Chapter 16

Money in macroeconomics

Money buys goods and goods buy money; but goods do not buy goods.


Up to now we have put monetary issues aside. The implicit assumption has been that the exchange of goods and services in the market economy can be carried out without friction as mere barter. This is, of course, not realistic. At best it can be an acceptable approximation to reality only for a limited set of macroeconomic issues. We now turn to models in which there is a demand for money. We thus turn to monetary theory, that is, the study of causes and consequences of the fact that a large part of the exchange of goods and services in the real world is mediated through the use of money.

16.1 What is money?

16.1.1 The concept of money

In economics money is defined as an asset (a store of value) which functions as a generally accepted medium of exchange, i.e., it can in principle be used directly to buy any good. A note of IOU (a bill of exchange) may also be a medium of exchange, but it is not generally accepted and is therefore not money. Generally accepted mediums of exchange are also called means of payment. So money is characterized by being a fully liquid asset. An asset is fully liquid if it can be used directly, instantly, and without any costs or restrictions to make payments.

Generally, liquidity should be conceived as a matter of degree so that an asset has a higher or lower degree of liquidity depending on the extent to
Three individuals: A, B, C
Three goods: 1, 2, 3

Figure 16.1: No direct exchange possible. A medium of exchange, here good 2, solves the problem (for details, see text).

which it can easily be exchanged for money or be used directly for making payments. By “easily” we mean “immediately, conveniently, and cheaply”. So an asset’s liquidity is the ease with which the asset can be converted into money or be used directly for making payments. Where to draw the line between “money” and “non-money assets” depends on what is appropriate for the problem at hand. In the list below of different monetary aggregates (Section 16.2), $M_1$ corresponds most closely to the traditional definition of money. Defined as currency in circulation plus demand deposits held by the non-bank public in commercial banks, $M_1$ embraces all in practice fully liquid assets in the hands of the non-bank public.

The reason that a market economy uses money is that money facilitates trade enormously, thereby reducing transaction costs. Money helps an economy to avoid the need for a “double coincidence of wants”. The classical way of illustrating this is by the exchange triangle in Fig. 16.1. The individuals A, B, and C are endowed with one unit of the goods 1, 3, and 2, respectively. But A, B, and C want to consume 3, 2, and 1, respectively. Thus, no direct exchange is possible between two individuals each wanting to consume the other's good. There is a lack of double coincidence of wants. The problem can be solved by indirect exchange where A exchanges good 1 for good 2 with C and then, in the next step, uses good 2 in an exchange for good 3 with B. Here good 2 serves as a medium of exchange. If good 2 becomes widely used and accepted as a medium of exchange, it is money. Extending the example to a situation with $n$ goods, we have that exchange without money (i.e., barter) requires $n(n - 1)/2$ markets (“trading spots”). Exchange with money, in the form of modern “paper money”, requires only $n$ markets.

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16.1.2 Historical remarks

In the past, ordinary commodities, such as seashells, rice, cocoa, precious metals etc., served as money. That is, commodities that were easily divisible, handy to carry, immutable, and involved low costs of storage and transportation could end up being used as money. This form of money is called \textit{commodity money}. Applying ordinary goods as a medium of exchange is costly, however, because these goods have alternative uses. A more efficient way to trade is by using currency, i.e., coins and notes in circulation with little or no intrinsic value, or pieces of paper, checks, representing claims on such currency. Regulation by a central authority (the state or the central bank) has been of key importance in bringing about this transition into the modern payment system.

Coins, notes, and pieces of paper, with no intrinsic value, that are generally accepted media of exchange, are called \textit{paper money}. By having these pieces of paper circulating and the real goods moving only once, from initial owner to final consumer, the trading costs in terms of time and effort are minimized.

In the industrialized countries these paper monies were in the last third of the nineteenth century and until the outbreak of the First World War \textit{backed} through the gold standard. And under the Bretton-Woods agreement, 1947-71, the currencies of the developed Western countries outside the United States were convertible into US dollars at a fixed exchange rate (or rather an exchange rate which is adjustable only under specific circumstances); and US dollar reserves of these countries were (in principle) convertible into gold by the United States at a fixed price (though in practice with some discouragement from the United States).

This indirect gold-exchange standard broke down in 1971-73, and nowadays money in most countries is \textit{unbacked} paper money (including electronic entries in banks’ accounts). This feature of modern money makes its valuation very different from that of other assets. A piece of paper money in a modern payments system has no worth at all to an individual unless she \textit{expects} other economic agents to value it in the next instant. There is an \textit{inherent circularity} in the acceptance of money. Hence the viability of such a paper money system is very much dependent on adequate juridical institutions as well as confidence in the ability and willingness of the government and central bank to conduct policies that sustain the purchasing power of the currency. One elementary juridical institution is that of “legal tender”, a status which is conferred to certain kinds of money. An example is the law that a money debt can always be settled by currency and a tax always be paid by currency. A medium of exchange whose market value derives entirely

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from its legal tender status is called **fiat money** (because it exists by “fiat”, a ruler’s declaration). In the absence of intrinsic value, maintaining the exchange value of fiat money over time, that is, avoiding high or fluctuating inflation, is one of the central tasks of monetary policy.

### 16.1.3 The functions of money

The following three functions are sometimes considered to be the definitional characteristics of money:

1. It is a generally accepted medium of exchange.

2. It is a store of value.

3. It serves as a unit of account in which prices are quoted and books kept (the *numeraire*).

On can argue, however, that the last function is on a different footing compared to the two others. Thus, we should make a distinction between the functions that money *necessarily* performs, according to its definition, and the functions that money *usually* performs. Property 1 and 2 certainly belong to the essential characteristics of money. By its role as a device for making transactions money helps an economy to avoid the need for a double coincidence of wants. In order to perform this role, money *must* be a store of value, i.e., a device that transfers and maintains value over time. The reason that people are willing to exchange their goods for pieces of paper is exactly that these can later be used to purchase other goods. As a store of value, however, money is *dominated* by other stores of value such as bonds and shares that pay a higher rate of return. When nevertheless there is a demand for money, it is due to the *liquidity* of this store of value, that is, its service as a medium of exchange.

Property 3, however, is not an indispensable function of money as we have defined it. Though the money unit is usually used as the unit of account in which prices are quoted, this function of money is conceptually distinct from the other two functions and has sometimes been distinct in practice. During times of high inflation, foreign currency has been used as a unit of account, whereas the local money continued to be used as the medium of exchange. During the German hyperinflation of 1922-23 US dollars were the unit of account used in parts of the economy, whereas the mark was the medium of exchange; ad during the Russian hyperinflation in the middle of the 1990s again US dollars were often the unit of account, but the rouble was still the medium of exchange.
This is not to say that it is of little importance that money usually serves as numeraire. Indeed, this function of money plays an important role for the short-run macroeconomic effects of changes in the money supply. These effects are due to nominal rigidities, that is, the fact that prices, usually denominated in money, of many goods and services generally adjust only sluggishly.

16.2 The money supply

The money supply is the total amount of money available in an economy at a particular point in time (a stock). As noted above, where to draw the line between assets that should be counted as money and those that should not, depends on the context.

16.2.1 Different measures of the money supply

Usually the money supply in an economy is measured as one of the following alternative monetary aggregates:

- $M_0$, i.e., the monetary base, sometimes called base money or high-powered money. This is defined as fully liquid claims on the central bank held by the private sector, that is, currency (coins and notes) in circulation plus demand deposits held by the commercial banks in the central bank.\(^1\) This monetary aggregate is under the direct control of the central bank and is changed by so-called open-market operations, that is, by the central bank buying or selling bonds, often short-term government bonds. But clearly it is an imperfect measure of the liquidity in the private sector.

- $M_1$, defined as currency in circulation plus demand deposits held by the non-bank public in commercial banks. These deposits are also called checking accounts because they are deposits on which checks can be written and payment cards (debit cards) be used. Note that $M_1$ does not include currency in the vaults of commercial banks and demand deposits held by commercial banks in the central bank. Thus, although $M_1$ is a “broader” measure of money supply and generally includes by far the most of $M_0$, it does not include all of $M_0$. The measure $M_1$ is intended to reflect the quantity of assets which serve as media of exchange in the hands of the non-bank public.

\(^1\)The commercial banks are part of the private sector and by law it is usually only the commercial banks that are allowed to have demand deposits in the central bank.

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Broader categories of money include:

- $M_2 = M_1$ plus savings deposits with unrestricted access and small-denomination time deposits (say under €100,000). These claims may not be instantly liquid.

- $M_3 = M_2$ plus large-denomination (say above €100,000) time-deposits.²

As we move down the list, the liquidity of the added assets decrease, while their interest yield increases.³ Currency earns zero interest. When in macroeconomic texts the term “money stock” is used, most often $M_1$ or $M_2$ is meant. Along with currency, the demand deposits in the commercial banks are normally fully liquid, at least as long as they are guaranteed by a governmental deposit insurance (although normally only up to a certain maximum per account). The interest earned on these demand deposits is usually low and in fact often ignored in simple theoretical models.

A related and theoretically important simple classification of money types is the following:

1. **Outside money** = money that on net is an asset of the private sector.

2. **Inside money** = money that on net is not net wealth of the private sector.

Clearly $M_0$ is outside money. However, most money in modern economies is inside money. Deposits at the commercial banks is an example of inside money. These deposits are an asset to their holders, but a liability of the banks. Even broader aggregates of money (or “near-money”) than $M_3$ are sometimes considered. For instance, it has been argued that the amounts that people are allowed to charge by using their credit cards should be included in the concept of “broad money”. But this would involve double counting. Actually you do not pay when you use a credit card at the store. It is the company issuing the credit card that pays to the store (shortly after you made your purchases). You postpone your payment until you receive your monthly bill from the credit card company. That is, the credit card company does the payment for you and gives credit to you. It is otherwise with a payment card where the amount for which you buy is almost instantly charged your account in the bank.

²So, whereas (in casual notation) $M_0 \not\subseteq M_1, M_1 \subset M_2 \subset M_3$.

³This could be an argument for weighing the different components of a monetary aggregate by their degree of liquidity (see Barnett, 1980, and Spindt, 1985).
16.2.2 The money multiplier

Bank lending is the channel through which the monetary base expands to an effective money supply, the “money stock”, considerably larger than the monetary base. The excess of the deposits of the public over bank reserves is lent out in the form of bank loans, purchases of bonds etc. The public then deposits a fraction of these loans on checking accounts. Next, the banks lend out a fraction of these and so on. This process is named the money multiplier process. And the ratio of the “money stock”, usually measured as $M_1$, to the monetary base is called the money multiplier.

Let

\[
\begin{align*}
\text{CUR} &= \text{currency held by the non-bank public}, \\
\text{DEP} &= \text{demand deposits held by the non-bank public}, \\
\frac{\text{CUR}}{\text{DEP}} &= \text{cd, the desired currency-deposit ratio}, \\
\text{RES} &= \text{bank reserves = currency held by commercial banks plus their demand deposits in the central bank}, \\
\frac{\text{RES}}{\text{DEP}} &= \text{rd, the desired reserve-deposit ratio}.
\end{align*}
\]

Notice that the currency-deposit ratio, $\text{cd}$, is chosen by the non-bank public, whereas the reserve-deposit ratio, $\text{rd}$, refers to the behavior of commercial banks. In many countries there is a minimum reserve-deposit ratio required by law. On the top of that the banks may hold excess reserves depending on their assessment of lending risks etc. To find the money multiplier, note that

\[
M_1 = \text{CUR} + \text{DEP} = (\text{cd} + 1)\text{DEP},
\]

where $\text{DEP}$ is related to the monetary base, $M_0$, through

\[
M_0 = \text{CUR} + \text{RES} = \text{cdDEP} + \text{rdDEP} = (\text{cd} + \text{rd})\text{DEP}.
\]

Substituting into (16.1) gives

\[
M_1 = \frac{\text{cd} + 1}{\text{cd} + \text{rd}} M_0 = \text{mm}M_0,
\]

where $\text{mm} = (\text{cd} + 1)/(\text{cd} + \text{rd})$ is the money multiplier.

As a not unrealistic example consider $\text{cd} \approx 0.7$ and $\text{rd} \approx 0.07$. Then we get $\text{mm} \approx 2.2$. When broader measures of money supply are considered, then, of course, a larger money multiplier arises. It should be kept in mind that both $\text{cd}$ and $\text{rd}$, and therefore also $\text{mm}$, are neither constant nor exogenous.
from the point of view of monetary models. They are highly endogenous and depend on interest rates on alternative assets, risks, the degree of sophistication of payment technologies etc. To some extent it is therefore a simple matter of identities and not particularly informative, when we say that, given \( M_0 \) and the currency-deposit ratio, the money supply is smaller, the larger is the reserve-deposit ratio. Similarly, since the latter ratio is usually considerably smaller than one, the money supply is also smaller, the larger is the currency-deposit ratio. Nevertheless, the money multiplier turns out to fairly stable under "normal circumstances". But not always. During 1929-33, in the early part of the Great Depression, the money multiplier in the US fell sharply. Although \( M_0 \) increased by 15\% during the four-year period, liquidity (\( M_1 \)) declined by 27\%.\(^4\) The banking panic lead people to withdraw their deposits (increasing \( c_d \)) and lead the banks to hold more reserves (increasing \( r_d \)). There is quite general agreement that these circumstances contributed to the depression and the ensuing deflation.

There is another formula for the money multiplier. Let \( cm \) denote the non-bank public’s desired currency-money ratio, i.e., \( cm = CUR/M_1 \). Then

\[
CUR = cmM_1 = cm(c_d + 1)DEP \quad \text{(by (16.1))}
\]

so that \( cm = cd/(cd + 1) \) and \( 1 - cm = 1/(cd + 1) \). Combining this with (16.2) yields

\[
M_1 = \frac{cd}{cd+1} + r_d \frac{1}{cd+1} = \frac{cm + r_d(1 - cm)}{cm + r_d(1 - cm)} = \frac{1}{1 - (1 - r_d)(1 - cm)}M_0 = \frac{mmM_0}{1 - (1 - r_d)(1 - cm)}.
\]

The way the central bank controls the monetary base is through open-market operations, that is, by buying or selling bonds (usually short-term bonds) in the amount needed to sustain a desired level of the monetary base. In the next stage the aim could be to obtain a desired level of \( M_1 \) or a desired level of the short-term interest rate or (in an open economy) a desired exchange rate vis-a-vis other currencies.

A perhaps more intuitive understanding of the money multiplier and the way commercial banks “create” money can be attained from a dynamic angle. Suppose the central bank increases \( M_0 \) by the amount \( \Delta M_0 \) through an open-market operation, thus purchasing bonds. This is the first round. The seller of the bonds deposits the fraction \( 1 - cm \) on a checking account in her bank and keeps the rest as cash. The bank keeps the fraction \( r_d \) of \( (1 - cm)\Delta M_0 \) as reserves and provides bank loans or buys bonds with the rest. This is the

\(^4\)Blanchard (2003).

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second round. Thus, in the first round money supply is increased by $\Delta M_0$; in the second round it is further increased by $(1 - rd)(1 - cm)\Delta M_0$; in the third round further by $(1 - rd)^2(1 - cm)^2\Delta M_0$, etc. In the end, the total increase in money supply is

$$\Delta M_1 = \Delta M_0 + (1 - rd)(1 - cm)\Delta M_0 + (1 - rd)^2(1 - cm)^2\Delta M_0 + \ldots$$

$$= \frac{1}{1 - (1 - rd)(1 - cm)}\Delta M_0 = mm\Delta M_0.$$

The second last equality comes from the rule for the sum of an infinite geometric series with quotient in absolute value less than one. The conclusion is that the money supply is increased $mm$ times the increase in the monetary base.

### 16.3 Money demand

Explaining at the microeconomic level in a precise way how paper money gets purchasing power and how the demand for money is determined, is a difficult task. Suffice it to say that in the presence of sequential trades and the absence of complete information and complete markets, there is a need for a generally accepted medium of exchange — money. In macroeconomics the demand for money is considered as part of a broader portfolio allocation problem about how economic agents allocate their financial wealth among the different existing assets, including money. The portfolio decision involves a balance of considerations of expected rate of return after tax, risk, and liquidity. Money is primarily demanded because of its liquidity service in transactions. The demand for money therefore depends on the amount of transactions expected to be carried out in the near future. The demand for money also depends on the need for flexibility in spending when there is uncertainty: it is convenient to have ready liquidity in case favorable opportunities should turn up. Generally money earns no interest at all or at least less interest than other assets, and therefore the demand for money involves a trade-off between the need for liquidity and the wish for a high interest yield.

The incorporation of a micro-founded money demand in macromodels is often based on one or another kind of short-cut:

- **The cash-in-advance constraint** (also called the Clower constraint).\(^6\)

  Here it is simply postulated that money must be used in most or all

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\(^5\)For simplicity, we assume here that $cm$ and $rd$ are constant.

\(^6\)After the American monetary theorist Robert Clower (1967).
transactions. The household’s purchases of consumption goods in a short period must be paid for by money held at the beginning of the period. In continuous time models the assumption is that the needed stock of money is given by some increasing function of the desired consumption per time unit.

- The *shopping-costs* approach. Here the liquidity services of money are modelled as reducing shopping time or other kinds of pecuniary or non-pecuniary shopping costs.

- The *money-in-the-utility function* approach. Here, the indirect utility that money provides through reducing non-pecuniary transaction costs is modelled as if the economic agents obtain direct utility by holding money. This will be our approach in the next chapter.

- The *money-in-the-production-function* approach. Here money facilitates the firms’ transactions, making the provision of the necessary inputs easier. After all, typically around a third of the aggregate money stock is held by firms.\(^7\)

### 16.4 What is then the “money market”?

In macroeconomic theory, by the “money market” is meant an abstract market place (not a physical location) where at any particular moment the aggregate demand for money “meets” the aggregate supply of money. Suppose the aggregate demand for real money balances can be approximated by the function \(L(Y, i)\), where \(L_Y > 0\) and \(L_i < 0\). The level of aggregate economic activity, \(Y\), enters as an argument because it proxies the volume of transactions to be carried out in the near future. The “short-term nominal interest rate”, \(i\), enters because it is the opportunity cost of holding cash instead of interest-bearing short-term securities.\(^8\) The latter constitute a close substitute to money because they have a relatively high degree of liquidity (they are extensively traded and their market value is less volatile than longer-term securities).

Let the monetary aggregate in focus be \(M_1\) and let \(P\) be the general price level in the economy (say the GDP deflator). Then money market

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\(^7\)Mankiw and Summers (1986). For more details about the different ways of modelling money demand in macroeconomics, the reader is referred to Walsh (2003).

\(^8\)To simplify, we assume that none of the components in the monetary aggregate considered earns interest. In practice demand deposits in the central bank and commercial banks may earn a small nominal interest.
16.4. What is then the “money market”?

Equilibrium is present if

\[ M_1 = PL(Y, i), \]

(16.4)

that is, the available amount of money equals nominal money demand. Note that supply and demand are in terms of stocks (amounts at a given point in time), not flows. One of the issues in monetary theory is to account for how this stock equilibrium is brought about at any instant. Which of the variables \( M_1, P, Y, \) and \( i \) is the equilibrating variable? In classical (pre-Keynesian) monetary theory it was \( P \), in Keynesian monetary theory it is primarily \( i \).

One may also think of the “money market” in a more narrow sense, however. We may translate (16.4) into a description of demand and supply for base money:

\[ M_0 = \frac{P}{mm}L(Y, i), \]

(16.5)

where \( mm \) is the money multiplier. The right-hand side of this equation reflects that the demand for \( M_1 \) via the actions of commercial banks is translated into a demand for base money.\(^9\) If the public needs more cash, the demand for bank loans increases and when granted, banks’ reserves are reduced. When in the next round the deposits in the banks increase, then generally also the banks’ reserves have to increase. To maintain the required reserve-deposit ratio, banks which for a few days have too little liquidity, borrow from other banks or other institutions which have too much.

This narrowly defined money market is closely related to what is by the practitioners and in the financial market statistics called the “money market”, namely the trade in debt-instruments, commercial paper, and treasury bills with maturity of less than one year. The agents trading in this market not only include the central bank and the commercial banks but also the mortgage credit institutions and possibly also life insurance companies and other financial institutions. What is in the theoretical models called the “short-term nominal interest rate” can normally be identified with what is in the financial market statistics called the money market rate or the interbank rate. This is the interest rate (measured as a per year rate) at which the commercial banks provide unsecured loans (“signature loans”) to each other, often on a day-to-day basis.

\(^9\) If the economy has ended up in a so-called liquidity trap with \( i \) at its lower bound, \( 0 \), an increase in \( M_1 \) will not generate further reductions in \( i \). Agents would prefer holding cash at zero interest rather than short-term bonds at negative interest. That is, the “=” in the equilibrium condition (16.4) should be replaced by “\( \geq \)”. This issue is taken up in later chapters.

\(^{10}\) Although the money multiplier tends to depend positively on \( i \), this aspect is unimportant for the discussion below and is ignored in the notation in (16.5).

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Open market operations The commercial banks may under certain conditions borrow (on a secured basis) from the central bank at a rate usually called the *discount rate*. This central bank lending rate will be somewhat above the central bank *deposit rate*, that is, the interest rate, possibly nil, earned by the commercial banks on their deposits in the central bank. The interval between the discount rate and the deposit rate constitutes the *interest rate corridor*, within which, under “normal circumstances”, the money market rate, \( i \), fluctuates. The central bank deposit rate acts as a floor for the money market rate and the central bank lending rate as a ceiling. Sometimes, however, the money market rate exceeds the central bank lending rate. This may happen in a financial crisis where the potential lenders are hesitant because of the risk that the borrowing bank goes bankrupt and because there are constraints on how much, and when, a commercial bank in need of cash can borrow from the central bank.

If the money market rate, \( i \), tends to deviate from what the central bank aims at (the “target rate”, also called the “policy rate”), the central bank will typically through open-market operations provide liquidity to the money market or withhold liquidity from it. The mechanism is as follows. Consider a one-period bond with a secured payoff equal to 1 Euro at the end of the period and no payoffs during the period (a so-called zero-coupon bond or discount bond). To fix ideas, let the period length be one month. Let \( Q \) be the market price (in Euros) of the bond at the beginning of the period. The implicit monthly interest rate, \( x \), is then the solution to the equation \( Q = (1 + x)^{-1} \), i.e.,

\[
x = \frac{1 - Q}{Q} = Q^{-1} - 1.
\]

Translated into an annual interest rate, with monthly compounding, this amounts to \( i = (1 + x)^{12} - 1 = Q^{-12} - 1 \) per year. With \( Q = 0.9975 \), we get \( i = 0.03049 \) per year.\(^{11}\)

Suppose the central bank finds that \( i \) is too high and buys a bunch of these bonds. Then less of them are available for the private sector, which on the other hand now has a larger money stock at its disposal. According to the Keynesian monetary theory (which is by now quite commonly accepted), under normal circumstances the general price level for goods and services is sticky in the short run. It will be the bond price, \( Q \), which responds. In the present case it moves up, thus lowering \( i \), until the available stocks of bonds and money are willingly held. In practice this adjustment of \( Q \), and hence \( i \), to a new equilibrium level takes place rapidly.

\(^{11}\)In continuous time with compound interest, we have \( Q = e^{-i/12} \) so that \( i = 12 \ln Q^{-1} = 0.03004 \) when \( Q = 0.9975 \).

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16.5. Key questions in monetary macroeconomics

In recent decades the short-term interest rate has been the main monetary policy tool when trying to stimulate or dampen the general level of economic activity. Under normal circumstances the open market operations give the central bank a quite narrow control over the short-term rate. Central banks typically announce their target level for the short-term rate and then adjust the monetary base such that the actual money market rate ends up close to the announced interest rate. This is what the European Central Bank (the ECB) does when it announces the target for EONIA (euro overnight index average) and what the U.S. central bank, the Federal Reserve, does when it announces the target for the federal funds rate, a weighted average of the interest rate commercial banks in the U.S. charge each other, usually overnight.

In the narrowly defined “money market” close substitutes to money are traded. From a logical point of view a more appropriate name for this market would be the “short-term bond market” or the “near-money market”. This would entail using the term “market” in its general meaning as a “market place” where a certain type of goods or assets are traded for money. Moreover, speaking of a “short-term bond market” would be in line with the standard name for market(s) for financial assets with maturity of one year or more, namely market(s) for longer-term bonds and equity; by practitioners these markets are also called the capital markets. Anyway, in this book we shall use the term “money market” in its broad theoretical meaning as an abstract market place where the aggregate demand for money “meets” the aggregate supply of money.

The open-market operations by the central bank affect directly or indirectly all the equilibrating prices in the financial markets as well as expectations about the future path of these prices. This influence derives from the direct control over the monetary base, $M_0$. The central bank has no direct control, however, over the money supply in the broader sense of $M_1$, $M_2$, or $M_3$. These broader monetary aggregates are also affected by the behavior of the commercial banks and the non-bank public. The money supply can at most be an intermediate target for monetary policy, that is, a target that can be reached in some average-sense in the medium run.

16.5 Key questions in monetary macroeconomics

Some of the central questions of monetary macroeconomics are:

1. How does the level and the growth rate of the money supply affect:

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(a) the real variables in the economy (resource allocation),
(b) the price level and the rate of inflation?

2. How can monetary policy be designed to stabilize the purchasing power of money and optimize the liquidity services to the inhabitants?

3. How can monetary policy be designed to stabilize business cycle fluctuations?

4. Do rational expectations rule out persistent real effects of changes in the money supply?

5. What kind of regulation of commercial banks is conducive to a smooth functioning of the credit system and reduced risk of a financial crisis?

6. Is hyperinflation always the result of an immense growth in the money supply or can hyperinflation be generated by self-fulfilling expectations?

As an example of a way to answer the long-run issues 1, 2, and 6, we will in the next chapter consider a kind of classical monetary model by Sidrauski (1967). In this model money enters as a separate argument in the utility function. The model provides a simple approach to the study of long-run aspects of a monetary economy, like the issues 1, 2, and 6 above. The model is less appropriate, however, for short- and medium-run issues such as 3, 4, and 5 in the list. These issues are dealt with in later chapters.

16.6 Bibliographical notes

In the Arrow-Debreu model, the basic microeconomic general equilibrium model, there is assumed to exist a complete set of markets. That is, there is a market for each “contingent commodity”, by which is meant that there are as many markets as there are possible combinations of physical characteristics of goods, dates of delivery, and “states of nature” that will then prevail. In such an idealized world any agent knows for sure the consequences of the choices made. All trades can be made once for all and there will thus be no need for any money holding.

16.7 Exercises

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