1. Who affects the money supply?

The Fed alone does not.

Three sets of people: central bank, banks, public

The interactions between these three groups determine the economy’s money supply.

2. 100% reserve banking

Money supply \( M \) = sum of currency \( C \) + demand deposits \( D \)

\[ C = \text{currency (cash) held by the public and currency held by banks} \]

\[ D = \text{deposits at banks which the public can withdraw on demand (e.g., checking accounts)} \]

Imagine a world with no banks. Suppose there is $1000 of currency in the economy. Hence, \( M \) = $1000.

Now introduce banks; banks only accept deposits but don’t make any loans.

People deposit the $1000 in the bank, which the bank holds as reserves \( R \). All 100% of it are just held by the bank as deposits.

This is 100% reserve banking.

After creation of the first bank, \( M \) is still $1000.

Now, \( C = 0 \), and \( D = 1000 \).

Key point: if banks hold 100% reserves (i.e., make no loans), they do not change the money supply.
3. Fractional reserve banking

Now banks are allowed to make loans. Some reserves must still be kept. Why?

Fractional reserve banking is a system where banks hold less than 100% of their deposits as reserves.

Let $ r = \text{fraction of deposits held as reserves}.

Then bank loans out $(1-r)D$.

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Then bank loans out $(1-r)D$.
Second bank: borrower deposits $800 in second bank; i.e. he deposits \((1-r)D\) (what he got as a loan from the first bank) into the second bank.

Second bank also keeps a fraction \(r\) (20\%) of this as reserves ($160), and lends out the remainder fraction \((1-r)\) or an amount $ 640.

So second bank lending is \((1-r)(1-r)D = (1-r)^2D = (1-0.2)^2\times 800 = 640\) which is the loan someone gets (as currency) and puts it into a third bank.

So money supply now is: \(1800 + 640 = 2440\). Or, new money supply is \(D + (1-r)D + (1-r)^2D\).

And so on....

This process of money creation goes on forever.

In general new money supply created is
\[
D + (1-r)D + (1-r)^2D + (1-r)^3D + \ldots = D \left[ 1 + (1-r) + (1-r)^2 + (1-r)^3 \right] = \left(\frac{1}{r}\right) \times D.
\]

So, our original $1000 eventually generates \(\left(\frac{1}{0.2}\right) \times 1000 = 5000\) of money.

Each unit of the monetary base allows \((1/r)\) units of money to be created leading to a money supply that is a multiple of the monetary base; all due to multiple expansion of loans and deposits.

### 4. Money Supply determination and the money multiplier

Definitions:
- \(M = C + D\) (money supply = currency + deposits)
- \(B = C + R\) (total number of dollars held by the public as currency \(C\) and by the banks as reserves \(R\)); Fed controls this; a.k.a high powered money

\[\begin{align*}
    r &= \text{reserve-deposit ratio} = \frac{R}{D} \\
    &\quad \text{(determined by the decisions of banks and by law); } r < 1.
\end{align*}\]

- \(c = \text{currency-deposit ratio}\)
  \(\text{(how much money does the public hold in plain currency and how much in deposits)}\)
  \(= \frac{C}{D};\) (determined by the public)

\[
\begin{align*}
    M &= C + D \\
    B &= C + R
\end{align*}
\]

Components of the monetary base
Show:
\[
M = \frac{c+1}{c+r} \cdot B = mB
\]

\[m\] is called the money multiplier.

Show: \(m > 1\).

\[C = 741.2; \text{ RES } = 71; \text{ DEP } = 636.4; \text{ all in billions of $; Jun 2006} \]

\[\text{BASE = C + RES } = 812.2\]
\[\text{M = C + DEP } = 1377.5\]
\[r = \text{ RES/DEP } = 0.11\]
\[c = \text{ CU / DEP } = 1.16\]

\[m = \frac{(1+c)}{(1+r)} = 1.70\]

5. What causes money supply to change?

Algebraically, it can be shown that an increase in \(c\) or \(r\) leads to a decrease in \(m\).

2. Intuition: when \(r\) increases, banks lend a smaller fraction of each dollar of deposits; hence less money is created; \(m\) falls.

When \(c\) increases, public want more currency and put less in banks as deposits; hence banks can make less loans; less money is created; \(m\) falls.

<table>
<thead>
<tr>
<th>year</th>
<th>M1 ($ billions)</th>
<th>MB ($ billions)</th>
<th>(m)</th>
<th>(e)</th>
<th>(c)</th>
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<td>1.79</td>
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</table>
6. Instruments of money supply control

Open Market Operations:
Fed sells bonds to the public; people use dollars to make the bond purchases; their currency holdings/deposits decrease; money supply falls

Imposes by law a minimum value for $r$; forces banks to hold a certain minimum amount in reserves (usually held either with the Fed or as vault cash); denote by $r\text{-min}$

When reserves corresponding to $r\text{-min}$ is greater than what banks want to hold, then the reserve requirement is binding.

By controlling $r\text{-min}$, or by appropriately setting $r\text{-min}$, Fed achieves a lot of control over the money supply.

In the US: banks do not have to meet reserve requirements on a daily basis; they have to meet average for 1-2 weeks. If reserves go negative on a daily basis, or reserves fall short over a 2-week period, banks are penalized.

Reserve requirement as a tax on banks: Fed does not pay interest on these reserves. Yet, forces banks to hold more higher balances than is necessary for daily business needs. Hence a tax.

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How do banks get around it: financial innovation (e.g., sweep accounts where banks transfer funds from reservable deposit accounts such as demand deposits to nonreservable accounts such as money market deposit accounts)

World without reserve requirements: in recent years, most countries are eliminating reserve requirements; Canada, UK, New Zealand have no reserve requirements; France and Japan about 1%.

As of Jan 2006, fed imposes only a 3% reserve requirement only on transactions deposits (checking accounts) in the US

Why the move towards no reserve requirements: (a) central banks today do not try to target the money supply; instead they target short-term interest rates (b) reduce the “tax” on banks.
3. Discount rate and federal funds rate

the interest rate Fed charges when it makes loans to private banks ("lender of last resort"). When discount rate is low, banks borrow more from the Fed; money supply rises.

Distinct from: The federal funds rate is the interest rate at which depository institutions lend balances at the Federal Reserve to other depository institutions overnight. (When banks have excess reserves they can lend to other banks); rate is market determined; shows more volatility

Using a combination of these three instruments, the Fed attempts to control the money supply.

Banks, the Fed, and the Great Depression

The Great Depression began in 1929 when the entire world suffered an enormous drop in output and an unprecedented rise in unemployment.

World economic output continued to decline until 1932 when it clinked bottom at 50% of its 1929 level.

Unemployment soared, in the United States it peaked at 24.9% in 1933. It remained above 20% for two more years, reluctantly declining to 14.3% by 1937. It then leapt back to 19% before its long-term decline.

Real GDP fell by 29% from 1929 to 1933 and the US stock market lost 89.5% of its value.

In early 1930, there were 60 bank failures per month in the US but when the Fed tightened its purse strings, things got much worse.

254 banks failed in November and 344 in December of 1930.

Among these was the Bank of the United States, with 450,000 depositors it was the fourth largest bank in New York.

Although it was a private bank, "The biggest bank failure in American history, the Bank of the United States bankruptcy fed a psychology of fear that gripped depositors across the country."
The currency-deposit ratio and the reserve-deposit ratio in the Great Depression

Monetary variables in the Great Depression

(a) The monetary base and the money multiplier in the Great Depression

Monetary variables in the Great Depression

(b) The money supply in the Great Depression

U.S. Macroeconomic Indicators: The Great Contraction

Index Numbers: 1929 = 100

- Real GNP (Index)
- Money Stock (Index)
- Money Velocity (Index)
- Price Level (Index)
The best-known, advanced by economists Milton Friedman and Anna Schwartz in *A Monetary History of the United States, 1867-1960*, blames the Federal Reserve for permitting two-fifths of the nation's banks to fail between 1929 and 1933 (or 10,797 of the 25,568 banks in 1929).

Since deposits were not insured then, the bank failures wiped out savings and shrank the money supply. From 1929 to 1933 the money supply dropped by one-third, choking off credit and making it impossible for many individuals and businesses to spend or invest.

Friedman and Schwartz argue that it was this drop in the money supply that strangled the economy. They consider the depression mainly an American affair that spread abroad. They maintain that the Federal Reserve could have prevented them by lending directly to weak banks and by aggressive "open market" operations (that is, by buying U.S. Treasury securities and thereby injecting new funds into banks and the economy). This action would have halted the depression, they argue. *They blame the Federal Reserve's timidity on the 1928 death of Benjamin Strong, the president of the Federal Reserve Bank of New York.*