Chapter 4

The Monetary System: What it Is and How It Works

Modified for ECON 2204
by Bob Murphy
IN THIS CHAPTER, YOU WILL LEARN:

- The definition, functions, and types of money
- How banks “create” money
- What a central bank is and how it controls the money supply
Money: **Definition**

**Money** is the stock of assets that can be readily used to make transactions.
Money: Functions

- **Medium of exchange**
  we use it to buy stuff

- **Store of value**
  transfers purchasing power from the present to the future

- **Unit of account**
  the common unit by which everyone measures prices and values
Money: Types

1. Fiat money
   - has no intrinsic value
   - example: the paper currency we use

2. Commodity money
   - has intrinsic value
   - examples:
     - gold coins,
     - cigarettes in P.O.W. camps
Discussion Question

Which of these are money?

a. Currency
b. Checks
c. Deposits in checking accounts ("demand deposits")
d. Credit cards
e. Certificates of deposit ("time deposits")
Two definitions

- The **money supply** is the quantity of money available in the economy.
- **Monetary policy** is the control over the money supply.
The central bank and monetary control

- Monetary policy is conducted by a country’s **central bank**.

- The U.S.’s central bank is called the **Federal Reserve** ("the Fed").

- To control the money supply, the Fed uses **open market operations**, the purchase and sale of government bonds.
## Money supply measures, July 2017

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Assets Included</th>
<th>Amount in July 2017 (billions of dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Currency</td>
<td>$1,486</td>
</tr>
<tr>
<td>M1</td>
<td>Currency plus demand deposits, traveler’s checks, and other checkable deposits</td>
<td>3,528</td>
</tr>
<tr>
<td>M2</td>
<td>M1 plus retail money market mutual fund balances, saving deposits (including money market deposit accounts), and small time deposits</td>
<td>13,602</td>
</tr>
</tbody>
</table>
Banks’ role in the monetary system

- The money supply equals currency plus demand (checking account) deposits:
  \[ M = C + D \]

- Since the money supply includes demand deposits, the banking system plays an important role.
A few preliminaries

- **Reserves** ($R$): the portion of deposits that banks have not lent.

- A bank’s liabilities include deposits; assets include reserves and outstanding loans.

- **100-percent-reserve banking**: a system in which banks hold all deposits as reserves.

- **Fractional-reserve banking**: a system in which banks hold a fraction of their deposits as reserves.
Banks’ role in the monetary system

- To understand the role of banks, we will consider three scenarios:
  1. No banks
  2. 100-percent-reserve banking (banks hold all deposits as reserves)
  3. Fractional-reserve banking (banks hold a fraction of deposits as reserves, use the rest to make loans)

- In each scenario, we assume \( C = $1,000 \).
SCENARIO 1: No banks

With no banks,

\[ D = 0 \quad \text{and} \quad M = C = $1,000. \]
SCENARIO 2: 100-percent-reserve banking

- Initially \( C = 1000 \), \( D = 0 \), \( M = 1,000 \).
- Now suppose households deposit the $1,000 at “Firstbank.”

Firstbank’s balance sheet

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>reserves $1,000</td>
<td>deposits $1,000</td>
</tr>
</tbody>
</table>

- After the deposit: \( C = 0 \), \( D = 1,000 \), \( M = 1,000 \)

**Lesson:** 100%-reserve banking has no impact on size of money supply.
SCENARIO 3: Fractional-reserve banking

- Suppose banks hold 20% of deposits in reserve, making loans with the rest.
- Firstbank will make $800 in loans.

<table>
<thead>
<tr>
<th>FIRSTBANK’S balance sheet</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assets</strong></td>
</tr>
<tr>
<td>reserves $200</td>
</tr>
<tr>
<td>loans $800</td>
</tr>
</tbody>
</table>

The money supply now equals $1,800:
- Depositor has $1,000 in demand deposits.
- Borrower holds $800 in currency.
SCENARIO 3: Fractional-reserve banking

- Suppose the borrower deposits the $800 in Secondbank.
- Initially, Secondbank’s balance sheet is:

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>reserves</td>
<td>deposits</td>
</tr>
<tr>
<td>$160</td>
<td>$800</td>
</tr>
<tr>
<td>loans</td>
<td>$640</td>
</tr>
</tbody>
</table>

- Secondbank will loan 80% of this deposit.
SCENARIO 3: Fractional-reserve banking

- If this $640 is eventually deposited in Thirdbank,
- Then Thirdbank will keep 20% of it in reserve and loan the rest out:

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>reserves</td>
<td>deposits</td>
</tr>
<tr>
<td>$128</td>
<td>$640</td>
</tr>
<tr>
<td>loans</td>
<td></td>
</tr>
<tr>
<td>$512</td>
<td></td>
</tr>
</tbody>
</table>
Finding the total amount of money:

Original deposit = $1000
+ Firstbank lending = $ 800
+ Secondbank lending = $ 640
+ Thirdbank lending = $ 512
+ other lending...

Total money supply = \( \frac{1}{rr} \times 1,000 \)
where \( rr \) = ratio of reserves to deposits

In our example, \( rr = 0.2 \), so \( M = $5,000 \)
Money creation in the banking system

A fractional-reserve banking system creates money, but it doesn’t create wealth:

Bank loans give borrowers some new money and an equal amount of new debt.
Bank capital, leverage, and capital requirements

- **Bank capital**: the resources a bank’s owners have put into the bank

- A more realistic balance sheet:

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities and Owners’ Equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reserves</td>
<td>Deposits</td>
</tr>
<tr>
<td></td>
<td>$200</td>
</tr>
<tr>
<td>Loans</td>
<td>Debt</td>
</tr>
<tr>
<td>500</td>
<td>200</td>
</tr>
<tr>
<td>Securities</td>
<td>Capital (owners’ equity)</td>
</tr>
<tr>
<td>300</td>
<td>50</td>
</tr>
</tbody>
</table>
Bank capital, leverage, and capital requirements

- **Leverage**: the use of borrowed money to supplement existing funds for purposes of investment

- **Leverage ratio**  $= \frac{\text{assets}}{\text{capital}}$
  
  $= \frac{\$200 + 500 + 300}{\$50} = 20$

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities and Owners’ Equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reserves $200</td>
<td>Deposits $750</td>
</tr>
<tr>
<td>Loans 500</td>
<td>Debt 200</td>
</tr>
<tr>
<td>Securities 300</td>
<td>Capital (owners’ equity) 50</td>
</tr>
</tbody>
</table>
Bank capital, leverage, and capital requirements

- Being highly leveraged makes banks vulnerable.
- Example: Suppose a recession causes our bank’s assets to fall by 5%, to $950.
- Then, capital = assets – liabilities = 950 – 950 = 0

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<tr>
<td>Reserves</td>
<td>Deposits</td>
</tr>
<tr>
<td>$200</td>
<td>$750</td>
</tr>
<tr>
<td>Loans</td>
<td>Debt</td>
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<tr>
<td>500</td>
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<td>Capital (owners’ equity)</td>
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<tr>
<td>300</td>
<td>50</td>
</tr>
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</table>
Bank capital, leverage, and capital requirements

Capital requirement:

- minimum amount of capital mandated by regulators
- intended to ensure banks will be able to pay off depositors
- higher for banks that hold more risky assets

2008-2009 financial crisis:

- Losses on mortgages shrank bank capital, slowed lending, exacerbated the recession.
- Govt injected billions of dollars of capital into banks to ease the crisis and encourage more lending.
A model of the money supply

exogenous variables

- **Monetary base**, $B = C + R$
  
  *controlled by the central bank*

- **Reserve-deposit ratio**, $rr = \frac{R}{D}$
  
  *depends on regulations & bank policies*

- **Currency-deposit ratio**, $cr = \frac{C}{D}$
  
  *depends on households’ preferences*
Solving for the money supply:

\[ M = C + D = \frac{C + D}{B} \times B = m \times B \]

where

\[ m = \frac{C + D}{B} \]

\[ = \frac{C + D}{C + R} = \frac{(C/D) + (D/D)}{(C/D) + (R/D)} = \frac{cr + 1}{cr + rr} \]
The money multiplier

\[ M = m \times B, \quad \text{where} \quad m = \frac{cr + 1}{cr + rr} \]

- If \( rr < 1 \), then \( m > 1 \)
- If monetary base changes by \( \Delta B \), then \( \Delta M = m \times \Delta B \)
- \( m \) is the money multiplier, the increase in the money supply resulting from a one-dollar increase in the monetary base.
The money multiplier

\[ M = m \times B, \quad \text{where} \quad m = \frac{cr + 1}{cr + rr} \]

Suppose households decide to hold more of their money as currency and less in the form of demand deposits.

1. Determine impact on money supply.

2. Explain the intuition for your result.
The instruments of monetary policy

The Fed can change the monetary base using:

- open market operations (the Fed’s preferred method of monetary control)
  - To increase the base, the Fed could buy government bonds, paying with new dollars.
- the discount rate: the interest rate the Fed charges on loans to banks
  - To increase the base, the Fed could lower the discount rate, encouraging banks to borrow more reserves.
The instruments of monetary policy

The Fed can change the reserve-deposit ratio using:

- **reserve requirements**: Fed regulations that impose a minimum reserve-deposit ratio
  - To reduce the reserve-deposit ratio, the Fed could reduce reserve requirements.

- **interest on reserves**: the Fed pays interest on bank reserves deposited with the Fed
  - To reduce the reserve-deposit ratio, the Fed could pay a lower interest rate on reserves.
Why the Fed can’t precisely control $M$

$$M = m \times B, \text{ where } m = \frac{cr + 1}{cr + rr}$$

- Households can change $cr$, causing $m$ and $M$ to change.
- Banks often hold excess reserves (reserves above the reserve requirement). If banks change their excess reserves, then $rr$, $m$, and $M$ change.
From 8/2008 to 8/2011, the monetary base tripled, but $M_1$ grew only about 40%.
CASE STUDY: Quantitative Easing


- The Fed also bought mortgage-backed securities to help the housing market.

- But after losses on bad loans, banks tightened lending standards and increased excess reserves, causing money multiplier to fall.

- If banks start lending more as economy recovers, rapid money growth may cause inflation. To prevent, the Fed is considering various “exit strategies.”
Money Supply and Monetary Base

Figure 2   The Money Supply and the Monetary Base

Source: Board of Governors of the Federal Reserve System.
As discussed in Chapter 4, the money multiplier measures the ratio of the money supply to the monetary base. Each dollar of the monetary base gives rise to a multiple expansion in credit as banks make loans from the funds they receive in deposits.

Figure 1 shows the money multiplier for the money supply measure known as $M_1$. As the financial crisis intensified during the fall of 2008, the money multiplier declined sharply, as banks became cautious about lending (see Supplements 20-7 and 20-8). The multiplier fell from a value of about 1.7 before the crisis to 0.8 by late 2009.

Note: Money supply measure is $M_1$.

Source: Board of Governors of the Federal Reserve System and author’s calculations.

Figure 2 plots the level of the money supply and monetary base. The monetary base increased rapidly during the crisis, eventually rising above $M_1$. This expansion in the monetary base was reflected in the more than quadrupling of the Fed’s balance sheet as it flooded the economy with liquidity through numerous facilities and programs. Unlike during the Great Depression of the 1930s, the money supply continued to grow during the recent crisis, as a result of the extraordinary actions taken by the Fed.
Banks typically hold relatively low amounts of reserves compared to their deposits, as they seek to lend out as much of their funds as possible while meeting required reserve minimums set by regulators. But as uncertainty skyrocketed during September 2008, banks began to hoard reserves. With the Federal Reserve providing liquidity to financial markets through various lending facilities, reserves available to the banking system increased sharply.

As Figure 1 illustrates, the ratio of bank reserves to deposits shot up rapidly during late 2008 and then increased further during 2009–2011. The ratio historically had been around 0.07 but hit a high of 1.7 in 2011. As discussed in Chapter 4, during the financial crisis of the early 1930s, the reserve–deposit ratio also increased when a bank panic caused banks to curtail their lending.

But unlike during the crisis of the early 1930s, the currency–deposit ratio did not rise during the recent crisis. As shown in Figure 1, it actually declined slightly. Even so, the increase in the reserve–deposit ratio caused the money multiplier to drop sharply (see Supplement 20-6). But because the Fed had tripled the monetary base, the money supply continued to expand, in contrast to the 1930s, when the Fed did not increase reserves sufficiently to keep the money supply from plummeting.

Note: Reserves are for all depository institutions, currency is currency in circulation, and deposits are those associated with the money supply measure, M1.

Source: Board of Governors of the Federal Reserve System and author’s calculations.
CASE STUDY: Bank failures in the 1930s

- From 1929 to 1933:
  - over 9,000 banks closed
  - money supply fell 28%

- This drop in the money supply may not have caused The Great Depression, but certainly contributed to its severity.
CASE STUDY:
Bank failures in the 1930s

\[ M = m \times B, \quad \text{where} \quad m = \frac{cr + 1}{cr + rr} \]

- Loss of confidence in banks: increases \( cr \), reduces \( m \)
- Banks became more cautious: increases \( rr \), reduces \( m \)
CASE STUDY:
Bank failures in the 1930s

<table>
<thead>
<tr>
<th></th>
<th>August 1929</th>
<th>March 1933</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>26.5</td>
<td>19.0</td>
<td>−28.3%</td>
</tr>
<tr>
<td>C</td>
<td>3.9</td>
<td>5.5</td>
<td>41.0</td>
</tr>
<tr>
<td>D</td>
<td>22.6</td>
<td>13.5</td>
<td>−40.3</td>
</tr>
<tr>
<td>B</td>
<td>7.1</td>
<td>8.4</td>
<td>18.3</td>
</tr>
<tr>
<td>C</td>
<td>3.9</td>
<td>5.5</td>
<td>41.0</td>
</tr>
<tr>
<td>R</td>
<td>3.2</td>
<td>2.9</td>
<td>−9.4</td>
</tr>
<tr>
<td>m</td>
<td>3.7</td>
<td>2.3</td>
<td>−37.8</td>
</tr>
<tr>
<td>rr</td>
<td>0.14</td>
<td>0.21</td>
<td>50.0</td>
</tr>
<tr>
<td>cr</td>
<td>0.17</td>
<td>0.41</td>
<td>141.2</td>
</tr>
</tbody>
</table>
Could this happen again?

- Many policies have been implemented since the 1930s to prevent such widespread bank failures.
- *E.g.*, Federal Deposit Insurance, to prevent bank runs and large swings in the currency-deposit ratio.