

# **LECTURE NOTES ON MACROECONOMIC PRINCIPLES**

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# Ch 29 The Monetary System

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## Introduction

In the absence of money, people would have to exchange goods and services through *barter*.

The problem with barter lies in finding a *double coincidence of wants*: a successful trade requires (i) you to want what your trading partner has and (ii) your trading partner to want what you have.

Money overcomes this problem, since everyone will accept it in exchange for goods and services.

But how exactly is money defined? What are its functions? How does the government control the supply of money? And what role do banks play in the money supply process?

These questions are the focus of this chapter.

The next chapter will then begin to relate changes in the supply of money to changes in other key economic variables.

## Outline

1. The Meaning of Money
2. The Federal Reserve System
3. Banks and the Money Supply
4. The Fed's Tools of Monetary Control
5. Two Final Points
  - A. Bank Runs and the Money Supply
  - B. The Federal Funds Rate

## The Meaning of Money

Sometimes people will say, "Bill Gates has a lot of money." But what they really mean is that Bill Gates has a lot of *wealth*.

Economists use the term "money" in a more specific sense, to refer to the set of assets that people use regularly to buy goods and services from other people.

## Functions of Money

1. Money is a **medium of exchange**, that is, an item that buyers give to sellers in exchange for goods and services.
2. Money is a **unit of account**, that is, the units in which prices are measured.
3. Money is a **store of value**, that is, an object that people can use to carry wealth from the present into the future.

Closely associated with the concept of money is that of **liquidity**: the ease with which an asset can be converted into the economy's medium of exchange.

- By definition, money is the most liquid asset.
- Stocks and bonds are pretty easy to buy and sell. They are highly liquid assets.
- Houses, valuable paintings, and antiques take more time and effort to sell. They are less liquid.

Notice that the first two items on this list highlight a trade-off. Money is the most liquid asset, but currency does not pay interest. Bonds are less liquid, but pay interest. This trade-off will become important later on in our analysis of how changes in the money supply affect the economy as a whole.

## Kinds of Money

Historically, gold or gold coins served as money. This type of money, that takes the form of a commodity with intrinsic value, is called **commodity money**.

US dollar bills have value, but that value is not based on the intrinsic value of the paper and ink themselves. Money without intrinsic value is called **fiat money**, since it is used as money because of government decree.

## Money in the US Economy

The **money stock** is the total quantity of money circulating in the economy.

Suppose we want to measure the money stock for the US. What assets would we include in our measure?

1. Certainly **currency**, the paper bills and coins in the hands of the public.
2. Probably checks as well. **Demand deposits** is the official name given to bank deposits that customers can access on demand by writing a check.
3. Maybe **savings deposits**. Banks won't let customers write checks on savings deposits, but they still can withdraw the funds anytime.
4. Maybe also **money market mutual funds**, some of which offer limited check-writing privileges.
5. Maybe also **time deposits** (also called **CD's** or **certificates of deposit**). Here, the funds can't be withdrawn without penalty for a fixed amount of time, but that amount of time tends to be short – three to six months – so these assets, too, are fairly liquid.

Evidently, the choice of what to include is not entirely clear-cut. For this reason, there are several official measures of the US money stock. Two of the most widely used are:

- **M1**. Includes only those assets that are clearly used as a medium of exchange: currency, demand deposits, traveler's checks, and "other checkable deposits" which is the official term for interest-earning checking deposits.
- **M2**. Includes everything in M1, plus other highly liquid assets: savings deposits, money market mutual funds, and small (under \$100,000) time deposits.

Figure 1 shows some data on M1 and M2 in 2004. Which measure is bigger? Why?

What about credit cards? Credit cards are clearly used to make purchases. Why aren't they included in M1? The reason is that credit cards are a means for *deferring* payments as opposed to *making* payments. At the end of the month, when you pay your credit card bill with a check, you are using the medium of change to finally pay for what you purchased earlier.

But while credit card balances are not included in M1, they clearly influence the level of M1. Before credit cards use became widespread, people had to hold a lot more currency.

Here's one other puzzle.

- In 2004 the stock of US currency in circulation was \$699 billion.
- In 2004, there were 223 million adults in the US.
- \$699 billion/223 people = \$3,135 per person!
- A lot of this currency is held overseas, as a store of value in countries with unstable political or economic systems.
- Undoubtedly, some of this currency is also held by drug dealers and other criminals.

## The Federal Reserve System

The **Federal Reserve** (Fed) is the **central bank** of the US: the institution responsible for overseeing the banking system and regulating the quantity of money in the economy.

The Federal Reserve System consists of:

- The Board of Governors in Washington DC
  - o Seven Board Members, called "Governors," with 14-year terms.
  - o Including the Chairperson of the Federal Reserve System: formerly Alan Greenspan and now Ben Bernanke.
- Twelve Federal Reserve Banks
  - o Located in major cities, including Boston and New York.

As a central bank, the Fed has two jobs:

1. It regulates banks, assists in check processing (clearing), and acts as a bank for banks – taking their deposits and, when other sources of credit dry up, making loans to banks. In this last role, the Fed is said to be the **lender of last resort**.
2. It regulates the **money supply**: the quantity of money in the economy. That is, it conducts **monetary policy**.

The monetary policymaking committee at the Fed is called the **Federal Open Market Committee** (FOMC). The FOMC meets every six weeks and consists of the seven Governors plus the 12 Reserve Bank Presidents. All seven Governors vote on Committee decisions; a rotating group of 5 Reserve Bank Presidents vote as well, with the President of the New York Fed always a voting member.

But exactly how does the Fed regulate the supply of money? By conducting **open market operations**, that is, by buying and selling US Government bonds. Loosely speaking:

- The Fed increases the money supply by using newly-created money to buy US Government bonds held by private investors.
- And decreases the money supply by selling US Government Bonds to private investors.

## Banks and the Money Supply

Because even the narrowest measure of money, M1, includes both currency and demand deposits, banks play a key role, together with the Fed, in the money supply process. But how exactly do banks participate in this process?

### The Simple Case of 100 Percent Reserve Banking

Start by considering an economy without banks, where all money consists of currency.

Suppose for simplicity that the total quantity of currency in circulation is \$100.

Now suppose that someone opens up a bank: call it the First National Bank.

But instead of making loans, all this bank does is to safeguard people's money: it accepts deposits, and keeps the currency in its vault until the depositor either asks for the currency back or writes a check against his or her balance.

Deposits that the bank receives but does not loan out are called **reserves**. So this simple form of banking without loans is called **100-percent-reserve banking**, for the obviously reason that 100 percent of all deposits are held as reserves.

We can use a **T-account** (a simplified balance sheet), to show what happens if the entire \$100 of currency in circulation is deposited in the bank:

First National Bank	
Assets	Liabilities
Reserves \$100	Deposits \$100

What has happened to the M1 money supply as a result of this transaction?

- Nothing!
- Currency in circulation declines by \$100.
- But demand deposits rise by \$100.

This first example illustrates that in an economy with 100-percent-reserve banking, banks do not influence the money supply.

## Money Creation with Fractional Reserve Banking

Now suppose that the managers of the First National Bank notice that not all of the bank's depositors ask for the money back on any given day. In fact, most customers are content to leave their money in the bank. What if the bank lends out some of the money it receives from deposits?

Now we'll consider a **fractional-reserve banking** system, in which banks hold only a fraction of the funds they receive from depositors as reserves.

The **reserve ratio** measures the fraction of deposits that banks hold as reserves.

Although banks want to lend funds out, in order to earn interest, they will always hold at least some reserves:

- Partly because they are required to by law. The Fed sets a minimum reserve ratio that each bank must maintain. Reserves held to satisfy this legal requirement are called **required reserves**.
- But banks will also hold **excess reserves** above what is legally required to cope with depositors' requests for withdrawals.

Let's suppose that First National Bank decides on a reserve ratio of 10 percent. Then it holds \$10 (or 10 percent) of its deposits as reserves and lends the rest out. The T-account now becomes

First National Bank	
Assets	Liabilities
Reserves \$10 Loans \$90	Deposits \$100

What's happened to the money supply as a result of this transaction?

- It has increased!
- Depositors still hold \$100 in demand deposits.
- But now the people who receive the loans hold \$90 in currency.
- The total money supply is \$190.

This second example illustrates that in a fractional reserve system, banks can create money.

Notice, however, that while the money supply has gone up because of this transaction, people aren't really wealthier:

- The depositors have \$100 in deposits, just as before.
- The borrowers have \$90 in currency, but now they owe that \$90 to the bank. So that balances out too.

Another way to think about this is that people aren't wealthier, but they are more liquid.

## The Money Multiplier

In an economy with a fractional reserve banking system, however, the action does not really stop at the end of this second example.

Now the First National Bank's borrower has \$90 in currency. Presumably, that borrower wanted the funds in order to buy something: a consumption good or an investment good.

But then the seller of this good gets the \$90. Let's suppose that he or she then takes that currency, and deposits it in his or her bank: the Second National Bank.

If the Second National Bank also chooses a 10 percent reserve ratio, it will take the \$90 in currency, hold \$9 (10 percent) as reserves, and lend the remaining \$81 out. Its T-account appears as

<b>Second National Bank</b>	
<b>Assets</b>	<b>Liabilities</b>
Reserves \$9 Loans \$81	Deposits \$90

What does this do to the money supply?

- The First National Bank's customers have \$100 in deposits.
- The Second National Bank's customers have \$90 in deposits.
- The Second National Bank's borrower has \$81 in currency.
- Now the money supply is  $\$100 + 90 + 81 = \$271!$

But now the Second National Bank's borrower uses the \$81 in currency to buy something. The seller takes the \$81 and deposits it in his or her account at the Third National Bank.

The Third National Bank, if it also chooses a 10 percent reserve ratio, holds \$8.10 (10 percent) of the \$81 as reserves, and lends the remaining \$72.90 out. Its T-account appears as

<b>Third National Bank</b>	
<b>Assets</b>	<b>Liabilities</b>
Reserves \$8.10 Loans \$72.90	Deposits \$81

What's the money supply now?

- The First National Bank's customers have \$100 in deposits.
- The Second National Bank's customers have \$90 in deposits.
- The Third National Bank's customers have \$81 in deposits.
- The Third National Bank's borrower has \$72.90 in currency.
- Now the money supply is \$343.90.

We could go on and on, repeating this forever. The Third National Bank's borrower buys something, the seller deposits the funds in the Fourth National Bank, which keeps 10 percent as reserves and lends the rest out ....

But notice that in each step, the additions to the money supply get smaller and smaller. So eventually the process will converge. Use a calculator or better yet a computer spreadsheet to do the endless repetitions and what you will find is that when the banking system finally holds the entire \$100 as reserves, the money supply is \$1000.

In this case, the **money multiplier** – the amount of money that the banking system generates per dollar of reserves – is  $\$1000/\$100 = 10$ .

In this example, where all banks choose a reserve ratio of **10 percent**, is it an accident that the money multiplier is **10**? No!

In general, if

$$R = \text{the reserve ratio}$$

then

$$1/R = \text{the money multiplier}$$

So if as in our example  $R = 0.10$  or 10 percent, then the money multiplier is  $1/R = 1/0.10 = 10$ .

To see why this *reciprocal formula* must be true, remember that the reserve ratio measures the fraction of deposits that banks hold as reserves:

$$R = \text{Reserves/Deposits}$$

or

$$\text{Deposits} = (1/R) \times \text{Reserves}$$

In our example, everyone deposits all of their money, so

$$\text{Money Supply} = \text{Deposits} = (1/R) \times \text{Reserves}$$

But now remember that the money multiplier is defined as

$$\text{Money Multiplier} = \text{Money Supply/Reserves} = 1/R$$

This last set of calculations reveals two important assumptions that are built into our second example:

1. All banks have the same reserve ratio  $R$ .
2. All bank customers hold all of their money as deposits.

What happens when the first assumption is violated, say because some banks choose to hold more reserves?

- The money multiplier goes down, because when some banks hold more reserves, they make smaller loans, so the process of monetary expansion is curtailed.

What happens when the second assumption is violated, say because some people choose to hold some currency as well as deposits?

- Again, the money multiplier goes down, because when some people hold some currency, they deposit less, and again the process of monetary expansion is curtailed.

## The Fed's Tools of Monetary Control

But, as long as banks do not hold all of their deposits as reserves, and as long as people don't hold all of their money as currency, the fractional reserve system allows banks to play a key role in the money supply process.

The Fed must take banks' role into account when making monetary policy decisions.

## Open Market Operations

Recall that **open market operations** occur when the Fed buys or sells US Government bonds from or to private investors.

When the Fed buys US Government bonds, each newly-created dollar held as currency increases the money supply by \$1. But each newly-created dollar held as a deposit increases the money supply by even more, because of the money multiplier.

And when the Fed sells US Government bonds, if the seller pays for the bond with currency, the money supply decreases by \$1. But if the seller pays for the bond using funds from a bank deposit, the money supply decreases by even more, as the process of multiple deposit creation works in reverse.

Open market operations are easy for the Fed to execute. There is a trading desk at the Federal Reserve Bank of New York that links the Fed to the US Government bond market. The Fed can trade in this market just like all other financial institutions and individual investors.

Open market operations can also be used to change the money supply by large or small amounts.

Because of these advantages, open market operations are the Fed's most frequently-used policy tool.

## Reserve Requirements

**Reserve requirements** are the legally-imposed minimum amount of reserves that banks must hold against their deposits.

We've already seen that a higher reserve ratio leads to a smaller money multiplier.

The same reasoning implies that when the Fed increases reserve requirements, the money supply will fall.

But changes in reserve requirements disrupt bank business. To avoid these disruptions, the Fed rarely uses changes in reserve requirements to affect the money supply.

## The Discount Rate

The Fed also acts as a **lender of last resort** for banks that cannot obtain funds through other sources.

The **discount rate** is the interest rate that Fed charges on its loans to banks.

When the Fed makes a loan to a bank, in effect it lends newly-created money to that bank. The bank has more reserves, some of which it can lend out. Through the process of multiple deposit creation, the money supply will rise.

Hence, when the Fed lowers the discount rate, inducing more banks to borrow from the Fed, the money supply will rise.

But the Fed rarely uses discount lending to control the money supply. Instead, it uses its role as lender of last resort to help banks when they are in financial trouble.

## Problems in Controlling the Money Supply

All of this discussion highlights that the Fed cannot perfectly control the money supply.

It cannot control how much money people hold as currency as opposed to depositing in banks.

And it cannot control how much banks hold in reserves as opposed to making loans.

In practice, therefore, Federal Reserve analysts need to constantly monitor the behavior of banks and their depositors, to keep the money supply on track.

## Two Final Points

### Bank Runs and the Money Supply

Note that in a fractional reserve banking system, if all depositors attempt to withdraw their money at once, there will not be enough reserves to satisfy them all.

In a bank run or panic, depositors rush to withdraw their funds, not wanting to be the ones who lose out.

This actually happened during the Great Depression of the 1930s. Many banks had to close until enough loans were repaid to allow them to satisfy all of the withdrawal requests.

The problems were magnified by the fact that this experience made people lose their trust in banks, and hold more money as currency. The decline in the money multiplier then led to a large decline in the money supply, which many economists blame for making the Depression more severe.

Today, the Federal Deposit Insurance Corporation guarantees the safety of most bank deposits. So it is unlikely that bank runs or panics will happen again.

On the other hand, during the most recent financial crisis, events very similar to bank runs began happening not to banks but to money market mutual funds; in response, the US Treasury moved last Fall to extend deposit insurance temporarily to money market mutual funds as well.

## The Federal Funds Rate

What's the connection between this analysis of reserves, the money multiplier, and the money supply, and the more common way of talking about monetary policy, where changes in Federal Reserve policy are always described as changes in the federal funds rate?

The **federal funds rate** is the interest rate that banks charge each other on short-term loans of reserves, or federal funds.

Just like, previously, we traced out a downward-sloping demand curve for loanable funds in the economy as a whole, we can trace out a downward-sloping demand curve for federal funds in the interbank loan market.

In Graph 1, the Federal Reserve sets a target  $Res^*$  for reserves, and conducts open market operations so as to hit this target:

- In this case, the supply curve for reserves is vertical, or *perfectly inelastic*.
- The market for interbank loans then clears with the federal funds rate at  $FF^*$ .
- If the federal funds rate were below  $FF^*$ , the demand for loans of federal funds would be greater than the supply. Upward pressure on the federal funds rate would result, until the funds rate rises to  $FF^*$ .
- If the federal funds rate were above  $FF^*$ , the demand for loans of federal funds would be smaller than the supply. Downward pressure on the federal funds rate would result, until the funds rate falls to  $FF^*$ .

Graph 1 illustrates the workings of monetary policy as we've envisioned it so far.

Alternatively, though, we could think of the Federal Reserve as setting a target  $FF^*$  for the federal funds rate:

- In this situation, illustrated in Graph 2, the supply curve for reserves becomes horizontal, or *perfectly elastic*.
- The Federal Reserve must conduct open market operations so that it is supplying  $Res^*$  in reserves.

Comparing Graphs 1 and 2 suggests that there's not too much difference between these two monetary policy strategies:

1. Setting a target  $Res^*$  for reserves, and accepting the equilibrium funds rate  $FF^*$ .
2. Setting a target  $FF^*$  for the funds rate, and supplying  $Res^*$  in reserves to hit that target.

Either way, the outcome is the same: reserves are  $Res^*$  and the federal funds rate is  $FF^*$ .

But things change when we allow the demand curve for reserves to shift.

Why might the demand curve for reserves shift?

- Perhaps banks' lending opportunities change, so that they want to hold larger or smaller stocks of reserves at any given interest rate.
- Perhaps depositors' behavior changes, so that they provide banks with more or less currency to hold as reserves.

In Graph 3, the Fed sets a target  $Res^*$  for reserves, and the demand curve for reserves shifts. As a consequence, the equilibrium funds rate rises from  $FF^*$  to  $FF^{**}$ .

This graph implies that if the demand curve for reserves were subject to ongoing shifts, a policy strategy of targeting reserves would lead to volatility in the federal funds rate.

In Graph 4, the Fed sets a target  $FF^*$  for the federal funds rate, and the demand curve for reserve shifts. The Fed must conduct open market operations so that the equilibrium quantity of reserves rises from  $Res^*$  to  $Res^{**}$ . But, by doing so, it can stabilize the funds rate in the face of ongoing shifts in the demand for reserves.

In practice, the Federal Reserve conducts monetary policy by setting a target for the federal funds rate as opposed to a target for reserves.

That is why *changes* in Federal Reserve policy are always described as *changes in the federal funds rate target*.

But note that in order to implement a strategy of federal funds rate targeting, the Fed must constantly be engaging in open market operations, adding or withdrawing reserves from the banking system to stabilize the funds rate in the fact of shifts to the demand curve for reserves.

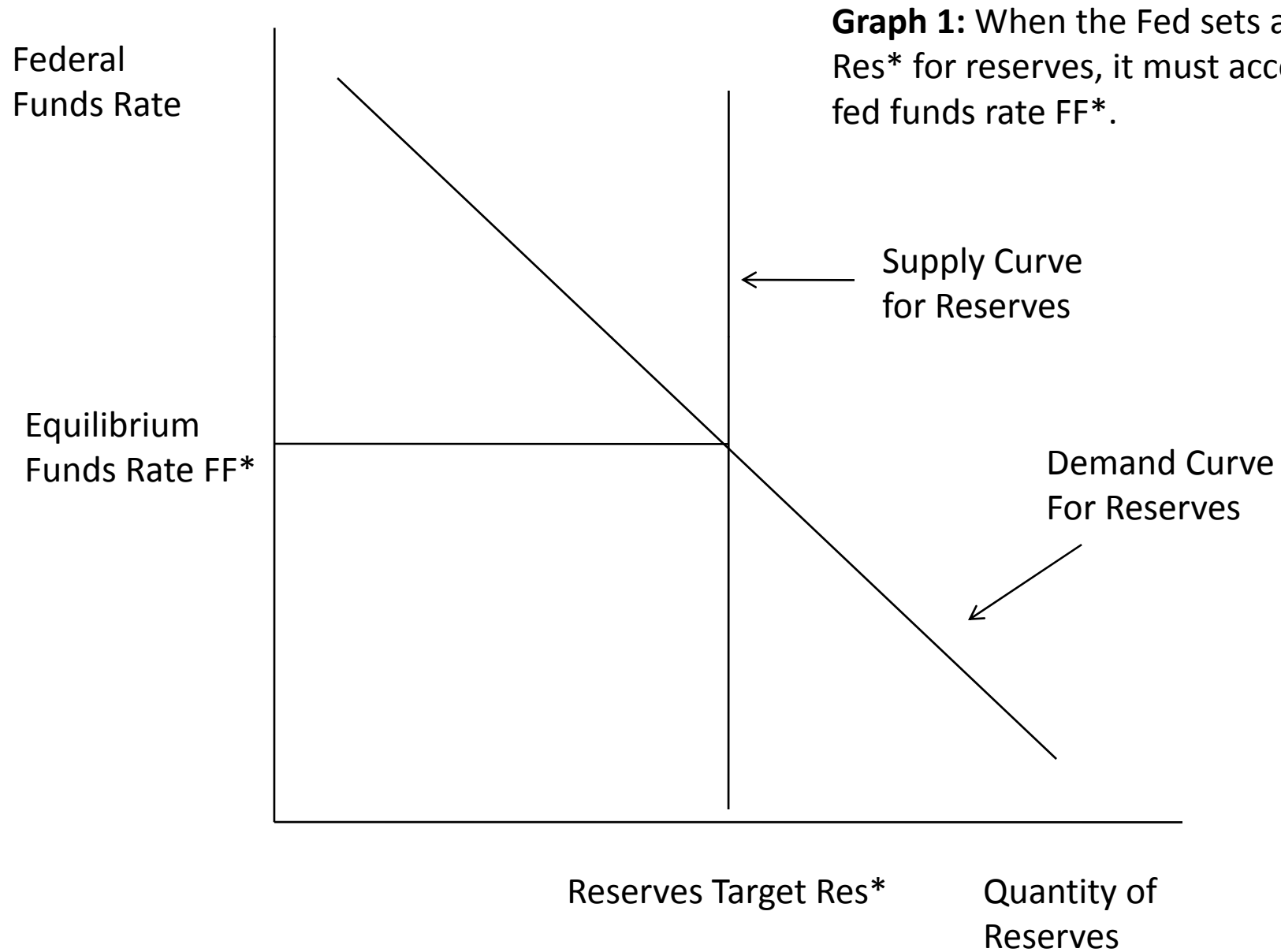
Why, in practice, does the Fed choose to conduct policy in this way, with a target for the funds rate as opposed to a target for reserves?

1. It believes that the demand curve for reserves is unstable, exhibiting continual shifts. Thus, it believes that a reserves-targeting strategy would lead to excessive volatility in the federal funds rate and possible instability in the banking system.
2. It also believes that instability in the federal funds rate would spill over into other financial markets as well, leading to more volatile interest rates economy-wide.

Finally, Graph 5 illustrates what happens when the Fed raises its federal funds rate target. To raise the target from  $FF^*$  to  $FF^{**}$ , the Fed must use open market operations to drain reserves from the banking system, specifically, to lower the quantity of reserves from  $Res^*$  to  $Res^{**}$ . Through the money multiplier, the money supply will also contract. Monetary policy becomes “tighter” or “more restrictive.”

Symmetrically, Graph 6 shows that when the Fed lowers its funds rate target, it must use open market operations to add reserves to the bank system. And, through the money multiplier, the money supply will also expand. Monetary policy becomes “looser” or “more accommodative.”

These last two graphs highlight how reserves, open market operations, the money multiplier, and the money supply all continue to work just as in the textbook, even under the Fed’s current operation procedures, which focus most of the immediate attention on the federal funds rate.



**Graph 1:** When the Fed sets a target  $Res^*$  for reserves, it must accept the fed funds rate  $FF^*$ .

