of demand for imports is greater than unity. Thus, $(\eta x + \eta m) > 1$.

If the sum of these two elasticities is less than unity, then a devaluation will lead to a deterioration of the current account.

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.

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.



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

The pass-through effect describes the extent to which a 1% depreciation (appreciation) leads to a rise (fall) in import prices. If there is complete pass-through, a 10% depreciation (appreciation) of the currency leads to a 10% rise (fall) in import prices. If, however, a 10% depreciation (appreciation) leads to only a 6% rise (fall) in import prices, then there is only a partial pass-through effect, with the elasticity of exchange rate pass-through being 0.6. Some of the reasons (previous slide) explain why an x% depreciation of the exchange rate may lead to a less than x% rise in prices in the short run.

In a world of imperfect competition, foreign firms may not be prepared to risk losing market share following a depreciation and decide to absorb part of the depreciation by reducing their foreign currency price of exports so that the price rise following the devaluation will be less than the x% devaluation. Yang (1997) studied 77 manufacturing industries in the United States for the period December 1980 until December 1991 and reported that the key factors determining the elasticity of pass-through is the degree of product differentiation

The greater the degree of product differentiation then the more the ability of foreign exporters to raise their prices presumably because firms in industries where the product is differentiated tend to face more price-inelastic demand for their product and so are able to pass on price rises with less fear of losing sales

Criticisms

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 criticized 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.

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.

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).

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.

Taking the equation for national income

$$Y = C + I + G + X - M \quad \text{and defining domestic absorption as;}$$

$$A = C + I + G, \quad \text{the equation can be rearranged as follows;}$$

$$CA = X - M = Y - A$$

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 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;

$dA = a dY + dA_d$. by substitution.

$dCA = (1-a)dY - dA_d$.

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, dA_d . The condition for a devaluation to improve the current account is $(1 - a)dY > dA_d$. that is, any change in income not spent on absorption must exceed any change in direct absorption

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

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.



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 reduces 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.

Note that the rise in the general price index will tend to reduce the real income of those with fixed incomes, but if overall income is unchanged then those with variable incomes would have gained. Those with fixed incomes tend to have a high propensity to absorb, while those on variable incomes are better off and have a lower propensity to absorb. If income is redistributed from those with fixed incomes to those with variable incomes, then this income redistribution effect will tend to reduce direct absorption.

A devaluation often leads to an improvement of company profits through increased sales in export and import-competing industries. Real wages are reduced by the rise in the aggregate price index and take time to catch up. The effect on direct absorption of this redistribution is not clear, while firms may have a lower tendency to absorb than workers this will be very much dependent on their expectations about the future. If these expectations are very favourable then the devaluation and profits rise may stimulate investment and even raise direct absorption.

There may be considerable income adjustments within groups of companies and workers. Some companies' profits will benefit from a devaluation as export sales rise, however, some firms that are reliant on imported inputs may find that the costs increase reduce their profit margins. Similarly, some workers will be able to protect themselves against the induced price rise because they are represented by strong trade unions, while others with no union representation may not secure compensating rises. The overall effect on direct absorption will then depend on whether the companies and workers that gain have a higher propensity to absorb than those that lose.

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.



1.6.2 Money and BOP Adjustment

Monetary Approach to Balance of Payments

The monetary view of the balance of payments or the global monetarist approach emerged late 1950s. The monetary approach emerged in 1950s first as a monetary approach to the balance of payment and then was refocused to the exchange rates[14]. The first champion of the monetary approach, later redefined by Hahn[16], Pearce[17], Prais[18], Mundell[19,20], Johnson, and other followers. These monetarists suggest that the balance of payment is a monetary phenomenon. Thus, since the exchange rate is the price of one currency expressed in terms of another currency, the balance of payment should be expressed from the point of view of supply and demand of money.

The model starts with the reasonable statement that, as the exchange rate is the relative price of foreign and domestic money, it should be determined by the relative supply and demand for these moneys. This simply suggests, if people demand more money than is being supplied by the central bank then the excess demand for money would be met by inflow of money from abroad, hence the trade balance will improve. On the contrary, if the central bank supplies more money than is demanded, the excess supply of money is eliminated by outflow of money to the other countries and this will worsen the trade balance. It is inherent therefore that, any excess demand for goods, services and assets, resulting in a deficit of the balance of payments, reflects an excess supply or demand of the stock of money. It seems the central point of the monetary approach to the balance of payment is that balance of payment deficits or surpluses reflect stock disequilibrium between demand and supply in the market for money.

With monetary approach therefore, it is important to emphasize the role of demand and supply of money in determining the exchange rates. Thus, similar to any merchandise which is for sale, the foreign exchange value is subjected to the law of supply and demand. This is the reason why the exchange rate will be explained using the same geometric artifices which are used to explain the formation of prices in general. Therefore, according to this approach, the exchange rate between two currencies is the ratio of their values determined on the basis of money supply and money demand positions of the two countries.

The monetary approach to the balance of payments emphasizes that a country's balance of payments is a monetary phenomenon. Thus, the balance of payments is analyzed in terms of money demand and money supply.

There are three key assumptions that underlie the monetary model;

- stable money demand function
- vertical aggregate supply schedule, and
- purchasing power parity (PPP).

This approach 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 sterilization 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.

Stable Money Demand Function

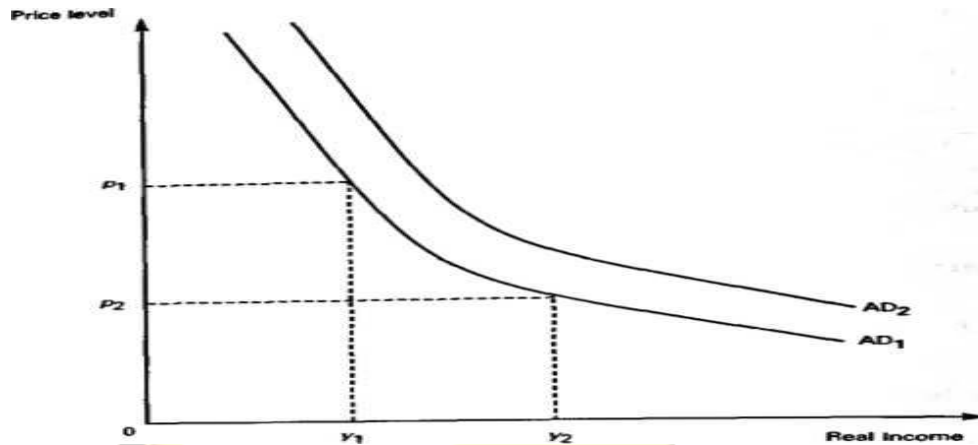
By assuming a stable demand for money, the quantity theory of money is used as the basis of the money demand function, which is written as;

$$M_d = kPy \quad \text{where } k > 0$$

where M_d 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.

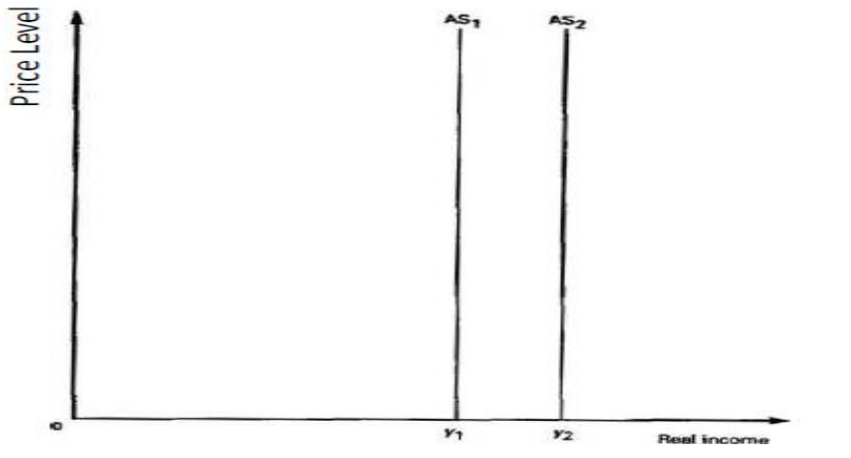
The aggregate demand schedule:

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 $P_1y_1 = P_2y_2$, 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.



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. However, improvement in productivity due to technological progress may shift the AS curve to AS_2



Purchasing Power Parity (PPP)

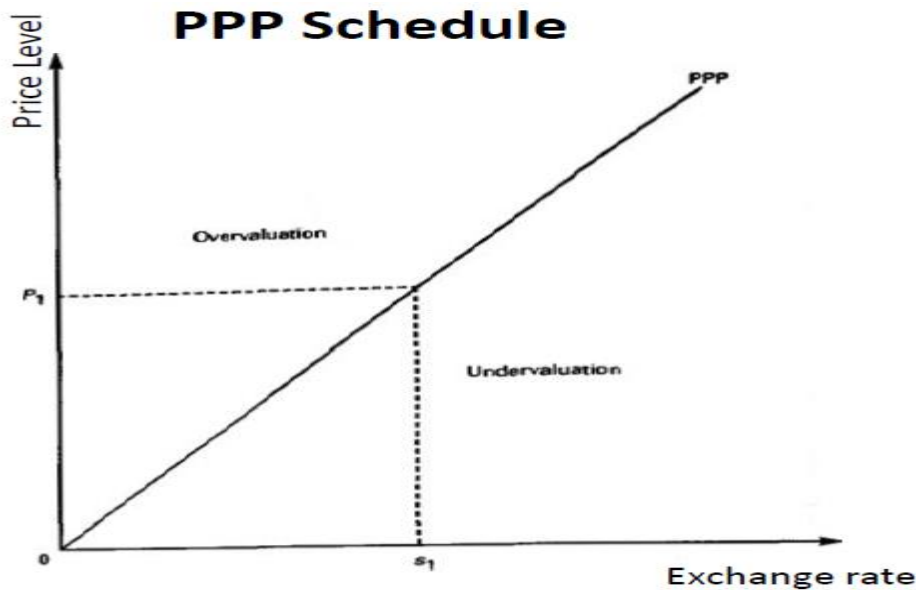
The final assumption that underpins the monetary model is the assumption of purchasing power parity. The theory says that the exchange rate adjusts such to keep the following equation in equilibrium;

$$S = \frac{P}{P^*} \quad \text{that is } P = SP^*$$

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.



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 M_s 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

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;

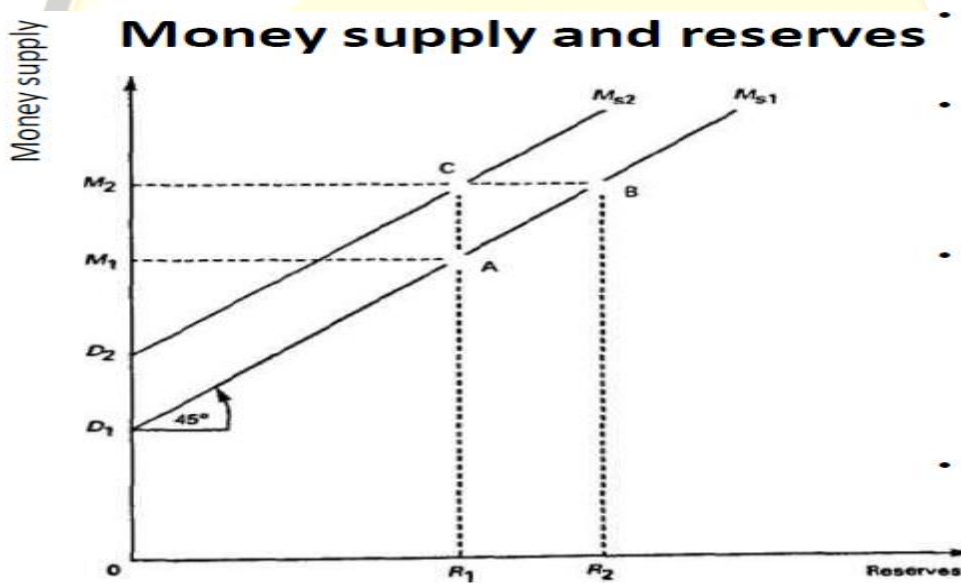
$$dM_s = dD + dR$$

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 $D_1 + R_1$.

An OMO will shift the M_s 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 M_{s1} to M_{s2} and the total money supply rises from M_1 to M_2 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 M_2 and this moves the money supply schedule from M_{s1} to M_{s2} represented by point A to B.



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.

This is completely the reverse of the Keynesian approach which views the current account items as the autonomous and capital account and reserve changes as the accommodating items. This different way of looking at the balance of payments statistics is sometimes contrasted by saying



that Keynesians look at the balance of payments statistics from the 'top down' while the monetarists look from the 'bottom up'. 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;

$$BP = CA + K + dR = 0 \quad \text{so that;}$$

$$CA + K = -dR$$

where CA is the current account balance, K is the capital account balance and dR is the change in the authorities reserves.

$$CA + K = -dR$$

According to 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.

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 D_1 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.

Formal determination

In what follows, we will systematically go through the 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:

$$Ms = a(BR + C), \text{ where}$$

BR = reserves of commercial banks

C = currency held by nonbank public

a = the money multiplier

Or central bank assets



$M_s = a(DR + IR)$, where

DR = domestic reserves

IR = international reserves

The money multiplier refers to the notion of multiple deposit creation. If the reserve requirement is 10%, a new deposit of \$1,000 creates \$900 of excess reserves, which can be lent out. The loan recipient deposits the \$900 in her bank; this creates \$810 of excess reserves which can be lent, etc. The money multiplier is $1/r$ or 10. Anything that increases the assets of the central bank (or equivalently, its liabilities) allows the money supply to expand via the multiplier process. 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

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.

Frequently a general expression for money demand is used:

$$L = kPY, \text{ where}$$

P and Y are as discussed, and k is a constant embodying all other influences on money demand.

Money market equilibrium occurs when

$M_s = L$ or

$$a(DR+IR) = a(BR+C) = f[Y,P,I,W,E(p),O]$$

or



$$M_s = kPY.$$

How can we understand balance of payments adjustments using money supply and demand? Let us assume a fixed exchange rate system. What happens when the central bank increases M_s , perhaps by purchasing government securities (increasing DR)?

BR and/or C will increase, and there will now be an excess supply of money. Current account excess cash balances imply individuals spend more, bidding up P. Y and W may rise. Higher P and Y will lead to lower exports (X) and higher imports (M).

Therefore, the excess supply of money leads to a current account deficit.

Private capital account: excess cash causes individual to bid up price of financial assets; this drives down i . In the end, this causes a deficit in the private capital account. Together, these effects indicate that a money supply increase leads to a balance of payments deficit.

To summarize:

Increase in M_s 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 M_s 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 M_s is increased? If M_s 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 M_s 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. If we assume that absolute purchasing power parity holds, then

$$e = P_A/P_B$$

Similarly, for Country B,

$$M_{sB} = k_B P_B Y_B$$

It must be true that

$$\frac{M_{sA}}{M_{sB}} = \frac{k_A P_A Y_A}{k_B P_B Y_B}$$

For Country A, monetary equilibrium means that

$$M_{sA} = k_A P_A Y_A$$

This means that

$$\frac{M_{sA}}{M_{sB}} = \frac{k_A Y_A}{k_B Y_B} e$$



Rearranging yields

$$e = \frac{k_B Y_B M_{SA}}{k_A Y_A M_{SB}}$$

This expression demonstrates that an increase in M_s by Country A will lead to a depreciation of the currency. Inflationary monetary policy only causes currency depreciation.

Monetary Policy Coordination: M_{sA} and M_{sB}

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 (B_d) and for foreign bonds (B_f). B_d yields interest return of i_d ; B_f yields a return of i_f . The relationship between interest rates is as follows:

$$i_d = i_f + x_a - RP, \text{ where}$$

RP is the risk premium associated with the imperfect international mobility of capital

x_a is the expected percentage appreciation of the foreign currency, or $[E(e)/e] - 1$

Demand by home country individual for home money

$$L = f(i_d, i_f, x_a, Y_d, P_d, W_d), \text{ where}$$

i_d = return on home-country bonds

i_f = return on foreign-country bonds

x_a = expected appreciation of foreign currency

Y_d = home country real income

P_d = home country price level

W_d = home country real wealth

Home money demand (L) will be:

inversely related to i_d .

Inversely related to i_f .

Inversely related to x_a .

Positively related to Y_d .

Positively related to P_d .

Positively related to W_d .

Demand by home country individual for home bonds

$$B_d = h(i_d, i_f, x_a, Y_d, P_d, W_d), \text{ where}$$



Home bond demand will be

Positively related to i_d

Inversely related to i_f

Inversely related to x_a

Inversely related to Y_d

Inversely related to P_d

Positively related to W_d

Demand by home country individual for foreign bonds (multiplied by e so that it's in terms of domestic currency

$eB_f = j(i_d, i_f, x_a, Y_d, P_d, W_d)$, where

Foreign bond demand will be

Inversely related to i_d

Positively related to i_f

Positively related to x_a

Inversely related to Y_d

Inversely related to P_d

Positively related to W_d

Home country central bank sells government securities (i.e., decreases M_s and increase home bond supply). i_d 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 M_s and increase home bond supply).

i_f should falls rise.

The foreign currency depreciates (e falls), assuming flexible exchange rates.

x_a rises.

There are therefore 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, x_a 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, and
- increase in foreign bond demand.

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.

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 i_d , 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 an appreciation of the home currency. On net, it is likely that the home currency appreciates.

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 i_d . This also leads to an increase in demand for foreign bonds and for domestic bonds, both of which lead to a decrease in i_d . 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

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.

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 i_d will rise. The result is an appreciation. If from point B prices were to rise to P_2 , demand for money would rise, and the home currency would appreciate (i.e., e falls). the Asset Market



Money and BOP adjustment

According to David Hume balance of payment moves towards equilibrium automatically as national price levels adjust. With reference to the gold standard:

each nation's money supply consisted of gold or paper money backed by gold each nation set price of gold in terms of its currency free import and export of gold balance of payments surplus causes nation to acquire gold and increase its money supply assuming balance of payments deficit gold outflow (under classical gold standard) decrease money supply reduce domestic price level and increase international competitiveness. This leads to an increase in exports and decrease imports return to balance of payment equilibrium. Assuming a balance of payments surplus, the business sector's receipts from foreigners exceed payments. The domestic commercial banks and the central bank accumulate reserves. When the commercial banks deposit the foreign currency at the central bank, their reserves increase by the amount of the surplus. This represents an increase in un-borrowed reserves and all other things being equal expands the money supply by;

$$\Delta M = \frac{B}{h + z(1 - h)}$$

Where h is the fraction of the money supply the public hold as currency, and z is the reserve ratio.

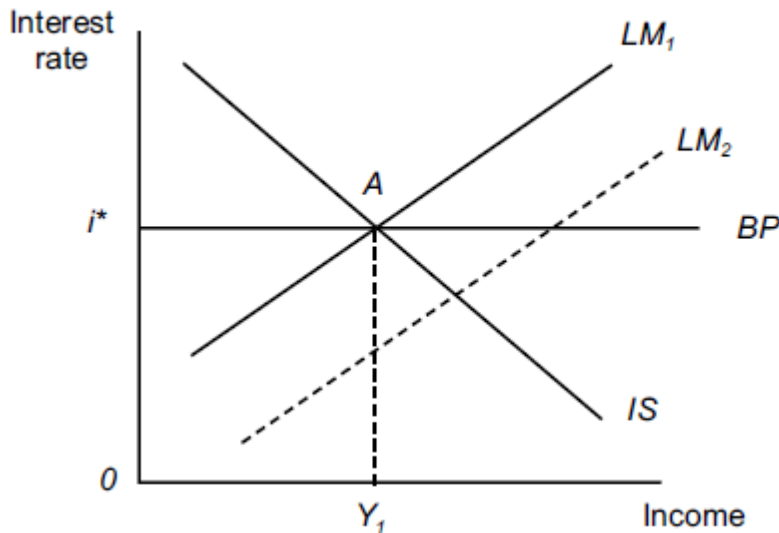
1.6.3 Monetary Policy Under Alternative Exchange Rate Regimes

Monetary policy with fixed exchange rates We return to the Mundell-Fleming model mentioned earlier. Now we assume fixed exchange rates and perfect capital mobility. Perfect capital mobility requires foreign and domestic bonds to be perfect substitutes. 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.

Domestic monetary policy is completely ineffective. An expansionary monetary policy does not cause even a temporary increase in income. This is illustrated in Figure 6.4, in which 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 Y_1 .

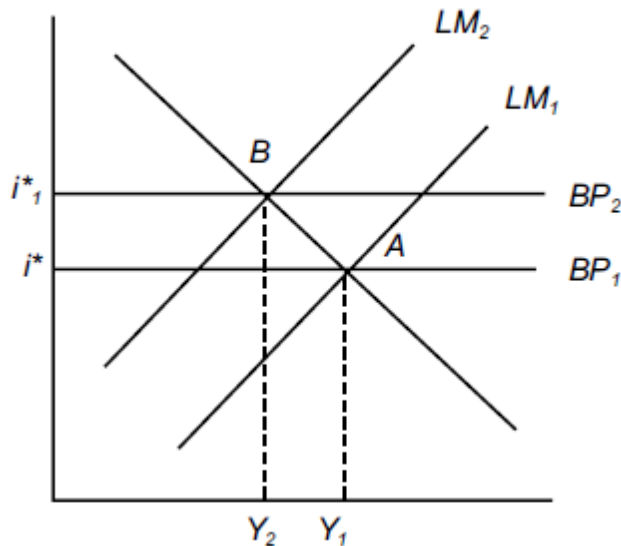
Figure 6.4: Monetary policy with fixed exchange rates and capital mobility



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 latter case 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. For the moment, 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.

We begin at A in Figure 6.5, with the domestic economy in equilibrium at a full employment income level, Y_1 . The strong country tightens its monetary policy, forcing the world interest rate up to i_1^* . 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 i_1^*) 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.

Figure 6.5 The transmission of monetary policy with fixed exchange rates



The LM curve moves back to LM_2 . 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.¹ In effect, the government with the inflation problem borrows a reputation for financial prudence from the strong country in the system.

Opponents of fixed exchange rates argue, rather, 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. Let point A in Figure 6.5 now represent a level of income at which there is high unemployment and low inflation.

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.

Clearly, 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. However, if there are hysteresis effects, then the application of a tight monetary policy during a period when the economy is already experiencing high unemployment increases that unemployment in the short run and results in long term damage.

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.

The strong country need not adopt an anti-inflationary stance. Expansionary policy is transmitted through a fixed exchange rate system just as is deflationary policy. Much depends on what gives the strong country its position within the system. The Bretton Woods adjustable peg exchange rate system was criticized because the macroeconomic policy of the USA in the later years of the system's operation was more inflationary than that desired by other major countries and US inflation was being transmitted to other countries through the fixed exchange rates. US inflation made US goods uncompetitive and this, together with the capital outflow resulting from low US interest rates, produced a balance of payments deficit. The principal trading partners of the USA found themselves in balance of payments surplus, their international reserves increased and so did their money stocks.

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.

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.

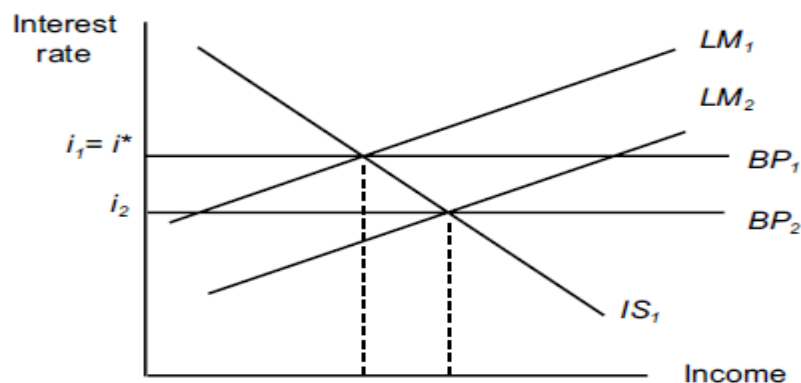
Countries are, thus, able to maintain a balance of payments balance for any given level of income at a lower interest rate. The BP curve moves down to BP2, as shown in Figure 6.5. This enables the authorities to run a more expansionary monetary policy. Interest rates fall (the LM curve shifts down to LM2), capital flows out of the economy and the current account surplus is offset by a capital account deficit.

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.

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

Figure 10.3 Short-run freedom for monetary policy after devaluation



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.

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.



Although some policy independence may be granted by occasional exchange rate changes, this cannot occur as a matter of course. 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'.² 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.

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.

International capital was sufficiently mobile by the late 1960s to make sterilization difficult for countries such as Japan, Switzerland, and Germany, which regarded US policy as over-expansionary. To try to make it work, they had to operate draconian capital controls to limit the inflow of capital. Countries wishing to avoid deflationary monetary impulses from abroad without changing their exchange rate parities also require capital controls, this time to prevent the outflow of capital. In the absence of both exchange rate adjustments and capital controls, the weak country is constrained to remain at point B in Figure 6.4.

We should not rule out entirely the possibility of operating a fixed exchange rate system with capital controls. They played an important role in the EMS up until 1991 and have been resorted to in emergencies since then. However, they are widely regarded as undesirable and have become increasingly difficult to enforce with the development of offshore financial markets. In the modern world, they can probably only be enforced for short periods, at best. The difficulties caused to monetary authorities by the international mobility of capital has led to a call by some economists for a tax on international capital movements in the hope of slowing them down.

However, even as things are, the chances of some degree of monetary policy independence within a fixed exchange rate system are not quite as slim as we have so far suggested. 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 normally, also, 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.

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.

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. Following the turmoil in the EMS in that month, an extremely wide band of ± 15 per cent was adopted, although this was intended to be only temporary and was not fully used. Its sole purpose was to reduce the scope for profit-making attacks on currencies by speculators.

The rules of the system may prevent the full use of the band. In the EMS system, currencies were required to stay within their bands both against the European Currency Unit (Ecu) — a weighted currency basket consisting of the currencies of all members of the European Union (EU) — and against each other single currency. This meant in practice that the range of variation before July 1993 was limited to 2.25 or 6 per cent against the strongest or weakest currency in the system. Further, governments could not allow their currencies to fall to the bottom of the allowed band since this raised expectations of a possible devaluation and encouraged speculation against the currency.

Nonetheless, the existence of bands around parities can provide governments with a limited amount of monetary policy freedom. This applies if the central exchange rates to which the bands apply are thoroughly credible. Consider Figure 6.6. Here we again assume perfect capital mobility and show an initial equilibrium with the IS, LM and BP curves intersecting at point A. We assume this equilibrium to be at the country's central rate of exchange within a fixed exchange rate system. BP1 and BP2 show the BP curves that would apply at exchange rates 2.25 per cent above and below the existing central rate. Next we assume that the domestic monetary authorities expand the money stock, pushing the LM curve down to LM2, intersecting the IS curve at B, which implies an exchange rate still within the allowable band. In the usual way, however, the fall in interest rate causes capital to flow out, the money stock falls and the economy moves back to A.

It remains that B may be a position of short-run equilibrium if it is fully believed that the exchange rate will move back to its original position. The expected increase in the value of the currency causes agents to be willing to hold the currency even at a rate of interest temporarily below the world level.

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.

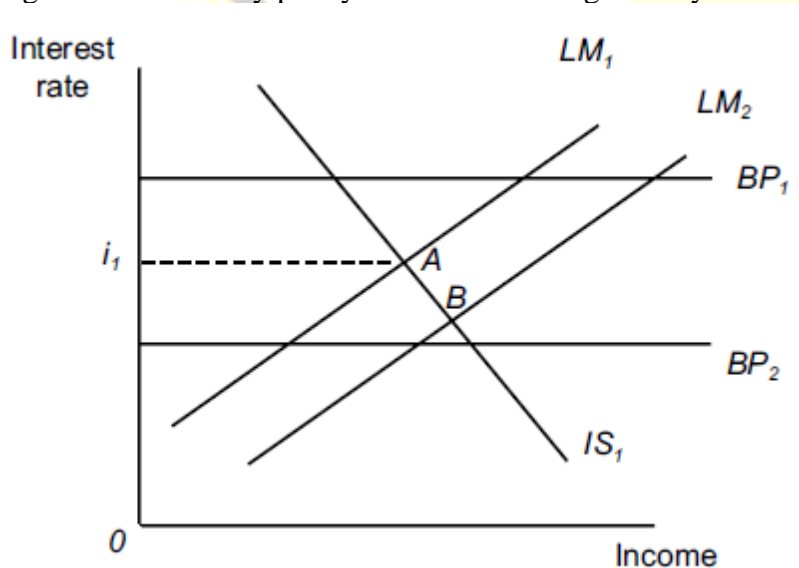
Limitations on free trade

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.

Expectations of future devaluations following a devaluation

Finally, 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.

Figure 6.6: Monetary policy in a fixed exchange rate system





To sum up this section, we can refer to the ‘inconsistent quartet’,⁴ which states that governments cannot at the same time maintain all of the following:

- free trade
- full capital mobility
- fixed exchange rates
- national autonomy in the conduct of monetary policy.

This does not apply to the strong country of the system, which is able to determine its own monetary policy, as long as it is able to withstand the political pressure emanating from other members in cases where interests conflict.

Monetary policy with floating exchange rates

Our limited analysis earlier in this section concluded that 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.

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.

This analysis implied that the exchange rate changed to restore the goods and money markets and the balance of payments to equilibrium. Income, then, increases, but the size of any real effects of monetary policy depends on the extent to which this reflects an increase in the price level, rather than output. This, in turn, depends on the extent of the depreciation that follows the monetary expansion. If the value of the currency falls in proportion to the increase in the money supply, the full weight of the expansion falls on the price level. There are no real effects. Money is neutral. To allow us to say more about this, we need to look briefly at theories of the determination of exchange rates in floating exchange rate systems.

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, transactions 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. Thus, if the interest rate on UK bonds were two per cent above the interest rate on US bonds, investors would expect sterling to depreciate by two per cent against the dollar. The key determinants of exchange rates are the supply of and demand for money.



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:

$$m^* - p^* = \eta y^* - si^*$$

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:

$$s = (m - m^*) - \eta(y - y^*) + \sigma (i - i^*)$$

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.

However, the predictions of this model are not supported by evidence, which is not surprising since neither PPP nor UIRP hold in the short run.

Consequently, the model has been modified to allow for exchange rate overshooting in the short run. That is, we continue to assume the existence of long-run equilibrium rates of exchange and to incorporate both UIRP and PPP. We also assume rational expectations and so market participants in the model make the best use of all relevant information and employ the best model for forecasting future exchange rates. Therefore, they know what the long-run equilibrium exchange

rate is. Despite this, exchange rates overshoot their long-run equilibrium positions. That is, if the exchange rate is pushed above its equilibrium it will fall well below the equilibrium rate before once again rising towards equilibrium. Equally, an exchange rate pushed below its equilibrium rate will not move directly back to equilibrium but will rise well above it before returning to equilibrium. This result is achieved by assuming the existence of sticky prices. The best-known sticky price model was developed by Dornbusch (1976).

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.

The model is described by four equations:

(a) uncovered interest rate parity

$$E_s = i - i^*$$

(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 long-run equilibrium value.

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.

The diagrammatic solution of the model gives a relationship between the exchange rate and the price level with the asset market always in equilibrium as in Figure 6.7, in which equilibrium is at

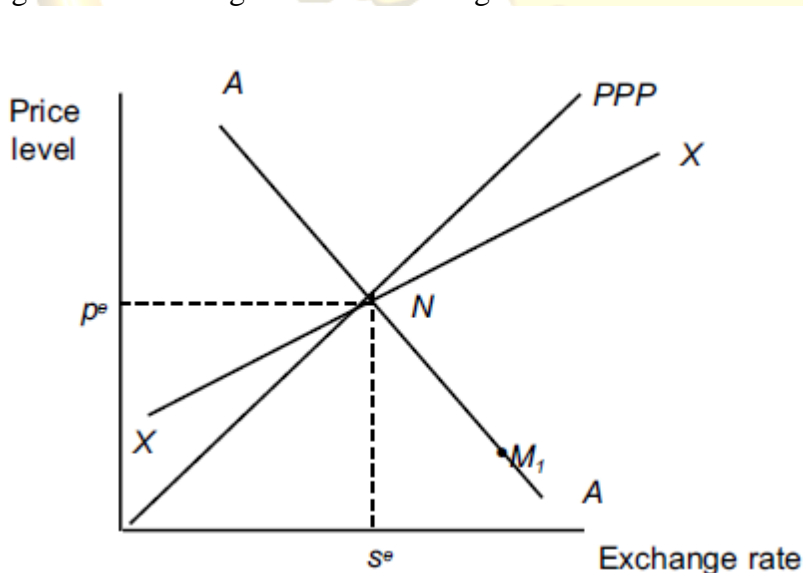
N , with p_e and s_e . Note that the exchange rate is here expressed in direct terms. That is, as we move along the horizontal axis s increases but this means that the value of the home currency falls (one has to pay more home currency for one unit of foreign currency).

In Figure 6.7, 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.

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 M_1 , 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.

Figure 6.7: Exchange rate overshooting



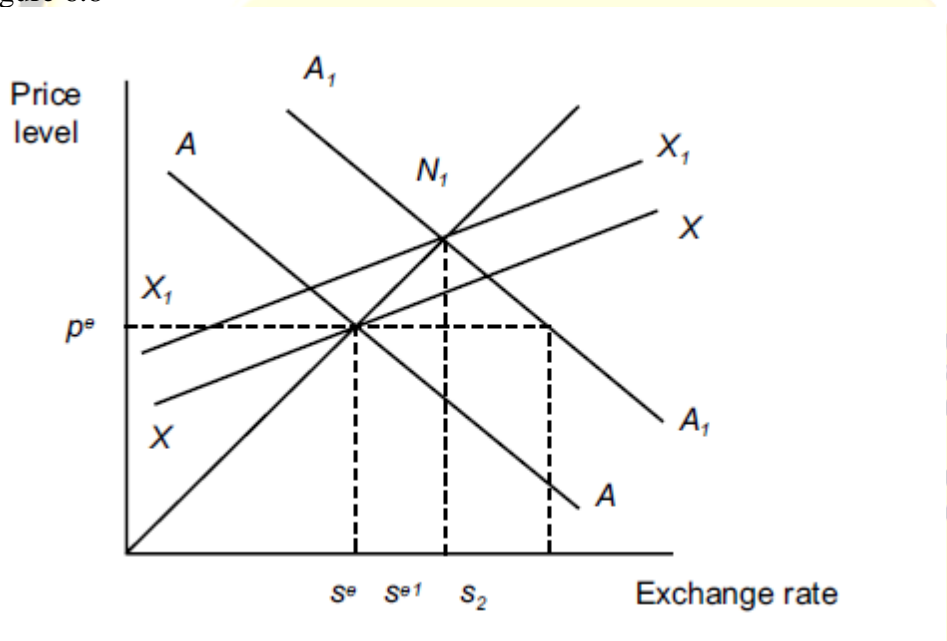
Assume now a once and for all unanticipated increase in the supply of money. The AA curve shifts out to A_1A_1 in Figure 10.6. There is no permanent effect on the current account of the balance of payments and PPP holds at the new equilibrium at N_1 (X_1X_1 shifts up). Investors realize this.

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 N_1 with an exchange rate of s_{e1} . 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 s_2 . At s_2 , 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.

There follows a gradual adjustment to the new equilibrium exchange rate, s_{e1} , 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 in s Figure 6.8: A money supply increase in the Dornbusch model

Figure 6.8



Another well-known model (Frankel, 1979) combines inflationary expectations with the sticky price element of the Dornbusch model. As in Dornbusch, 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.

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.

As in the Dornbusch model, an unanticipated monetary expansion in the domestic economy causes the exchange rate to overshoot its long-run equilibrium level. Other similar models have been developed, distinguishing for example between the speeds of adjustment of the prices of tradable and non-tradable goods or of volumes and prices of exports and imports (known in the balance of payments literature as the J-curve). The central feature of these models is that they retain most of the assumptions of the standard approach to foreign exchange markets while attempting to produce results closer to the reality of volatile exchange rates. They also suggest that the monetary authorities can influence real variables in the short run, although not in the long run. The importance of the freedom granted to the monetary authorities depends on the length of time taken for prices and the nominal exchange rate to move to their long-run equilibrium positions.

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. For example, assume the monetary authorities wish to reduce the rate of inflation. If they reduce the rate of growth of the money supply sharply and interest rates rise, but prices do not change in the short run, the nominal and real exchange rates fall sharply (overshooting the long-run equilibrium level), causing problems for exporters and import-competing industries. Unemployment results. If prices were slow to change, these real problems would persist for a considerable time. The position would be worse if the short-run overvaluation of the currency caused bankruptcies of domestic firms and serious loss of market share in important industries. The short-run cost of reducing inflation could be high. This leads to the view that monetary policy should be applied gradually to allow the economy to adjust slowly.

There remain 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.

However, the country's holding of foreign exchange reserves increases and the money supply rises, creating inflationary pressure. The inflation then removes the competitive advantage obtained from the higher exchange rate of the domestic currency. The monetary authorities aim to counter this by selling domestic bonds to reduce the domestic component of the money stock. Consider this in terms of equation 7.2 :

$$M = D + R$$



The authorities attempt to increase R and reduce D so that the money supply does not change, but the exchange rate does, but this type of operation is not possible within the framework of a monetary model of exchange rate determination because domestic and foreign bonds are perfect substitutes.

Changes in D and R have equivalent effects on the exchange rate. This is another way of saying that in a monetary model, the monetary authorities cannot influence the real exchange rate (except in the short-run, in sticky price models).

Portfolio models of the exchange rate overcome this by dropping the assumption that foreign and domestic bonds are perfect substitutes. Uncovered interest rate parity does not apply. We assume that residents of the domestic economy think foreign bonds are more risky than equivalent domestic bonds and hence require a higher rate of interest on foreign bonds to be persuaded to hold them. This inclusion of differential risk in the analysis allows open market operations and foreign exchange operations to have different effects on interest rates and exchange rates, and introduces the possibility of monetary authorities making use of sterilized foreign exchange operations. Monetary authorities now have a wider choice of policy actions.

We have so far seen that with mobile capital the following applies:

- (a) in fixed exchange rate systems, the target of monetary policy is the exchange rate — domestic inflation rates are determined by the monetary policy of the whole system;
- (b) in floating rate systems, the monetary authorities can target the domestic rate of inflation.

In practice, however, exchange rates in floating exchange rate systems do not float freely. Central banks intervene to varying degrees to influence exchange rates. Sometimes the intervention is light, with the intention only of smoothing out fluctuations in exchange rates. On other occasions, central banks join together to intervene strongly in the foreign exchange market in the hope of influencing the direction in which exchange rates are moving or to try to keep rates within unspecified target ranges. In this case, monetary policy may be aimed either at internal or at external objectives.

1.6.4 The Policy Mix and Monetary Policy Coordination

One of the standard arguments for floating exchange rates is that they isolate an economy from external shocks, allowing the authorities to pursue their own independent monetary policy. However, it has become clear that all economies are interdependent and are subject to spillovers from the domestic monetary policies of other economies. Further, the degree of interdependence among countries has been growing. This happened particularly in the early 1970s because of:

- increased capital flows after the collapse of the Bretton Woods fixed exchange rate system
- alterations in terms of trade following large changes in world oil Prices a greater degree of openness to foreign trade and the development of offshore financial markets.



Our particular interest here is in what has been called ‘sensitivity independence’, defined by Cooper (1985) as the amount of adjustment a country has to make to foreign events under conditions of normal economic activity. This is determined by factors such as the marginal propensities to spend on foreign products or assets, the elasticity of substitution between foreign and domestic products or assets, the elasticity of substitution in production and the relative size of the economies in question. The theoretical approach to macroeconomic policy coordination calls upon a number of areas of macroeconomic theory, as well as making use of games theory to incorporate in models the notions of credibility and reputation, and the sustainability and time consistency of policy.

The first stage in the analysis of macroeconomic interdependence among economies was the investigation of the channels along which influence flows from one economy to another. The beginnings of a case for some form of policy coordination can be derived from the simple open economy multiplier. For a small economy, it is clear that increased linkages with the rest of the world weaken the impact on domestic targets of domestic fiscal policy. Models can, however, be greatly complicated by dropping the small country limitation, by making different assumptions about the nature of the exchange rate regime, by introducing various forms of price or wage stickiness, or by considering the timing and nature of tax policy changes needed to pay for government expenditure increases.

The analysis of monetary linkages builds on the Mundell-Fleming model, making varying assumptions about the exchange rate regime, the degree of international capital mobility, and country size. Depending on the assumptions made, spillovers from domestic macroeconomic policy may be positive or negative. The importance of spillovers became clearer, however, with the recognition of price spillovers operating through the terms of trade linkage (Hamada, 1976). This plainly meant the end of arguments that a country could fully insulate itself from events and policies in the rest of the world. Even with perfectly flexible exchange rates, the terms of trade transmission works.

Cooper (1969) examined the impact of spillovers on domestic policy using a simple model with fixed exchange rates and constant prices. He argued that the greater is the degree of interdependence (and the stronger are spillovers), the less will be the effectiveness of policies in non-cooperating economies. Greater interdependence, in other words, leads to either worse results from domestic policies and longer periods away from equilibrium, or greater costs to restore targets to their desired values.

In Canzoneri and Gray’s (1985) model, the governments of two identical countries both attempt to achieve full employment output without increasing inflation. Both countries are subject to supply shocks. The paper is concerned with the monetary transmission mechanism, specifically with the impact of an expansion of the money supply in each country. Canzoneri and Gray consider three possibilities:

- (a) beggar-thy-neighbour in which monetary expansion in one economy has a negative effect on output in the other economy
- (b) locomotive in which the spillover effects are positive and
- (c) asymmetric in which monetary spillovers have different signs, the result depending on the size



of the exchange rate and interest rate changes following the domestic monetary expansion as well as the import content of the foreign price index. The outcome is an empirical question, depending on the structure of the economies involved.

It has been shown that it is possible both for an instrument's spillovers to change signs over time and for an instrument to have impacts of different signs depending on the target at which it is aimed. Specific conclusions of theoretical models must, however, be treated with caution since many depend on the sign or relative size of particular coefficients while the models assume that the economy's behavioural parameters are unchanged under different conditions. They thus founder on the Lucas critique. In addition, there have not been enough empirical studies to produce clear ideas about the likely direction and size of spillovers in practice. We are only left, following Hughes-Hallett (1989), with a set of not very surprising theoretical conclusions:

- Spillovers vary with the policies pursued in other countries
- There are multiple transmission mechanisms that operate simultaneously
- Net spillover effects depend on the particular circumstances of the economies concerned
- The impacts of spillovers crucially depend on the size of the economy, the degree of asset substitutability, relative price and wage flexibility and exchange rate flexibility.

Games theory has been used to analyze the desirability of policy coordination. This commenced with the development of models incorporating two simple forms of policy decisions by national governments in an international context — Nash non-cooperative games in which either governments act independently taking the decisions of other governments as given or one country acts as leader; and cooperative games in which countries attempt to pursue some common interest, attempting to maximize the sum or product of the utilities of the national governments. The problem is to elucidate and, if possible, to quantify the gains from co-operative decisions.

Non-cooperative models suffer from a variety of defects. For example, they consider only static decisions and thus allowance cannot be made for predictable future effects of current decisions. Further, the restrictions on the assumptions regarding the behaviour of the other country's policy makers presupposes that policy makers already know the form of the equilibrium decision rule: but this can only be so in special circumstances. Despite these difficulties, the sub-optimality of non-cooperative decisions is accepted. The presence of significant policy spillovers forms the basis of a well-known model (Hamada 1976, 1985) illustrating the case for international policy coordination between countries. It is a two-country model, with each country targeting its inflation rate and balance of payments position in a fixed exchange rate regime. Each country controls a single policy instrument — the level of domestic credit creation. Neither country can attain both objectives by acting alone except by coincidence. In one version of this model with demand-constrained output and price inertia, Nash noncooperative behaviour gives the system a deflationary bias. Coordination is clearly preferable.

This fits in with the general conclusion that non-cooperative decisions are socially inefficient except under special conditions.

However, it is one thing to argue for the inefficiency of non-cooperation, but quite another to



accept the need for coordination. To begin with, one can produce cases where Nash non-cooperative behaviour is superior to cooperation. Perhaps the best-known example of this is Rogoff's international inflation game in which governments gain from unexpected inflation (Rogoff, 1985b). In Rogoff's model, governments fix exchange rates and then agree to raise their domestic money supplies. By cooperating, they are able to exploit the gains to be had from inflation surprises. Their citizens lose out. This assumes that the private sector can be taken by surprise.

Most models rule this possibility out by assuming forward-looking expectations. Without surprises, the costs to the private sector of anticipated inflation remain, but an understanding of the nature of government policy by the private sector leads to a rapid reduction in their willingness to hold government debt except at interest rates that fully take government policy into account. One can also show that the degree of sub-optimality of non-cooperative decisions can be affected by the strength of preferences of national policy makers, by the economy's policy responses, and by capacity constraints.

We can only conclude that the size of net gains (or losses) from cooperation can only be determined by empirical analysis. In attempting to bridge the gap, however, between theory and reality, economic theory has paid most attention to a different set of difficulties — if governments succeed in reaching an agreement to coordinate macroeconomic policies, how can we be sure that such policies will be sustained in each country? There are two separate issues here.

The first deals with the relationship between the state and the private sector. If rational expectations are assumed and thus the private sector cannot be taken by surprise by the government, the effectiveness of macroeconomic policy depends on that policy being credible to the private sector. If this is not the case, macroeconomic policy is ineffective. One way out for governments is to pre-commit themselves to their stated policy. An obvious example is the pre-commitment of monetary policy through membership of a fixed exchange rate regime as long as the exchange rate parity is itself credible.

The second issue relates to the temptation felt by governments to renege on their agreements with other governments. The issue hardly arises in the Hamada two-country model since an attempt by one country to improve its position by renegeing on the agreement will be met by a withdrawal of the other country from the agreement — both countries move back to the original sub-optimal non-cooperative equilibrium and are worse off. The threat of such action prevents either country from renegeing. However, with more than two participants, the question of the credibility of threats becomes relevant.

Where the incentive to renege on agreements cannot be removed by credible threats to retaliate, policy coordination cannot be sustained. There are two ways out of this dilemma. The first is to concentrate on the notion of reputation. Governments may adopt a longer term view of coordination than is implied by the one-off bargains that dominate the world of policy models.

Consequently, they may be willing to forgo potential short-term gains available from renegeing on agreements in order to make future bargains possible. Yet again, the loss of reputation in the field of macroeconomic policy coordination might be thought likely to affect a country's standing in



other international negotiations. This is an example of the problems involved in analyzing macroeconomic policy in isolation. It is clear that the outcomes of G7 economic summits have been influenced by much more than narrow macroeconomic considerations.

The second way out is to develop arguments in favour of rule-based rather than discretionary policy coordination. The acceptance of rules means that all governments are pre-committed to agreed policies, removing the dangers apparent in cases where some parties are effectively pre-committed but others are not. A considerable number of empirical studies have been undertaken. These have produced mixed results regarding the benefits from macroeconomic policy coordination. On balance, where studies have shown gains from coordination, they have tended to be rather small, although the gains appear to increase with the persistence of disturbances that lead to coordination.

They also appear to increase over time. In the long run, gains from cooperation in the face of permanent supply or demand shocks may be very considerable. Such studies are of some interest in themselves but the ability of researchers to vary the results by making relatively small changes in their models means that they can, at best, provide only lukewarm support for policy coordination.



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