

August 7, 2000

Note On Monetary Policy and Institutions

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Monetary policy and monetary and financial institutions are of crucial importance for the global economy. There are several reasons for this:

- The banking system determines the quantity of money available in the economy. The money supply in the long run determines the price level. In other words, over long periods of time the growth of the money supply will determine the inflation rate.
- In a modern economy, financial institutions are the intermediaries that bring agents with excess resources (savers) together with agents in need of resources (investors). A well functioning financial system matches lenders and borrowers both within the domestic economy and with the rest of the world when current account imbalances lead to the accumulation of assets in one country or another.
- A sound banking system is essential to the operation of a modern economy. A sound banking and financial system will have a payments mechanism that can be used for transactions and will maintain a money asset that is trusted and accepted.
- Finally, government macroeconomic policy works through the financial system. Monetary policy is clearly a direct influence on the financial system. Fiscal policy also affects the financial system through its effects on government borrowing needs. Finally, government exchange rate policy affects the financial markets directly.

In this note we provide a brief introduction to seven basic monetary policy and monetary institutions topics:

- 1.** Banks and Central Banks
- 2.** Money: What is it and Why is it so important?
- 3.** Tools of Monetary Policy
- 4.** Effects of Monetary Policy
- 5.** Structure of the U.S. Federal Reserve
- 6.** Bank Regulation
- 7.** Central Banks and the Foreign Exchange Market

1. Banks and Central Banks

To begin, consider the balance sheet of a country's aggregate banking sector. That is, we will add all the banks together to obtain the aggregate balance sheet. As always, assets are on the left and liabilities are on the right.

Aggregate Bank Balance Sheet

ASSETS

Reserves, Res
Cash
Loans
Securities

LIABILITIES

Deposits
 Demand deposits, D
 Time deposits, etc. T
Borrowing from
 Central Bank B
 Other

Capital
 Equity and retained earnings
 Loan loss reserves

Bank assets include reserves, cash in the vaults, loans to customers and securities owned by banks. Bank reserves are a specific term that refers to the banking sector's deposits at the central bank. Bank liabilities include deposits and borrowing by the bank. (Actually, deposits are a form of borrowing: the bank is borrowing from the depositor.) Borrowing consists of borrowing from the central bank and other borrowing. The excess of assets over liabilities is the banking sector's capital. It consists of equity and accumulated retained earnings and loan loss reserves. We have labeled those terms that will be used specifically later on.

Now let's look at a typical central bank balance sheet:

Central Bank Balance Sheet

ASSETS

Securities Q
Loans to Banks B
Foreign Exchange reserves FX

LIABILITIES

Currency C
Reserves Res
Other deposits OD

Central bank assets include a portfolio of securities (usually government securities), loans that the central bank has made to banks in the country and the nation's foreign exchange reserves. The foreign exchange reserves can come in various forms: deposits at other central banks, bank deposits abroad, securities denominated in other currencies. For example, China has large foreign exchange reserves, which consist of a large portfolio of U.S., Japanese and other government securities. The central bank's liabilities include currency issues, the reserve deposits of the banks and other deposits. (Open your wallet and take out a dollar bill. It is a Federal Reserve note or a liability of a Federal Reserve Bank to you.) The central bank's other depositors can include foreign central banks, the government and perhaps some others.

The central bank can influence the behavior of the banking and financial system in two broad ways:

1. Macroeconomic monetary policy – Note that the banks hold reserves (an asset) that are supplied or created by the central bank (its liability). Monetary policy works through central bank intervention in the market for reserves. Monetary policy influences the banks efforts at profit maximization and how the banking sector manipulates its balance sheet.
2. Bank regulatory policy – Central banks are concerned with the stability of the banking and financial system and in order to maintain a sound banking system they impose safety and soundness regulations on the banks. Banks are subject to more regulation than other businesses because bank failure can have systemic consequences. Bank failure can impede the operation of the payments system and inhibit the process of intermediation, particularly if it leads to a panic in the banking system.

We will begin with the tools of macro monetary policy by looking at the market for reserves. That, is the supply and demand for reserves will be our focus.

Reserves, a liability of the central bank are deposits that are created by the central bank itself. A reserve deposit comes into existence when the central bank acquires an asset. For example, if the Bank of China buys U.S. government securities it pays for them by giving the seller (or its bank) a reserve deposit at the Bank of China. Similarly, when the Federal Reserve lends money to a bank it provides the loan by creating a reserve deposit for the lender. In short, reserves are created or supplied by the central bank

Reserves Supply by Central Bank

$$\text{Res}^S = Q + B(r, r^d) + \text{FX} - C - \text{OD}$$

Our reserve supply function is simply the balance sheet identity of the central bank re-written. That is, the supply of reserves changes as the central bank takes actions to change its balance sheet. For example, if the Central bank buys securities (Q increases) then it will pay for the securities by creating reserve deposits, crediting the reserve deposit accounts of the seller or its bank.

We have added one feature to the balance sheet identity. That is, we indicate that bank borrowing from the central bank depends on interest rates such as an inter-bank borrowing rate, r ,

and the rate set by the central bank for borrowing by banks, r^d , (the discount rate in the U.S.). The inter-bank borrowing rate (the Fed Funds rate in the U.S.) is a market-determined rate for borrowing of reserves of one bank from the other. This occurs because one bank may have more on deposit at the central bank than it wishes to hold while another seeks to hold more. Borrowing from the central bank itself is an increasing function of this interbank rate because central bank borrowing is more attractive when the interbank rate is high. The level of borrowing is a decreasing function of the central bank lending rate itself.

Next, we examine the demand for reserves. Reserves are central bank deposits held by the banks. In the U.S. (but not all other countries) these are non-interest earning deposits so, why would the banks want to hold such deposits? In other words, why is there a demand for reserves by banks?

A traditional answer to this last question is: “it’s the law, they have to.” That is, banks are often required to hold reserve deposits at the central bank. Often these reserve requirements are based on the size of the banks’ own deposit base. In the U.S. reserve requirements have been reduced over the years and are now quite small. Banks are required to hold reserves that are approximately 10% of demand deposit liabilities (D). These required reserves are small because demand deposits are only a small fraction of the banking sector balance sheet. In other countries such as Canada and the U.K. there are no statutory reserve requirements. So, we need another answer to the question: why demand reserves?

Banks use their accounts at the central bank for inter-bank clearing of funds. When I write you a check on an account at Bank X and you deposit it in your account in Bank Y, how does Y collect from X? The answer is that Bank X will instruct the central bank to transfer funds from the Bank X reserve account to the Bank Y reserve account. (Note that the total amount of reserves in existence does not change in this process.) Thus, Banks like X and Y hold reserve balances for clearing purposes. They will hold reserve accounts to be able to meet their anticipated need for clearing balances. In the U.S. the total reserve balances are just a tiny fraction of the total amount of check clearing that goes on in any day.

Now if the interbank rate is low, a bank might not be worried about being short of reserve balances because they can be borrowed from other banks cheaply. So the demand for reserves is a decreasing function of the interbank rate.

Reserves Demand by Banks

$$\text{Res}^D = F(\underset{+}{D}, \underset{+}{T}, \underset{+}{k}, \underset{-}{r}, \underset{-}{r}^d)$$

The demand for reserves is an increasing function of deposit balances (**D and T**) for two reasons: 1) remaining reserve requirements depend on deposit balances and 2) desired clearing balances will depend on deposit balances as well. The reserve demand function introduces reserve requirements explicitly by including the reserve requirement ratio, **k**. Finally, the demand for reserves declines with the interbank rate and the central bank borrowing rate.

Once we have specified the supply and demand for money, we can look at the market for reserves and the determination of the inter bank lending rate and show how monetary policy is implemented and works. Before we do so, we should make sure that the concept of money is clear.

2. Money: What is it and Why is it important?

Money is the stock of assets used to conduct transactions. In addition, holdings of money represent a store of value because they can always be exchanged for goods. Finally, the money unit of account (e.g. dollar, franc or yen) provides a common reference unit for quoting prices (called a numeraire). Although there is general agreement about this conceptual definition, it is often difficult to implement it specifically.

What is money? The answer is obvious, even to a toddler who has no problem recognizing bills and coins - currency. However, this definition is much too restrictive. Many objects have served various societies as money (including wampum and even cigarettes). In addition money has changed its physical characteristics over time. In the classical world, money consisted of gold and silver coins. Paper money that was convertible into specie dates to the seventeenth century. It is only recently that paper money that is not convertible into a precious metal has been widely used. Furthermore, in the modern world the role of money is often played by computer entries, which need never take on any tangible form.

It is best to define money in terms of the roles that it plays in economic society, rather than in terms of its physical attributes. The most important function of money is that it acts as a **medium of exchange**. People use money for purchases and sales of goods and services. Money is then whatever is accepted and used for transactions.

This transactions role of money is extremely important. Imagine the difficulties involved with living in a society without money. If people could not use money in exchange for goods and services, they would need to resort to barter. That is, they would need to exchange goods and services directly. A farmer would need to take her produce and find a cloth maker who not only had the type of cloth the farmer needed for her clothing but who also wanted the kind of produce the farmer had to sell. Next, the farmer would need to find someone who had the type of parts that fit her tractor and who wanted exactly the produce the farmer offered, and so on. The time and effort expended would be enormous.

The savings of time, effort and resources afforded by the use of a uniform money for all transactions provide a great benefit to society. It is no wonder that one of the principal goals of government is to see to it that society has a viable money asset.

Money also serves two other functions. It acts as a standard of value; it is the unit in which prices are expressed. It would be enormously difficult to keep track of prices in the absence of a

common reference unit. Finally, money can also act as a store of value. If we hold money, we are able to transfer our purchasing power over time.

What then are the assets in our economy that serve these purposes and can be called money? In practice, it is not often easy to draw a hard-and-fast line between money and other financial assets. In the United States, the Federal Reserve Board provides several formal definitions for the money stock. A summary of the formal definitions of the money supply is presented below. The narrow definition $M1$, consists of the assets which are most clearly held for transactions purposes. The broader definitions $M2$ and $M3$, include other financial assets which can be used for transactions with minimum difficulty or can be readily converted into a transaction asset. In addition to the three definitions of the money supply in common use, the Federal Reserve also prepares and monitors two broadly defined money aggregates, L (for liquidity) and *total debt*.

The narrowly defined money stock, $M1$, consists of coins, currency, demand deposits, and other checkable deposits (including travelers' checks). **Coins and currency** (paper money) are clearly used for transactions and should be included in even the narrowest measure of money. In addition, **checkable deposits** (deposits at banks and other financial institutions that are subject to payment upon demand) are used and accepted for most transactions. In fact, in the U.S. most transactions use checks or transfers of checkable deposits.

Some financial assets or instruments are not used directly for transactions but are easily and readily converted into a form that can be used for transactions. These **near-money** assets are included in the broader measures of the money supply. The broadly defined money supply, $M2$, includes all of the items in $M1$ and some instruments that are very easily converted into a transactions balance or can themselves be used for transactions with some restrictions. Thus, in addition to coins, currency, and checkable deposits, $M2$ includes savings deposits (including money market deposit accounts - MMDA), small time deposits (under \$100,000) with a specific maturity, money market mutual funds (MMMF) and overnight repurchase agreements.

There are measures of the money supply that are still broader than $M2$. These measures include financial instruments that are somewhat less easy to use for transactions than are the instruments in $M2$. For example, $M3$ includes all items in $M2$ along with time deposits in excess of \$100,000, term repurchase agreements, and some Eurodollar deposits held by U.S. residents.

In the 1960's and 1970's the monetarist economists emphasized the importance of the stock of the transactions asset. As a result policy makers began to follow the $M1$ aggregate closely. This culminated in a 1979 decision by the Federal Reserve to conduct policy by targeting the growth in $M1$. However, the deregulation of financial institutions and the technological advances in banking since the 1970's has reduced the differences between assets in $M1$ and in $M2$. In particular, some checkable deposits earn interest and deposit assets can be instantaneously moved into a transactions asset (at your corner cash machine). Thus, a broader definition of the money stock was preferred for policy analysis. In the 1990's, the ease with which economic agents can move among different types of money assets and non-money assets has increased enormously. As a result, changes in technology, tastes and small changes in interest rates have dramatic effects on money balances. By the end of the century, policy analysts generally ignore short run movements in the M 's.

U.S. MONETARY AGGREGATES, December 1994

	Billions of \$	Percentage Change over 1993
Currency	353.6	10.0%
Demand deposits	383.3	-0.4
OCDs	402.3	-2.9
Travelers checks	8.4	6.3
	-----	-----
<i>M1</i>	1147.6	1.7
 Savings deposits and MMDA	1145.5	-5.8
Small time deposits	818.1	4.1
MMMF	374.5	7.4
Overnight RPS and Euro\$	117.2	27.0
	-----	-----
<i>M2</i>	3600.0	0.9
 Large time deposits	363.6	7.3
Term RPs and Euro\$	103.6	7.0
Institutional MMMF	176.6	-10.4
	-----	-----
<i>M3</i>	4282.4	1.2
 Other liquid assets		
Savings bonds, short-term Treasuries,		
Bankers Acceptances, Commercial Paper		
	-----	-----
<i>L</i>	5269.9	2.4
 <i>Total Debt of Domestic Nonfinancial sectors</i>		
	12961.0	5.0

(NOTE: Totals do not add up due to omitted balancing items.)

For the present we will assume that there is a uniquely defined set of assets used for transactions purposes, which we call money and label M . Why is it so important?

The quantity equation relates the stock of money to the level of nominal income. The stock of the transactions assets turns over at a rate - called **velocity**, V - in order to generate the transactions that underlie the level of nominal income -- PY . The quantity **theory of money** states that the stock of money, M , times the rate of turn over is equal to the level of nominal income, PY :

$$MV = PY$$

Furthermore, the rate of turnover, velocity, will, in the long run be determined by the technology of the payments system so we will take it as given. In addition, in the long run the level of real output, Y , is determined by the productive potential of the economy. So, if V is given and Y is determined, then the quantity equation tells us that in the long run the price level, P , is determined by the money stock, M .

The quantity theory implies that changes in the money supply effect the price level and has no other effects. The enormous emphasis on monetary policy suggests that there are also short-run effects of changes in monetary policy and the money stock, which we will explore later. The long-run view, which is that in the long-run money determines the price level and the rate of money growth, determines the inflation rate:

$$\% \Delta M + \% \Delta V = \% \Delta (PY) = \% \Delta P + \% \Delta Y$$

3. Tools of Monetary Policy

Monetary policy is conducted by central bank intervention in the market for reserves. If we look at the supply and demand for reserves, there are three principal policy tools that the central bank can use:

- Open Market Operations -- Q
- Reserve requirement ratio -- k
- Discount rate -- r^d

Each of the monetary tools affects the market for reserves – the availability of reserves and the critical short-term market interest rate – the inter-bank rate. When these change, bank behavior and short-term interest rates throughout the economy are affected and that is how monetary policy affects the economy.

These three are the tools that are available to the U.S. central bank, the Federal Reserve. There are some other countries with different institutional arrangements but in the last 20 years, central bank operations in both developed and emerging markets have become increasingly similar to this model. For example, in the U.S. open market operations are conducted by Fed purchases and sales of government securities (Q). In other countries, the central bank intervenes in the foreign exchange market rather than the securities markets. We will return to the relationship between the

central bank and exchange rates later. First, how does each of the policy tools work in the U.S. context?

Open Market Operations

The Federal Reserve can increase its holdings of government securities, Q , by making open market purchases. They pay for the purchase by crediting bank reserve accounts – the Fed creates reserves. This means that clearing balances are more abundant and also reduces the interbank lending rate. The banking system has more liquidity, more clearing balances and interest rates are lower. The financial system will expand lending, monetary policy is looser and the money supply increases.

Although the Fed now uses the interbank rate (the fed Funds rate) as its policy target, the most important tool used to reach that target is open market operations. The Fed specifies a target level for the Funds rate and uses daily open market operations to make sure that the market determined inter bank rate stays close to the targeted level. On a daily basis, the Fed undertakes a large volume of defensive operations in order to offset the large and frequent random variations in the volume of reserves that occur as part of the normal operations of the banking system.

Exactly how does an open market purchase of securities by the Fed lead to an increase in the stock of money? The best way to answer this question will be to trace all the elements of a transaction on the balance sheets of the central bank (the Fed), the banks and the public. Imagine that THE FED buys a government bond from the public (ME). I get a check from the Fed for the price of the bond and the check is written against the Fed itself. Here's what happens to the balance sheets:

THE FED buys MY T-Bill

<u>ME</u>		<u>THE FED</u>	
Fed check +		T-bill	Fed check
T-bill -			

Of course, I take the Fed check and deposit it in my account at MY BANK. So, there is a change in my balance sheet and my bank's:

I deposit the check in MY BANK

<u>ME</u>		<u>MY BANK</u>	
Bank deposit +		Fed check	Bank deposit
Fed check -			

My part in the transaction - the open market purchase - is now complete. I sold my T-bill and I now hold money - a bank deposit - instead. MY BANK presents the check to the Fed for

collection. The Fed credits MY BANK's account at the Fed with the amount of the check and the open market purchase is concluded:

MY BANK takes check to THE FED

<u>MY BANK</u>		<u>THE FED</u>	
Fed check -		Fed Check	Fed deposit
Fed deposit +			

The summary below highlights the important implications of the Fed's open market purchase on the balance sheet of the Fed and of the banks. An open market purchase adds to the Fed's portfolio of government securities. The Fed pays for this by creating reserve deposits. For the banking system, the deposit balances of the public have increased and the bank's reserves held at the Fed have also increased.

There are important implications of this increase in reserve availability. First, there are more reserves available and the price at which reserves are borrowed and lent among financial institutions will change. The open market purchase increases reserves and the Fed Funds rate will fall. Second, the increased availability of reserves will lead to changes in bank behavior. The banks will buy more assets and make more loans.

The open market purchase increases reserves and leads to more bank lending and thus an expansion in the money supply.

SUMMARY: The Effect of an Open Market Purchase of Securities

<u>Federal Reserve Bank</u>		<u>My Bank</u>	
Assets	Liabilities	Assets	Liabilities
T-Bill	Reserve Deposit	Reserve Deposit	My deposit

The Fed creates bank reserves when it purchases Treasury Bills or other securities. The effect of this creation of bank reserves is to increase the money supply initially by the amount of the purchase. In addition, the amount of reserves in existence increases by the same amount. The banking system will find that it has excess reserves since its deposit liabilities and reserves have increased by the same amount. These excess reserves can then be used for loans and investments and the ultimate impact on the money supply will exceed the initial increase. There will be a multiple expansion of deposits as consequence of the open market purchase.

Now suppose that the Fed sold \$1m in government securities in the open market. If Mr. Y purchases these securities from the Fed and pays with a check drawn on an account at HIS BANK, the Fed's assets will decline by \$1 million, as will its liabilities. HIS BANK finds that its deposits have declined by \$1 million and its reserves will also decline by this amount when the Fed clears the check by debiting HIS BANK's account at the Fed. After the open market sale of securities by the Fed, HIS BANK finds itself short of reserves since deposits and reserves have declined by the same amount. As HIS BANK then reduces its loans and investments in order to increase its reserves, the process of multiple expansion of deposits will begin to operate in reverse, and the ultimate contraction of the money supply that results from the open market sale will exceed the initial size of the sale.

- When the Fed **purchases** securities, it adds reserves to the banking system and the Fed Funds rate declines. Other short term interest rates **decline** and the money supply **increases**.
- When the Fed **sells** securities, it **drains** reserves from the banking system and the Fed Funds rate **increases**. Other short term interest rates **increase** and the money supply **contracts**.

Discount Rate

The discount rate is the term used in the U.S. for the rate charged by the central bank when it makes loans to banks. A higher discount rate, a higher cost of borrowing from the Fed, will discourage the banks from incurring reserve deficiencies since the cost of doing so increases. Thus, when the cost of borrowing from the central bank increases, the banks will tend to maintain higher reserve positions and be more careful to avoid costly borrowing of reserves from the Fed. Thus, an increase in the discount rate will tend to reduce the money supply.

Discount borrowing was once the major tool of monetary policy used by the Fed. With the development of the Federal Funds - interbank market for reserves - market in the post-war period, discount borrowing became less important. A bank that finds itself short of reserves can borrow the reserves from other banks or sell assets, such as the banks own holding of securities, in order to increase its reserves position.

Nevertheless, the discount window (as the borrowing facility is called) is still important. First, many small banks do not have ready access to the Federal Funds market where the minimum size of transactions is \$5 million and most transactions exceed \$25 million. Second, if a bank is in economic difficulty, it may not be able to borrow from other banks in the Fed Funds market. Lenders will not want the risk. The Fed uses the discount window to provide support for banks in trouble. This also implies that banks will try to avoid discount borrowing because it might convey to the public that the bank is in trouble. In practice, the Fed carefully manages access to the discount window.¹

¹ The Fed usually keeps the discount rate below (about 1/4 of a percentage point) the Fed Funds rate. This helps small banks that use the discount window. It could also be an inducement for banks to use the discount window except that Fed limits access to the window. While the Fed does not have a formal rationing system for borrowed reserves, it discourages discount borrowing by monitoring individual banks' behavior and discussing with them any

The discount rate does not have a large impact on bank behavior and the economy at the current time because borrowed reserves are a very small part of bank reserves, and the Fed can easily offset any change in borrowing by member banks through its open market operations. However, changes in the discount rate are thought to be important as signal of Fed policy.

Reserve Requirements

If reserve requirements are increased, a bank that held no excess reserves before the reserve requirement increase will find that its reserve holdings are deficient and will have to adjust its portfolio in order to satisfy the reserve requirement. An increase in reserve requirement reduces the money supply because it forces the banks to reduce their loans outstanding or to sell other assets (e.g. securities) in order to hold more reserves. In both instances, deposit balances will fall (as the public pays back loans or pays for securities) and the money supply declines.

Changes in the reserve requirement ratios -- the amount of reserves that banks must hold for every dollar of deposits -- are rarely used as a tool of monetary policy. Although the Fed has the ability to set reserve requirements within broad ranges dictated by Congress, changes in legal reserve requirements are made only infrequently. Reserve requirement ratio changes would be a very clumsy and inefficient tool for influencing the money supply. The Fed does not use reserve requirements for short-run control of the monetary system.

Reserve requirements were extended and made largely uniform by a major banking reform bill in 1980, the Depository Institutions and Monetary Control Act (DIMCA). Reserve requirements were extended to all depository institutions, and the structure of reserve requirements for various deposit types was vastly simplified. The changes were made to improve the Fed's control over the money stock, which includes the liabilities of depository institutions other than commercial banks. However, since reserve balances at the Fed are not interest earning, the banks view them as an unfair burden that other financial institutions do not have. As a consequence, the Fed has, over time, reduced the level of reserve requirements.

Most recently, the reserve requirements on time and savings deposits (which had been 3%) were eliminated in December 1990 and the reserve requirement ratio on transaction accounts (including demand deposits) was reduced from 12% to 10% in April 1992. These steps were taken at this particular time to both ease the burden on the banks of reserve accounts that are non-interest earning and to influence monetary policy.

In 1990-91, the Federal Reserve took several distinct steps to loosen monetary policy as an anti-recessionary policy. Interest rates declined but the volume of new bank loans did not increase.

perceived excessive use of the discount window for borrowing reserves. The Federal Reserve actively manages the privilege of borrowing at the discount rate. Banks and other depository institutions are discouraged from using discount borrowings on a regular basis. Borrowings are allowed to enable banks to meet temporary reserve deficiencies, but not as a continued source of reserve funds. Exceptions to this are seasonal borrowing by small banks which experience wide seasonal fluctuations in deposits or loans and the so-called extended credit facility, which the Fed uses to provide liquidity to banks in serious financial trouble.

The banks simply did not increase their loans to business and the money supply did not expand. The banks were not willing to expand their loan portfolios because of their concern with their own weak capital positions and the large amount of non-performing loans already in their portfolios.

This episode was called a credit crunch because businesses without access to other sources of borrowing were squeezed out of the markets. The credit crunch increased the severity of the recession. The Fed took the unusual step of reducing reserve requirements in order to offset the crunch. The changes in reserve requirements were being used at this time as a monetary policy action. The reduction in reserve requirement ratios directly increases bank profitability (the banks can hold interest earning assets instead of reserve deposits at the Fed) and was intended to induce the banks to make more loans to business and to help end the recession.

The changes in reserve requirements are also a reflection of changes in the way the Fed determines monetary policy. In the 1970's the Fed was strongly influenced by the monetarist point of view, which gave great emphasis to the rate of growth of the money stock. As noted above, the 1980 banking legislation, DIDMCA, extended reserve requirements to all banking institutions and thus gave the Fed close control over *M1*. Soon thereafter, innovations in banking technology made it easier for deposit holders to substitute between *M1* and *M2* deposits. Thus, movements in the *M1* aggregate became less meaningful. However, most of *M2* is not subject to reserve requirements; in fact since 1990 only transactions deposits are subject to reserve requirements. By the end of the 1990s, further developments in banking technology led to a weakening of the relationship between *M2* and the macroeconomy. Thus, by the end of the decade the Fed placed virtually no emphasis on direct control over the monetary aggregates. Although, the growth of the money aggregates - particularly *M2* - is an important longer term indicator of how monetary policy is working, the Fed now pays little attention to money growth in the short run. The Fed now uses the target for the Fed Funds rate as its short run policy target and relies on open market operations to influence interest rates. Of course, interest rate changes do have an impact on the growth of the money aggregates.

4. Effects Of Monetary Policy

Changes in the availability of reserves affect the macroeconomy in two ways. First, the availability of reserves effects the banks' willingness and ability to create money and generally expand the amount of borrowing and credit. Second, open market sales (purchases) will push down (up) the price of government bonds, which raises (lowers) interest rates. Changes in monetary policy affect interest rates for additional reasons as well. For example, if reserves are in short supply, the banks will raise the price of borrowing that is loan rates go up. Thus, a tight monetary policy is associated with higher interest rates, which inhibit borrowing and the expansion of economic activity.

What are the magnitudes and timing of these effects of monetary policy on the economy? There is a rather clear consensus among economists concerning the answer to this question. In the short-run monetary policy has a strong affect on real output; the effects on the inflation rate appear with a lag. In the long run, the economy tends to its natural output equilibrium and money growth determines the inflation rate.

Milton Friedman's description of the relationship of monetary policy to the economy is anecdotal but informative:

Over any long period of time...Higher monetary growth means high inflation, and high inflation produces high interest rates...

Over shorter periods, the situation is more complex. The initial impact of slower monetary growth is to raise interest rates; of faster monetary growth to lower interest rates. However, as the markets have learned the longer-term relationships, the duration of the short-term effects has become shorter and shorter...

The rapid response of interest rates reflects market anticipations of the future effects of monetary growth. The economy itself does not respond as rapidly. The typical pattern is that higher monetary growth is followed by some three to nine months later by higher growth in total spending. The higher spending, in turn, first takes the form of higher growth in output and employment, and only later still of higher inflation.... The total delay between monetary change and inflation is on the order of 18 to 24 months.

[*Newsweek*, December 29, 1980]

5. Structure of the Federal Reserve

Early in the history of the United States there was a strong central bank. Alexander Hamilton established the First Bank of the United States in 1791 with substantial powers over the banking system. The Second Bank replaced it about 25 years later. However, in the populist era of Andrew Jackson, opposition to the concentration of economic power and the extension of federal government authority over the states emerged. The charter of the Second Bank was not renewed, and the country entered a period of free banking in which entry into the banking business and the expansion of credit were largely unregulated. The National Currency Act of 1863 imposed some reserve requirements and solved the problem of not having a uniform national currency. However, there was no central bank to provide loans to the banks when they had temporary liquidity problems or to influence the overall availability of reserves and the growth of the money supply. The need for a strong central bank became apparent during the panic of 1907, and the Federal Reserve Act was passed in 1913.

The act created the Federal Reserve System that exists today. Although the structure of the central banking system has been largely the same for over 80 years, the functions and activities of the system are now very different from what was originally envisioned. Today we emphasize the macroeconomic monetary policy role of the Federal Reserve but this function emerged only in the last few decades. Originally, the primary function of the central bank was to smooth out fluctuations in the banking system by providing liquidity when needed.

The Federal Reserve System consists of twelve regional banks and the seven-member Board of Governors that is located in Washington, D.C. Nineteenth-century wariness of central government power led to great emphasis on a decentralized structure. The Federal Reserve Bank of New York has considerably more influence than the other regional banks because some of the

important policy operations of the system (open market operations, the buying and selling of securities, and the foreign exchange market interventions) are conducted by the New York bank and most of the nation's largest banks are located in the New York district. However, the center of power in the entire system has tended over the years to shift away from the regional banks and the New York Fed in particular and toward the Board of Governors, and the board chairman in particular.

Each of the twelve regional Federal Reserve banks is owned by the member banks and controlled by a Board of Directors. However, the profits of the Federal Reserve, which are substantial, are turned over to the Treasury.

The Federal Reserve Banks and the Board of Governors play a diverse set of roles, not all of which relate to macroeconomic policy. Therefore, the functions of the banks will be briefly outlined here.

The functions of the Federal Reserve banks can be separated into "chore" functions and policy functions. The chore functions are to:

- Examine the member banks
- Review merger applications
- Provide check-clearing services and electronic funds transfers
- Act as an agent for the distribution of new currency and for the sale of Treasury securities.

The policy functions of the Federal Reserve banks are to:

- Set the discount rate, which is the rate which financial institutions pay for borrowing from the Fed. In practice, the Board of Governors determines the rate, which the regional banks are allowed to set. It is almost always uniform across the country.
- Administer the discount window. Banks are discouraged from making use of borrowings from the Federal Reserve on a continuing basis, and each regional bank determines policy on how much borrowing to allow.
- Participate on the Federal Open Market Committee (FOMC). The regional bank presidents sit on the FOMC and have voting privileges on a revolving basis, with the exception of the president of the New York Fed, who is a permanent voting member. The important role of the FOMC will be discussed below.

In addition, the Federal Reserve Bank of New York has several functions that are not shared with the other banks:

- The Open Market Desk where transactions in government securities are conducted is located in the New York Fed.
- The New York Fed holds the deposits and securities of foreign central banks, and any U.S. central bank intervention in the foreign exchange markets is directed there.
- The New York Fed holds and manages the country's gold stock.

The Board of Governors consists of seven members who hold 14-year terms and are appointed by the President. The chairman is the center of power for the whole Federal Reserve System. He or she is a board member appointed to a 4-year term as chairman by the President.

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Interestingly, the term does not coincide with the President's. Membership on the board is neither particularly remunerative nor very exciting, and so the governors rarely stay for full terms. The purpose of the long term was to make the governors who are appointed by the President subject to congressional approval, independent of political influence or concerns.

The formal functions of the Board include the following:

- Approve bank mergers.
- Set the regulations, which determine what activities commercial banks are allowed to engage in.
- Set reserve requirements and approve changes in the discount rate.
- Direct open market operations through the FOMC.

The chairman of the Board directs the Board staff and is the most powerful individual in the system. Recent chairmen have become national public figures while in office (Alan Greenspan, Paul Volcker, Arthur Burns). The chairman is also the dominant figure on the Federal Open Market Committee.

A major feature of the Federal Reserve System is its independence from the rest of the government. The regional banks are not government agencies and the Board of Governors is largely independent of the President and the Congress. Monetary and banking policies are set by the Fed and not directly by elected officials.

However, there is some modest oversight of the Fed's policy making. The Full Employment and Balanced Growth Act of 1978 requires that the Board chairman testify before Congress twice a year on the monetary policy objectives of the Federal Reserve. Although this provision of the act expired and was not renewed, the Board chairman has continued to make monetary policy reports to Congress. Fed officials do not meet with the President or his staff when considering monetary policy decisions.

Although enormously important to society, the bank regulatory responsibilities of the Fed are less relevant to our focus on macroeconomic policy and will not be discussed in detail. The macroeconomic policy role of the Fed is centered on the activities of the FOMC.

The Federal Open Market Committee (FOMC) consists of the Board's governors and the presidents of the regional banks. Five of the twelve Federal Reserve Bank presidents are voting members of the FOMC at any one time. The committee meets in Washington about 8 times a year and reviews economic conditions and the behavior of the financial system. The purpose of the meeting is to formulate a directive on monetary policy. This directive provides instructions to the managers of the Open Market Desk (at the New York Fed) about how to conduct open market operations. If changes in economic and financial conditions warrant, the committee holds a telephone consultation between its regular meetings and changes the directive.

The way in which the FOMC directs monetary policy has changed over the years. At the present time, the FOMC establishes a target for a particularly important short-term interest rate - the Federal Funds rate - which provides guidance for the purchase and sale of securities by the

open market desk at the Federal Reserve Bank of New York. The Federal Funds rate is the rate at which reserve deposits (funds at the Fed or Fed Funds) are lent by one financial institution to another. A bank with more reserve deposits than it would like to hold can lend them (sell Fed Funds) to another bank. Thus, the Fed Funds rate is a market determined interest rate; the Fed does not set it. However, as we will see below, the buying and selling of securities by the Fed will have a very direct influence on the market Funds rate so the Fed can keep the Fed Funds rate at or near the target set by the FOMC. It does so by buying and selling securities from the Fed's portfolio (Q in the model above). In the next section we will show how changes in Q affect interest rates, the money supply and the economy.

The other Fed policy instruments are the reserve requirement ratio and the discount rate. The Board of Governors sets the reserve requirements (within a legislative framework) and the Board determines the discount rate as well. In the next section, we return to our model framework and explain how each of the three monetary policy tools work.

6. Bank Regulation

We noted earlier that in addition to macroeconomic monetary policy, central banks are often responsible for bank and financial sector regulatory policy. (Sometimes these functions are housed in separate government agency.) The description of Fed Reserve activities in the U.S. included many regulatory functions.

The central bank is concerned with the safety and soundness of the banking system and imposes various regulatory constraints to insure that the banks remain solvent.

Liquidity regulations come in the form of some balance sheet constraints that might require that some fraction of assets remain in liquid form. In fact, reserve requirements originated for this reason. If we go back a century, both the inter-bank lending market and the securities markets were not fully developed. Thus, a bank in need of liquid funds quickly might have difficulty obtaining them. In fact, central banks evolved with the role of being the lender of last resort to banks with liquidity needs. The lender of last resort function is provided to solvent banks with liquidity problems. Liquidity requirements are designed so that banks can generally avoid the central bank lender of last resort.

Capital requirements are in the form of a minimum ratio of capital to bank assets. The international banking community (through the Bank for International Settlements) has adopted standard minimums of capital to risk-adjusted assets. The BIS capital requirements are supposed to be minimums but are often viewed as all that is necessary, particularly in emerging markets where capital asset ratios should be higher. The correct definitions of capital and the correct way to make adjustments for different risks are a source of continued controversy.

Bank examination is the last major element of bank regulation. Bank portfolios are reviewed to make sure that assets are properly classified (so that loan losses are not a surprise) and that adequate loan loss reserves are maintained. The quality of bank examination procedures

various enormously around the world and inadequate application of procedures often leads to banking crises.

It is easy to see why examination is important and how banks can get into trouble. If bank management makes a lot of poor lending decisions then the portfolio of loans might include numerous non-performing loans. Proper management indicates that such loans should be written off against capital (that is why the bank maintains a loan loss reserve). However, this could lead to a situation where the capital asset ratio falls and the bank would appear to be under-capitalized. Thus, the manager has every reason to carry worthless loans on the books of the bank. In fact, central banks often help create bank crises. The central bank might hesitate to insist that the bad loans be recognized for political reasons or simply to avoid a bank closure that might effect the payments system and the economy. Often, central banks will make loans to banks that are already insolvent, which makes a bad situation worse.

7. The Central Bank and the Foreign Exchange Market

Central banks play an important role in foreign exchange markets and in changes in international reserves. In this section we will look at the mechanics of international transactions and how they affect foreign exchange reserve positions and the central bank balance sheets.

Let us start with a simple international movement of funds: say Mexican businessman (Sr. X) wants to open a dollar deposit account a bank in New York. He asks his bank in Mexico to convert his Peso account to dollars at the market exchange rate so that he can make a deposit in NY. There is a capital outflow from Mexico. To better understand the possible implications of this outflow it is helpful to know exactly what happens in the Mexican and US banking systems.

- Consider a case where the Mexican Bank has a deposit balance in NY. This would not be surprising; many foreign banks maintain correspondent relationships with money center banks in order to facilitate transactions like this one for their home customers. In this case, the balance sheet changes that occur are:

NY Bank

Assets	Liabilities
	Sr. X's bank deposit +
	Mexican bank's deposit -

Mexican Bank

Assets	Liabilities
\$ Deposit in NY -	Sr. X's Peso deposit -

- Next, consider a case where the Mexican bank does not have a \$ deposit balance available. It can go to foreign exchange market and offer to sell a Peso deposit for a \$ deposit. In this case the Mexican bank is creating a new Peso deposit that replaces Sr. X's deposit balance. At the same time the sale is likely to cause the Peso to depreciate.

Mexican Bank

Assets	Liabilities
\$ Deposit in NY +	Peso deposit +

- Another possibility is the Mexican bank will borrow \$ in NY.

Mexican Bank

Assets	Liabilities
\$ Deposit in NY +	Borrowing in \$ +

The Mexican bank will use its \$ deposit in NY to fund the capital outflow. That is, it will sell the deposit to Sr. X and debit his peso deposit:

Mexican Bank

Assets	Liabilities
	Borrowing in \$ +
	Sr. X's peso deposit -

The Mexican bank now has a \$ dollar liability but it still has the same peso assets that it had at the start. The Mexican bank is exposed to exchange rate risk. If the peso depreciates, then its liabilities will increase in peso terms but its assets remain unchanged. It might hedge such a position in the derivatives markets.

The banks in NY might not be willing to lend to the Mexican bank if they view the risks to be too great. On the other hand, if the NY banks are confident that the Mexican central bank will maintain the exchange rate, they might be more than willing to lend to Mexican banks.

- Now, consider a case where the Central Bank of Mexico is maintaining the exchange rate. In the extreme it could announce a commitment to a fixed exchange rate and agree to buy and sell pesos from all comers at this rate. Or it could have a less commitment in which case it simply (and perhaps without even telling) goes to the foreign exchange market to buy pesos when others are selling.

Let us say, that our Mexican Bank goes to the Central Bank of Mexico to obtain \$ that it can provide to Sr. X. The Mexican Bank draws down its reserve deposit balance at the central bank to get \$ that it can provide to Sr. X:

Mexican Bank

Assets	Liabilities
Reserve deposits at Central bank of Mexico -	Peso deposit -

In turn, the central bank gives the Mexican bank a check on a \$ deposit abroad. The Mexican bank can give this check to Sr. X who deposits it in NY. Here's what happens to bank balance sheets in NY:

Bank in NY

Assets	Liabilities
\$ deposit of Sr. X +	
FX reserve deposit of Central Bank of Mexico -	

And the central bank of Mexico's own balance sheet looks like this:

Central Bank of Mexico

Assets	Liabilities
FX Reserve deposits -	Reserves of bank in Mexico –

The capital outflow leads to a loss of foreign exchange reserves and a contraction of bank reserves in Mexico. The central bank of Mexico can maintain the exchange rate as long as it has sufficient reserves to deal with capital outflows.

What can the Central Bank of Mexico do if it is concerned with the disappearance of its foreign exchange reserves? There are several possible policy responses:

- Raise interest rates in Mexico to discourage Sr. X from taking his assets to NY.
- Enact rules – capital controls – that prevent Sr. X from (legally) taking his assets to NY.
- Borrow from banks, central banks, international institutions abroad in order to have sufficient FX (\$) to fund the outflow of capital.
- Allow the Mexican bank to go to the foreign exchange market to buy \$ deposits and thus allow the peso to depreciate.

Now consider a capital inflow.

Suppose Mr. Y in NY is considering direct foreign investment in Mexico. Mr. Y buys a factory from Sr. X and pays for it with a \$ check written on his NY bank account. Sr. X takes this check to his bank in Mexico and receives a peso deposit:

Mexican Bank

Assets	Liabilities
\$ check from Mr. Y	Peso deposit of Sr. X

The Mexican bank can do a number of things with the \$ check:

- It can hold a \$ deposit in NY.

- It can sell the \$ deposit for pesos on the foreign exchange market. In this case the inflow of \$ leads to an appreciation of the Peso.
- It can take it to the Central Bank of Mexico and receive a peso deposit. In this case, the capital inflow leads to an accumulation of foreign exchange reserves by the central bank of Mexico and unless some offsetting action takes place, there is an expansion of domestic bank reserves in Mexico and an expansion of the money supply will occur.

Mexican Bank

Assets	Liabilities
Reserve deposits at Central bank of Mexico	Peso deposit of Sr. X

Central Bank of Mexico

Assets	Liabilities
FX reserve deposits in \$ in NY	Reserve deposit of Mexican bank.