Money

Throughout history, a wide variety of items have served as money. These include gold, silver, large stone wheels, tobacco, beer, dog teeth, porpoise teeth, cattle, metal coins, paper bills and checks. All of these types of money should be judged on how well they accomplish the functions of money. Money is what money does!

The functions of money are to serve as a medium of exchange, a standard of value and a store of value.

To be a good *medium of exchange*, money must be *accepted by people* when they buy and sell goods and services. It should be *portable* or easily carried from place to place. It must also be *divisible* so that large and small transactions can be made. It must also be *uniform* so that a particular unit such as a quarter represents the same value as every other quarter.

To be a good *standard of value*, or *unit of account*, money must be useful for quoting prices. To accomplish this, money must be *familiar, divisible* and *accepted.*

To be a good *store of value*, money must be *durable* so it can be kept for future use. It also should have a *stable value* so people do not lose purchasing power if they use the money at a later time.

Money is any item or commodity that is generally accepted in payment for goods and services or in repayment of debts, and serves as an asset to its holder.

Activity written by John Morton, National Council on Economic Education, New York, N.Y., and revised by Charles A. Bennett, Gannon University, Erie, Pa.

1. Use the table below to evaluate how well each item would perform the functions of money in today's economy. If an item seems to fulfill the function, put a + sign in the box; if it does not fulfill a function in your opinion, place a − sign in the box. Put a ? sign in the box if you are unsure whether the item fulfills the functions of money. The item with the most + signs would be the best form of money for you. In the space below the table, list the top six forms of money, according to your evaluation.

Item	Medium of Exchange	Store of Value	Standard of Value
Salt			
Large stone wheels			
Cattle			
Gold			
Copper coins			
Beaver pelts			
Personal checks			
Savings account passbook			
Prepaid phone card			
Debit card			
Credit card			
Cigarettes			
Playing cards			
Bushels of wheat			
$1 bill			
$100 bill			

Your top six forms of money:

2. After you finish the evaluation in Question 1, rate the various items in the table below. Evaluate how well they meet the characteristics of money. Again, if an item seems to fit a characteristic, use a + sign; if the item does not seem to fit a characteristic, use a − sign. If there is a difference of opinion or if you are uncertain, use a ? sign. The item with the most + signs would best fit the characteristics of money. In the space below the table, list your six top items.

Item	Portability	Uniformity	Acceptability	Durability	Stability in Value
Salt					
Large stone wheels					
Cattle					
Gold					
Copper coins					
Beaver pelts					
Personal checks					
Savings account passbook					
Prepaid phone card					
Debit card					
Credit card					
Cigarettes					
Playing cards					
Bushels of wheat					
$1 bill					
$100 bill					

Your top six items:

3. Why might factors such as ease of storage, difficulty in counterfeiting and security of electronic transfer of funds also be characteristics that you might use in evaluating money?

What's All This About the Ms?

While monetary policy is the subject of debates that capture the public's attention, the first steps in the formulation of policy may appear relatively mundane. We must first define and measure the money supply. Defining and measuring money has become an increasingly difficult task because of reforms in the financial system, and because people and banks hold money in myriad different forms.

Money Defined . . .

There is general agreement on a simple conceptual *definition* of money. However, the complexity of the real world and our rapidly evolving financial system prevent agreement on a single *measure* of money, and this can cause confusion.

The Federal Reserve defines monetary aggregates by grouping assets that the public uses in roughly similar ways. In defining these measures of money, the Fed draws somewhat arbitrary lines between groups of assets that serve in varying degrees as both the medium-of-exchange and store-of-value functions of money.

Depository institutions such as banks, savings and loan associations and credit unions report to the Fed the value of their time and savings deposits, vault cash and transaction accounts such as checkable deposits.

The data on checkable deposits are the primary source for the calculation of required reserves and the construction of the monetary aggregates. The Fed's Board of Governors and the Federal Open Market Committee use this information in the formulation of monetary policy.

. . . and Measured

M1 is the narrowest definition and measure of the money supply. It includes assets used primarily for transactions or as a medium of exchange. M1 includes currency and coin held by the nonbank public, demand deposits, other checkable deposits and traveler's checks.

M2 is a broader measure of money stock. In addition to the items included in M1, M2 includes the amount held in savings and small time deposits, money market deposit accounts (MMDAs), noninstitutional money market mutual funds (MMMFs) and certain other short-term money market assets.

M3 is an even broader definition of the money supply. It includes all of the components of M2 plus a number of financial assets and instruments generally employed by large businesses and financial institutions.

We can look at the three definitions of money in the following terms:

- M1 includes items that are primarily used as a medium of exchange.
- M2 includes items that are used as a store of value.
- M3 includes items that serve as a unit of account.

Activity from *Econ Ed* (New York: The Federal Reserve Bank of New York, September 1987) and revised by Robert Wedge, Massachusetts Council on Economic Education, Waltham, Mass.

The Fed considers a number of factors when it measures the monetary aggregates, but ultimately what matters is how the public uses the different forms of money available. For example, depositors can write checks on their MMDAs or their MMMFs. The public, however, primarily uses these types of accounts for savings and only secondarily for transactions. Therefore, these accounts are typically placed in M2 with savings accounts and time deposits, which also primarily serve the store-of-value function of money.

On the other hand, deposits in NOW (negotiable order of withdrawal) accounts are included in M1 because they are primarily used as a medium of exchange, even though they earn interest and depositors use them for savings.

1. What are the three basic functions of money?

2. Why is it important for the Fed to know the size and rate of growth of the money supply?

   (A) What are the effects if the money supply grows too slowly?

   (B) What are the effects if the money supply grows too rapidly?

3. Name a type of money that serves primarily as a medium of exchange.

4. Name a type of money that serves primarily as a store of value.

5. With the use of credit cards becoming more prominent and the availability of credit broader than ever, why are credit cards not included in the Ms?

6. Why is it difficult for the Fed to get an accurate measure of the money supply?

7. Why must the Fed continue to develop new ways to track the money supply?

8. Use the data in Figure 35.1 to calculate M1, M2 and M3. Assume that all items not mentioned are zero. Show all components for your answers.

Figure 35.1

Calculating the Ms

Checkable deposits (demand deposits, NOW, ATM and credit union share draft accounts)	$850
Currency	$200
Large time deposits	$800
Noncheckable savings deposits	$302
Small time deposits	$1,745
Institutional money market mutual funds	$1,210

M1 = _____

M2 = _____

M3 = _____

The Monetary Equation of Exchange

Economists use an equation made famous by Irving Fisher to show the relationship among money, price and real output. This equation is called the *equation of exchange*, and it typically takes the following form:

MV = PQ

M = the amount of money in circulation
V = the income velocity of money
P = the average price level
Q = real GDP or real value of all final goods and services

This equation attempts to show the balance between "money," which is represented on the left side of the equation, and goods and services, which are represented on the right side. For a given level of income velocity, if the supply of money grows faster than the rate of real output (changes in Q), then there will be inflation in the economy. Classical economists assumed that the velocity of money was stable (constant) over time because institutional factors — such as how frequently people are paid — largely determine velocity.

Activity written by Robert Wedge, Massachusetts Council on Economic Education, Waltham, Mass.

Part A

1. Define (in your own words and in one or two sentences each) the four variables in the equation of exchange.

2. The product of velocity (V) and the money supply (M) equals PQ. How can PQ be defined?

3. Suppose velocity remains constant, while the money supply increases. Explain how this would affect nominal GDP.

4. During the past 30 years, the use of credit cards has increased, and banks and financial institutions increasingly use computers for transactions. Explain how these changes might affect velocity.

5. As the result of legislative and regulatory reform throughout the 1980s and 1990s, banks and other financial institutions began paying interest on a significant proportion of the checkable deposits in the M1 definition of the money supply. Explain how these changes might be expected to affect the velocity of M1.

Part B

The following tables give data on money supply, prices, real GDP and velocity for the U.S. economy for 14 recent years. Because of rounding, some totals may not come out exactly.

6. Complete the tables by filling in the blanks.

Figure 36.1
M1 Chart

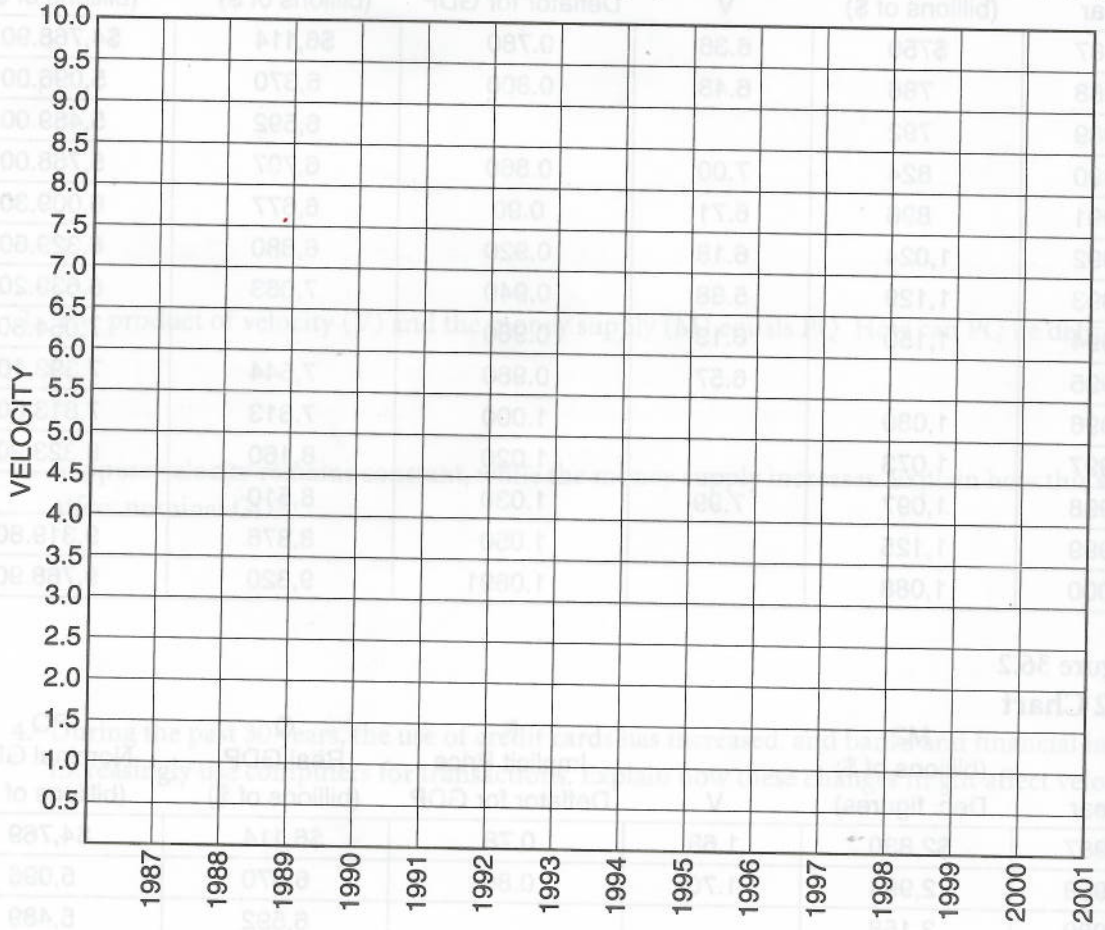
Year	M1 (billions of $)	V	P Implicit Price Deflator for GDP	Q Real GDP (billions of $)	PQ Nominal GDP (billions of $)
1987	$750	6.36	0.780	$6,114	$4,768.90
1988	786	6.48	0.800	6,370	5,096.00
1989	792			6,592	5,489.00
1990	824	7.00	0.860	6,707	5,768.00
1991	896	6.71	0.90	6,677	6,009.30
1992	1,024	6.18	0.920	6,880	6,329.60
1993	1,129	5.88	0.940	7,063	6,639.20
1994	1,150	6.13	0.960		7,054.30
1995		6.57	0.980	7,544	7,393.10
1996	1,080		1.000	7,813	7,813.00
1997	1,073		1.020	8,160	8,323.20
1998	1,097	7.99	1.030	8,510	
1999	1,125		1.050	8,876	9,319.80
2000	1,088		1.0691	9,320	9,768.90

Figure 36.2
M2 Chart

Year	M2 (billions of $; Dec. figures)	V	P Implicit Price Deflator for GDP	Q Real GDP (billions of $)	PQ Nominal GDP (billions of $)
1987	$2,830	1.68	0.78	$6,114	$4,769
1988	2,994	1.70	0.80	6,370	5,096
1989	3,158			6,592	5,489
1990	3,277	1.76	0.86	6,707	5,768
1991	3,377	1.78	0.90	6,677	6,009
1992	3,431	1.84	0.92	6,880	6,330
1993	3,484	1.91	0.94	7,063	6,639
1994	3,500	2.02	0.96	7,348	7,054
1995	3,642	2.03	0.98	7,544	
1996	3,815	2.05	1.00	7,813	7,813
1997	4,032	2.06	1.02		8,318
1998		2.00	1.03	8,510	8,790
1999	4,653		1.05	8,876	9,299
2000	4,945	2.01		9,319	9,963

7. What might one infer from the changes of the 1980s and 1990s about the classical assumption that institutional factors determine velocity?

8. Use the grid below and the M1 and M2 data to graph the income velocity from 1987 to 2000.



(A) What trends do you see?

(B) What is the difference in the value of M1 velocity and M2 velocity? Explain why they are different.

9. For a given money supply growth, a(n) (*increase / decrease*) in velocity will (*increase / decrease*) inflationary pressure. (Underline the correct word(s) in parentheses.)

The Multiple Expansion of Checkable Deposits

This activity is designed to illustrate how banks' lending of excess reserves can expand the nation's money supply and to explain how the Federal Reserve System can limit the growth of the money supply using the required reserve ratio.

Part A

Assume that

- the required reserve ratio is 10 percent of checkable deposits and banks lend out the other 90 percent of their deposits (banks wish to hold no excess reserves) and
- all money lent out by one bank is redeposited in another bank.

1. Under these assumptions, if a new checkable deposit of $1,000 is made in Bank 1,
   (A) how much will Bank 1 keep as required reserves? $_____
   (B) how much will Bank 1 lend out? $_____
   (C) how much will be redeposited in Bank 2? $_____
   (D) how much will Bank 2 keep as required reserves? $_____
   (E) how much will Bank 2 lend out? $_____
   (F) how much will be redeposited in Bank 3? $_____

2. Use your answers to Question 1 to help you complete the table in Figure 37.1. Fill in the blanks in the table, rounding numbers to the second decimal (for example, $59.049 = $59.05). After you have completed the table, answer the questions that follow by filling in the blanks or underlining the correct answer in parentheses so each statement is true.

Figure 37.1

Checkable Deposits, Reserves and Loans in Seven Banks

Bank No.	New Checkable Deposits	10% Fractional Reserves	Loans
1	$1,000.00	$100.00	$900.00
2	900.00		810.00
3		81.00	
4			656.10
5			
6		59.05	
7	531.44		478.30
All other banks combined			
Total for all banks	$10,000.00		$9,000.00

Adapted from Phillip Saunders, *Introduction to Macroeconomics: Student Workbook,* 18th ed. (Bloomington, Ind., 1998). Copyright Phillip Saunders. All rights reserved. Contributions made by Robert Wedge, Massachusetts Council on Economic Education, Waltham, Mass., and Lisa C. Herman-Ellison, Kokomo High School–South Campus, Kokomo, Ind.

3. In this example:

   (A) The original deposit of $1,000 increased total bank reserves by $_____. Eventually, this led to a total of $10,000 expansion of bank deposits, _____ of which was because of the original deposit, while _____ was because of bank lending activities.

   (B) Therefore, if the fractional reserve had been 15 percent instead of 10 percent, the amount of deposit expansion would have been *(more / less)* than in this example.

   (C) Therefore, if the fractional reserve had been 5 percent instead of 10 percent, the amount of deposit expansion would have been *(more / less)* than in this example.

   (D) If banks had not loaned out all of their excess reserves, the amount of deposit expansion would have been (*more / less*) than in this example.

   (E) If all loans had not been redeposited in the banking system, the amount of deposit expansion would have been (*more / less*) than in this example.

4. Another way to represent the multiple expansion of deposits is through *T-accounts.* In short, a T-account is an accounting relationship that looks at changes in balance sheet items. Since balance sheets must balance, so, too, must T-accounts. T-account entries on the asset side must be balanced by an offsetting asset or an offsetting liability. A sample T-account is provided below. For the bank, *assets* include accounts at the Federal Reserve District Bank, Treasury securities and loans; *liabilities* are deposits and *net worth* is assets minus liabilities. Show how the $1,000 checkable deposit described in Question 1 would be listed in a T-account.

Assets	Liabilities

Part B

The Federal Reserve sets the reserve requirements: the percentages of the bank's deposits that the bank must hold as reserves. Banks may not loan out these required reserves. As we said in Part A, this fractional reserve system actually allows banks to create money. The amount of reserves a bank holds is known as its *total reserves.* Total reserves are composed of *required reserves,* which the bank must keep, and *excess reserves,* which the bank can loan to other customers. The reserves held by the bank beyond those required by the Fed are *excess reserves.*

How much money would be created if the bank continued to loan out its excess reserves to the last penny? To find out, we must calculate the *deposit expansion multiplier.* The deposit expansion multiplier determines how much money can be created in the economy from an initial deposit. The formula for the deposit expansion multiplier is

$$\textbf{Deposit expansion multiplier} = \frac{1}{\textbf{reserve requirement}}$$

In the example in Part A, the Federal Reserve set the reserve requirement at 10 percent. So the deposit expansion multiplier would be

$$\textbf{Deposit expansion multiplier} = \frac{1}{0.10} = 10$$

To find the maximum amount of money that could be created, the formula is

Expansion of the money supply = deposit expansion multiplier x excess reserves

The multiplier is 10, and excess reserves from the initial bank deposit are $900. So the potential expansion of money (M1) would be

Expansion of the money supply = 10 x $900 = $9,000

M1 now consists of the original $1,000 deposit plus the $9,000 created.

5. Assume that $1,000 is deposited in the bank, and that each bank loans out all of its excess reserves. For each of the following required reserve ratios, calculate the amount that the bank must hold in required reserves, the amount that will be excess reserves, the deposit expansion multiplier and the maximum amount that the money supply could increase.

	Required Reserve Ratio					
	1%	5%	10%	12.5%	15%	25%
Required reserves						
Excess reserves						
Deposit expansion multiplier						
Maximum increase in the money supply						

6. If the required reserve ratio were 0 percent, then money supply expansion would be infinite. Why don't we want an infinite growth of the money supply? (Hint: remember the equation of exchange: MV = PQ.)

7. If the Federal Reserve wants to increase the money supply, should it raise or lower the reserve requirement? Why?

8. If the Federal Reserve increases the reserve requirement and velocity remains stable, what will happen to nominal GDP? Why?

9. What economic goal might the Federal Reserve try to meet by reducing the money supply?

10. Why might the money supply not expand by the amount predicted by the deposit expansion multiplier?

The Federal Reserve: The Mechanics of Monetary Policy

To manage the money supply, the Federal Reserve uses the tools of monetary policy to influence the quantity of reserves in the banking system. Increasing (decreasing) reserves tends to expand (contract) a bank's ability to make loans. Thus, reserve management gives the Fed powerful influence over the money supply and, in turn, over the general price level. The primary tool for reserve management today is open market operations (OMO). Discount rate changes serve primarily as signals; reserve requirements are rarely changed. Using T-accounts, Figures 38.1 and 38.2 show how the Fed could use open market operations to increase the money supply by $100.

Example: Baseline case

Figure 38.1 shows a baseline T-account. The required reserve ratio is 10 percent of checking deposits. With $26 in reserve accounts and $4 in Federal Reserve notes (vault cash), total bank reserves equal $30, exactly 10 percent of checkable deposits (in other words, no excess reserves). Net worth = assets – liabilities.

Figure 38.1
Baseline Case

Assets			Liabilities
	The Fed		
Treasury securities	$83	$26	Reserve accounts of banks
		$57	Federal Reserve notes
	Banks		
Reserve accounts	$26	$300	Checkable deposits
Federal Reserve notes	$4		
Loans	$405	$135	Net worth (to stockholders)
	Bank Customers		
Checkable deposits	$300	$405	Loans
Federal Reserve notes	$53		
Treasury securities	$52		
Money supply = $353 ($300 + $53)			

Activity written by Robert Graboyes, University of Richmond, Richmond, Va.

Example: Expansionary policy via open market purchases

Suppose the Fed believes the economy is heading into a recession and wishes to increase the money supply by $100. Using open market operations, the Fed purchases $10 worth of Treasury securities from the public.

Figure 38.2 shows the consolidated accounts after the changes of this Fed action work their way through the economy. Changes are shown in boldface. Be sure to compare Figure 38.1 with Figure 38.2 to see the changes. The Fed's $10 increase in reserve accounts yields a $100 increase in the money supply.

Figure 38.2
After $10 Open Market Purchase

Assets			Liabilities
	The Fed		
Treasury securities *(+$10)*	**$93**	**$36**	Reserve accounts of banks *(+$10)*
		$57	Federal Reserve notes
	Banks		
Reserve accounts *(+$10)*	**$36**	**$400**	Checkable deposits *(+$100)*
Federal Reserve notes	$4		
Loans *(+$90)*	**$495**	$135	Net worth (to stockholders)
	Bank Customers		
Checkable deposits *(+$100)*	**$400**	**$495**	Loans *(+$90)*
Federal Reserve notes	$53		
Treasury securities *(– $10)*	**$42**		

Money supply = **$453 ($400 + $53)**

For Questions 1 through 4, start with the baseline case in Figure 38.1. The Fed wishes to *decrease* the money supply from $353 to $303 by open market operations. The reserve requirement is 10 percent.

1. Will the Fed want to buy or sell existing Treasury securities? _____
2. What is the money multiplier? _____
3. What is the value of Treasury securities that need to be bought or sold? _____
4. Fill in Figure 38.3 to show the accounts after open market operations are finished and all changes have worked their way through the economy:

Figure 38.3
After Open Market Operations Are Finished

Assets		Liabilities
The Fed		
Treasury securities		Reserve accounts of banks
	$57	Federal Reserve notes
Banks		
Reserve accounts		Checkable deposits
Federal Reserve notes		
Loans	$135	Net worth (to stockholders)
Bank Customers		
Checkable deposits		Loans
Federal Reserve notes	$53	
Treasury securities		

Money supply = _____

For Questions 5 through 7, suppose banks keep zero excess reserves and the reserve requirement is 15 percent.

5. What is the deposit expansion multiplier? _____

6. A customer deposits $100,000 in his checking account.

   (A) How much of this can the bank lend to new customers? _____

   (B) How much must the bank add to its reserves? _____

   (C) In what two forms can a bank hold the new required reserves?

7. Suppose that the $100,000 had previously been held in Federal Reserve notes under the customer's mattress and that banks continue to hold no excess reserves. By how much will the customer's deposit cause the money supply to grow? _____

8. A very low discount rate may *(encourage banks to borrow / discourage banks from borrowing)* from the Federal Reserve. Underline the correct answer and explain why.

9. The federal funds rate is the interest rate at which financial institutions can borrow from other financial institutions. Suppose the federal funds rate is 5 percent and the discount rate is 4.5 percent. Why is it that a bank might choose to borrow in the federal funds market, rather than getting the lower interest rate available through the discount window?

10. In a foreign country, the reserve requirement is 100 percent. What will be the deposit expansion multiplier? _____

11. If the Fed decided to implement a policy action designed to increase the money supply, in which direction would bank reserves and the federal funds rate change and why?

12. Circle the correct symbol (↑ for increase, ↓ for decrease) in Figure 38.4.

Figure 38.4
Fed Actions and Their Effects

Federal Reserve Action	Bank Reserves	Money Supply	Fed Funds Rate
A. Sold Treasury securities on the open market	↑ ↓	↑ ↓	↑ ↓
B. Bought Treasury securities on the open market	↑ ↓	↑ ↓	↑ ↓
C. Raised the discount rate	↑ ↓	↑ ↓	↑ ↓
D. Lowered the discount rate	↑ ↓	↑ ↓	↑ ↓
E. Raised the reserve requirement	↑ ↓	↑ ↓	↑ ↓
F. Lowered the reserve requirement	↑ ↓	↑ ↓	↑ ↓

13. Indicate in the table in Figure 38.5 how the Federal Reserve could use each of the three monetary policy tools to pursue an expansionary policy and a contractionary policy.

Figure 38.5
Tools of Monetary Policy

Monetary Policy	Expansionary Policy	Contractionary Policy
A. Open market operations		
B. Discount rate		
C. Reserve requirements		

14. Why do banks hold excess reserves, which pay no interest?

15. Why does the Fed rarely use the reserve requirement as an instrument of monetary policy?

16. What does it mean to say that the Fed changes the discount rate mostly as a *signal* to markets?

17. Why does the Fed currently target the federal funds rate rather than the money supply?

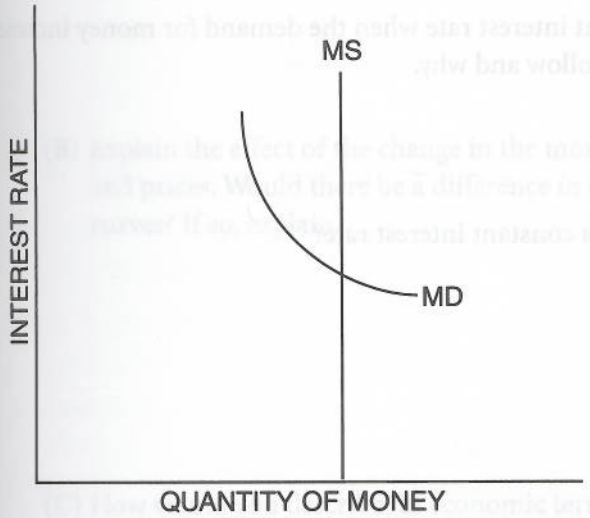
The Money Market

The money market consists of the demand for money and the supply of money. We generally assume that the Federal Reserve determines the supply of money. Thus, the supply of money is a vertical line. The demand for money is based on a decision of whether to hold your wealth in the form of interest bearing assets (savings accounts, stocks, etc.) or as money (noninterest bearing). The demand for money is a function of interest rates and income, and is determined by three motives:

- Transactions demand — the demand for money to make purchases of goods and services
- Precautionary demand — the demand for money to serve as protection against an unexpected need
- Speculative demand — the demand for money because it serves as a store of wealth

The interest rate represents the opportunity cost of holding money; that is, the interest rate represents the forgone income you might have made had you held an interest-bearing asset rather than money, a noninterest-bearing asset. Thus the demand for money has an inverse relationship with the interest rate. The demand curve represents the demand for money at various levels of the interest rate for the given income level (GDP). The graph of the money market looks like this:

Figure 39.1
The Money Market



Activity written by Rae Jean B. Goodman, U.S. Naval Academy, Annapolis, Md.

1. Suppose the Federal Reserve increases the money supply by buying Treasury securities.

   (A) What happens to the interest rate?

   (B) What happens to the quantity of money demanded?

   (C) Explain what happens to loans and interest rates as the Fed increases the money supply.

2. Suppose the demand for money increases.

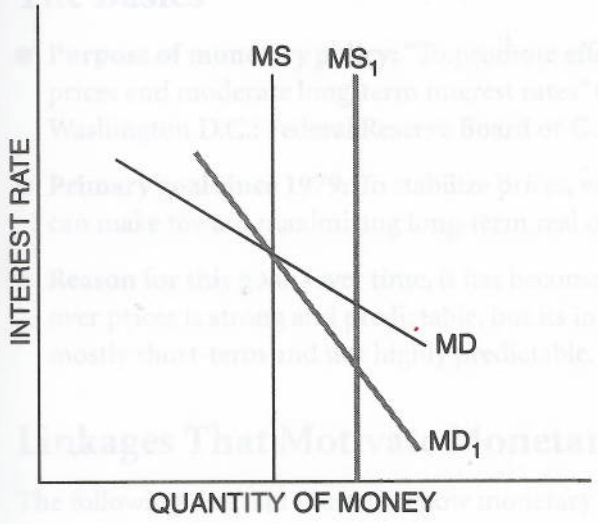
   (A) What happens to the interest rate?

   (B) What happens to the quantity of money supplied?

   (C) If the Fed wants to maintain a constant interest rate when the demand for money increases, explain what policy the Fed needs to follow and why.

   (D) Why might the Fed want to maintain a constant interest rate?

Figure 39.2
Alternative Money Demand Curves



3. Suppose there are two money demand curves — MD and MD_1 — and the Fed increases the money supply from MS to MS_1 as shown in Figure 39.2.

   (A) Compare what happens to the interest rate with each MD curve.

   (B) Explain the effect of the change in the money supply on consumption, investment, real output and prices. Would there be a difference in the effects under the two different money demand curves? If so, explain.

   (C) How would you describe, in economic terms, the difference between the two money demand curves?

   (D) If the Federal Reserve is trying to get the economy out of a recession, which money demand curve would it want to represent the economy? Explain.

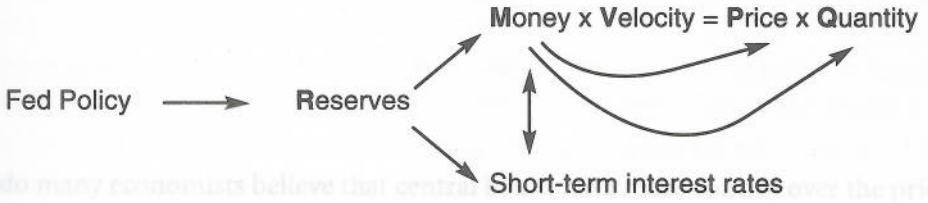
The Federal Reserve: Monetary Policy and Macroeconomics

The Basics

- **Purpose of monetary policy:** "To promote effectively the goals of maximum employment, stable prices and moderate long-term interest rates" (*The Federal Reserve System: Purpose and Functions*, Washington D.C.: Federal Reserve Board of Governors, page 17.)
- **Primary goal since 1979:** To stabilize prices, which is arguably the strongest contribution the Fed can make toward maximizing long-term real output and moderating long-term interest rates
- **Reason for this goal:** Over time, it has become evident that monetary policy's long-term influence over prices is strong and predictable, but its influence over real output and real interest rates is mostly short-term and not highly predictable.

Linkages That Motivate Monetary Policy

The following diagram illustrates how monetary policy operates and how it affects prices and quantities (real output).



The Fed Influences the Money Supply by Managing Reserves

A greater volume of reserves leads banks to expand credit, expanding the money supply through the *money multiplier.*

- **Tools of policy:** Open market operations are the most frequently used tool. Changes in the discount rate are used primarily to signal the Fed's policy. Reserve requirements are seldom adjusted.
- **Choice of policy targets:** The Fed can set money supply targets, knowing that such actions will affect short-term interest rates as a by-product. Or the Fed can target short-term interest rates directly. Because of changes in financial institutions and other economic relationships, the optimal operating procedures change over time.
- **Limitation on policy:** The Fed cannot target the money supply and short-term interest rates simultaneously. *Ceteris paribus*, or all other factors held constant, increasing (decreasing) the money supply decreases (increases) short-term interest rates.
- **Importance of velocity:** Changes in the money supply have little short-term effect on velocity, so changes in the money supply *must* affect prices or real output, or both. This linkage provides the underlying motive for the long-term conduct of monetary policy.

Activity written by Robert Graboyes, University of Richmond, Richmond, Va.

Economists Can Disagree Sharply Over the Effects of a Given Monetary Policy

This disagreement can occur because

- the relationship between reserves and the money supply can change.
- the relationship between the money supply and short-term interest rates can change.
- velocity is not entirely stable.
- it is difficult to determine which money supply measure is most appropriate to policy.
- though today's monetary economists do not generally fall neatly into categories such as "Keynesian" and "monetarist," debates persist over the relative impact of monetary policy on prices and output. These relative impacts can change over time.
- data are imperfect, and many data series are produced and transmitted with lags.
- economic relationships are dynamic. Action the Fed takes today affects the economy well into the future.

1. What is monetary policy?

2. From 1998 to 2002, what was the dominant focus of monetary policy and why?

3. Explain why the money supply and short-term interest rates are inversely related.

4. What are some reasons for lags and imperfections in data used by central banks?

5. Why do many economists believe that central banks have more control over the price level than over real output?

6. What might cause velocity to change?

7. If velocity were extremely volatile, why would this complicate the job of making monetary policy?

8. What role does the money multiplier play in enabling the Fed to conduct monetary policy?

9. What is the fed funds rate?

10. What happens to the fed funds rate if the Fed follows a contractionary (tight money) policy?

11. What happens to the fed funds rate if the Fed follows an expansionary (easy money) policy?

12. Why do observers pay close attention to the federal funds rate?

Real Interest Rates and Nominal Interest Rates

If you bought a one-year bond for $1,000 and the bond paid an interest rate of 10 percent, at the end of the year would you be 10 percent wealthier? You will certainly have 10 percent more money than you did a year earlier, but can you buy 10 percent more? If the price level has risen, the answer is that you cannot buy 10 percent more: If the inflation rate were 8 percent, then you could buy only 2 percent more; if the inflation rate were 12 percent, you would be able to buy 2 percent less! The *nominal interest rate* is the rate the bank pays you on your savings or the rate that appears on your bond or car loan. The *actual real interest rate* represents the change in your purchasing power. The *expected real interest rate* represents the amount you need to receive in real terms to forgo consumption now for consumption in the future.

The relationship between the nominal interest rate, the real interest rate and the inflation rate can be written as

$$r = i - \pi$$

where r is the real interest rate, i is the nominal interest rate and π is the inflation rate. This relationship is called the *Fisher Equation.* In the example above with the 10 percent bond, if the inflation rate were 6 percent, then your real interest rate (the increase in your purchasing power) would be 4 percent.

Obviously banks and customers do not know what inflation is going to be, so the interest rates on loans, bonds, etc. are set based on expected inflation. The expected real interest rate is

$$r^e = i - \pi^e$$

where π^e is the expected inflation rate. The equation can be rewritten as

$$i = r^e + \pi^e$$

A bank sets the nominal interest rate equal to its expected real interest rate plus the expected inflation rate. However, the real interest rate it actually receives may be different if inflation is not equal to the bank's expected inflation rate.

The equation of exchange is MV = PQ. If we assume that velocity (V) is constant, then changes in the money supply (M) result in changes in the nominal output (PQ). The equation of exchange can be rewritten in terms of percentage change to be

percentage change in money supply + percentage change in velocity = percentage change in price level + percentage change in real output

Activity written by Rae Jean B. Goodman, U.S. Naval Academy, Annapolis, Md.

The first term, *percentage change in the money supply,* is controlled by the monetary authority (Federal Reserve). Assuming that velocity is constant, the second term is zero. The third term is the inflation rate and the fourth term is the growth in real output. Output (Q) is determined by the factors of production, technology and the production function. Output can be taken as given. Therefore, the percentage change in the money supply results in an equal percentage change in the price level.

Increases in the money supply by the Federal Reserve will result in increases in the price level, or inflation. Using the Fisher Equation, the increase in inflation would result in an increase in the nominal interest rate or a decrease in the real interest rate or in some combination. This is known as the *Fisher Effect,* or *Fisher Hypothesis.* Evidence indicates that increases in the inflation rate result in increases in the nominal interest rate in the long run. Increases in the money supply are translated into increases in the price level and increases in the nominal interest rate *in the long run.*

We know that

- in the short run, increases in the money supply decrease the nominal interest rate and real interest rate;
- in the long run, increases in the money supply will result in an increase in the price level and the nominal interest rate.

Figure 41.1

Real and Nominal Interest Rates

Year	Nominal Interest Rate	Inflation Rate	Real Interest Rate
1991	5.41%	3.12%	
1992	3.46	2.30	
1993	3.02	2.42	
1994	4.27	2.05	
1995	5.51	2.12	
1996	5.02	1.87	
1997	5.07	1.85	
1998	4.78	1.14	
1999	4.64	1.56	
2000	5.82	2.29	
2001	3.39	1.96	

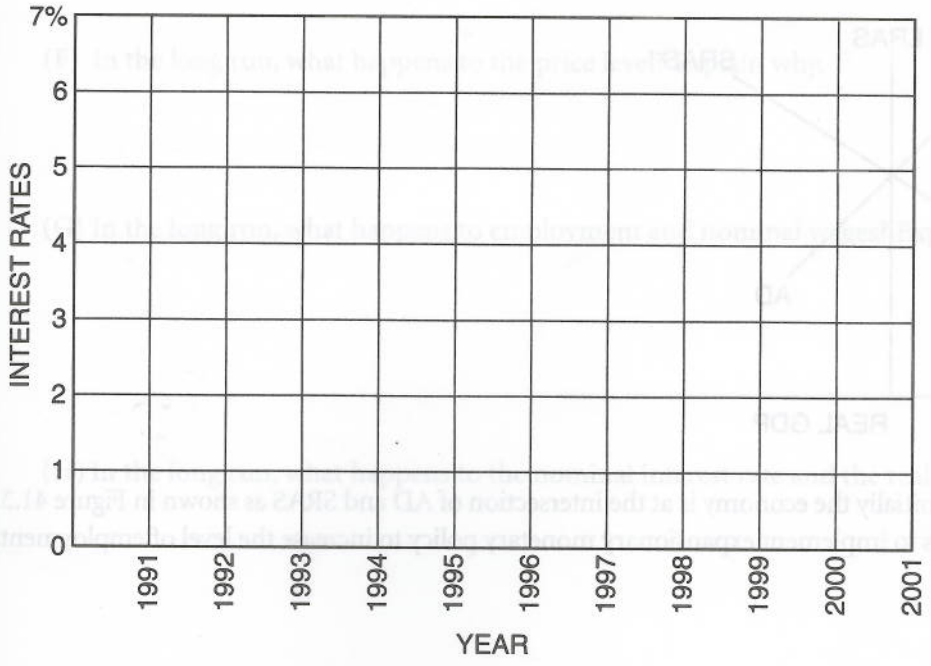
1. Figure 41.1 provides the nominal interest rates and inflation rates for the years 1991 through 2001.

   (A) Compute the actual real interest rates for 1991 through 2001.

   (B) Graph the nominal interest rates and the actual real interest rates on Figure 41.2.

Figure 41.2

Real and Nominal Interest Rates



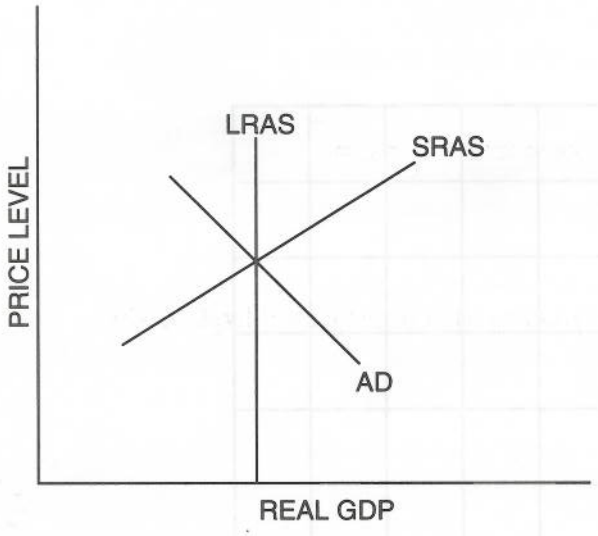
(C) Has the actual real interest rate stayed constant? _____

(D) If it has not, explain why you think the real rate has not been constant.

(E) For what years has the actual real interest rate remained nearly constant?

2. Frequently, economists argue that the monetary authorities should try to maintain a steady real interest rate. Explain why you think a steady real rate of interest is important to the economy.

Figure 41.3
Expansionary Monetary Policy



3. Suppose that initially the economy is at the intersection of AD and SRAS as shown in Figure 41.3. Now, the Fed decides to implement expansionary monetary policy to increase the level of employment.

(A) In the short run, what happens to real output? Explain why.

(B) In the short run, what happens to the price level? Explain why.

(C) In the short run, what happens to employment and nominal wages? Explain why.

(D) In the short run, what happens to nominal interest rates and real interest rates?

(E) In the long run, what happens to real output? Explain why.

(F) In the long run, what happens to the price level? Explain why.

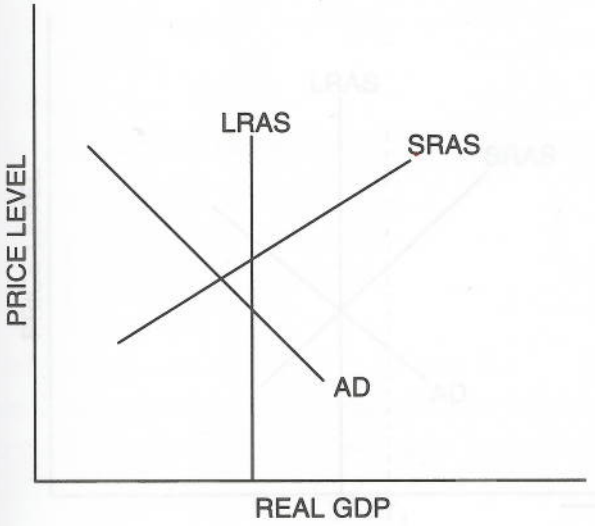
(G) In the long run, what happens to employment and nominal wages? Explain why.

(H) In the long run, what happens to the nominal interest rate and the real interest rate?

Monetary Policy

We now bring together all of the pieces of the process by which monetary policy is transmitted to the economy, and we examine both the short-run effects and the long-run effects of monetary policy.

Figure 42.1
Effects of Monetary Policy



1. Suppose that initially the economy is at the intersection of AD and SRAS in Figure 42.1.

   (A) What monetary policy should the Fed implement to move the economy to full-employment output? _____

   (B) If the Fed is going to use open market operations, it should *(buy / sell)* Treasury securities.

   (C) What is the effect on Treasury security (bond) prices?

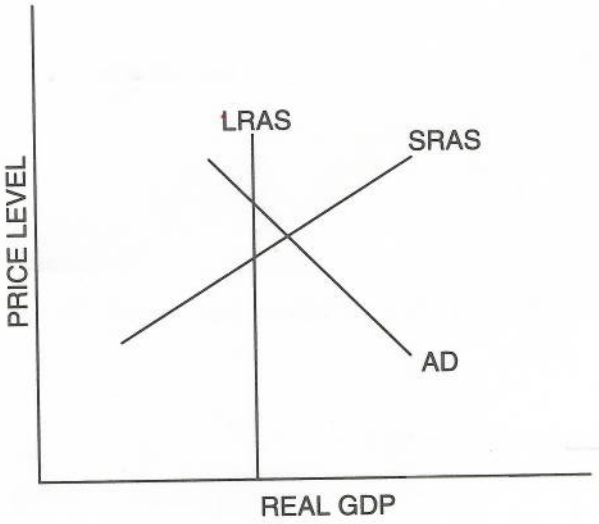
   (D) In the short run, what is the effect on nominal interest rates? Explain.

   (E) In the short run, what happens to real output? Explain how the Fed's action results in a change in real output.

Activity written by Rae Jean B. Goodman, U.S. Naval Academy, Annapolis, Md.

(F) In the short run, what happens to the price level? Explain how the Fed's action results in a change to the price level.

Figure 42.2
Moving to Full Employment



2. Suppose that initially the economy is at the intersection of AD and SRAS in Figure 42.2.

(A) What monetary policy should the Fed implement to move the economy to full-employment output? _____

(B) If the Fed is going to use open market operations, it should *(buy / sell)* Treasury securities.

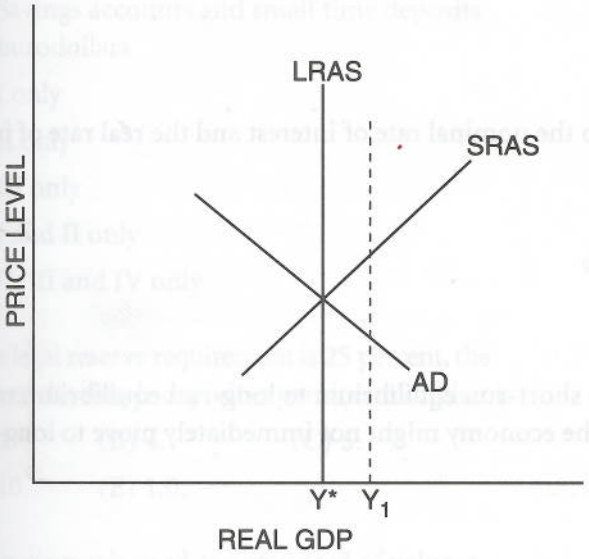
(C) What is the effect on Treasury security (bond) prices?

(D) In the short run, what is the effect on nominal interest rates? Explain.

(E) In the short run, what happens to real output? Explain how the Fed's action results in a change in real output.

(F) In the short run, what happens to the price level? Explain how the Fed's action results in a change to the price level.

Figure 42.3
Expansionary Monetary Policy



3. Suppose that in the situation shown in Figure 42.3, the aggregate supply and demand curves are represented by LRAS, SRAS and AD. The monetary authorities decide to maintain the level of employment represented by the output level Y_1 by using expansionary monetary policy.

   (A) Explain the effect of the expansionary monetary policy on the price level and output in the short run.

   (B) Explain the effect on the price level and output in the long run.

(C) Explain what you think will happen to the nominal rate of interest and the real rate of interest in the short run as the Fed continues to increase the money supply. Explain why.

(D) Explain what you think will happen to the nominal rate of interest and the real rate of interest in the long run. Explain why.

4. Many economists think that moving from short-run equilibrium to long-run equilibrium may take several years. List three reasons why the economy might not immediately move to long-run equilibrium.

5. In a short paragraph, summarize the long-run impact of an expansionary monetary policy on the economy.