Money Supply

ECON 40364: Monetary Theory & Policy

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Spring 2025

Readings

Friedman Ch. 1, Ch. 2 (sections "Mystery of Money" and "The Supply of Money")

Mishkin Ch. 3

Mishkin Ch. 14

GLS Ch. 32

What is Money?

Money is something that is accepted as payment for goods or services or in the repayment of debts

Friedman: "Money is whatever is generally accepted in exchange for goods and services – accepted not as an object to be consumed but as an object that represents a temporary abode of purchasing power to be used for buying still other goods and services."

Something has value as a medium of exchange because people think other people will accept that thing in exchange for goods and services

Stock vs. Flow

Money is a stock concept – something you accumulate and can carry across time (balance sheet)

Not a flow concept (income statement)

Assets and Liabilities

An asset is a claim on current and/or future resource/financial flows that you own

A liability is a claim against you on current and/or future resource/financial flows

For the holder of money, it is an asset. For the issuer, it is a liability

Money can be publicly or privately created. Most money is privately created

It is "backed" by something – something tangible (e.g., precious metals) or intangible (e.g., full faith and credit)

Functions of Money

Three functions of money:

1. Medium of exchange
2. Unit of account
3. Store of value

Medium of Exchange

Any asset can serve as a store of value (e.g., house, land, stocks, bonds), but most assets do not perform the first two roles of money

Unit of account is important (particularly in a diverse economy), though anything could serve as a unit of account

Medium of exchange role is the most important role of money:

- Eliminates need for barter, reduces transactions costs associated with exchange, and allows for greater specialization
- Even when currencies have failed (e.g., Wiemar Republic), people resort to alternative monies (e.g., cigarettes) before engaging directly in barter

Liquidity

As a store of value, money tends to be crummy relative to other assets like stocks and houses, which offer some expected return over time

Why then do people hold money? Because they value liquidity

Liquidity: ease with which an asset can be converted into a medium of exchange (i.e., money)

Money is the most liquid asset because it is the medium of exchange

If you held all your wealth in housing, and you wanted to buy a car, you would have to sell (liquidate) the house, which may not be easy to do, may take a while, and may involve selling at a discount if you must do it quickly

Liquidity (cont)

Need to take a somewhat nuanced interpretation of "ease with which asset can be converted into a medium of exchange"

We will use term "cash" to refer to physical currency *or* demand deposits which can be used in exchange

Shares of stock are nearly perfectly liquid in that I can easily convert them to cash quickly . . .

. . . but maybe not at the price I expect

Liquidity (cont)

Example: I have $1000, and I don't need to spend it today. I *might* need to spend it tomorrow (or the day after)

- I could store cash (either in currency under my mattress or in a checking account), or I could buy Apple stock (AAPL)
- If I store $1000 in cash, I will have $1000 in cash when I need it
- If I buy $1000 in Apple, I can get cash when I need it, but I'm uncertain as to how much cash (i.e., price could go up or down)

Liquidity (continued)

In addition to market liquidity, by which we mean the actual ease of selling an asset without affecting its market price, one might also measure an asset's liquidity by how much that asset's price fluctuates

The (nominal) value of money doesn't fluctuate – one dollar in cash today gives you one dollar with certainty tomorrow. Money is a special asset because it "trades at par" (par = face value). Not true for other assets like stocks, real estate

So-called near monies are assets that are very nearly as liquid as cash with either small transactions cost of liquidating them or small price uncertainty:

- Money market funds
- Non-transactions deposits (savings accounts, time deposits)
- Government bonds with short time to maturity

The Island of Stone Money

In Ch. 1, Friedman discusses the monetary system of the island of Uap

Their currency was *fei* – large stone wheels

People freely accepted these *fei* in exchange for goods and services, even without actually taking physical possession of them

Seems crazy, but you and I do this all the time

- I write you a check, my bank transfers funds from my account to your bank account
- We never take physical possession of anything (though we have the right to)

Evolution of Money and Payments

Commodity-based money: money made up of precious metals or other commodities

- Difficult to carry around, potentially difficult to divide, price may fluctuate if precious metal or commodity has consumption value independent of medium of exchange role

Currency: pieces of paper or coins that are accepted as medium of exchange. May be "backed" by some commodity (e.g., government guarantees conversion of paper into gold)

- Problems: easily stolen, difficult to track, and difficult to transport

Checks: instructions for holder of your money (a bank) to transfer money to another person or institution. Eliminates need to carry currency around

- Problems: processing of checks and transfer is potentially costly, people may not accept checks if they doubt soundness of your financial institution

Electronic Payment and E-Money

Electronic payment and e-money: like checks, but transfer happens instantaneously with a complete record (e.g., debit card)

Credit cards are not money

- These are short-term loans from your credit card company to you
- Company transfers funds (deposits) to institution/entity you purchase from

Venmo, Paypal, etc:

- Payments technologies, like a credit card
- Not money

Fiat Money

Prior to 1971, every major currency had been linked directly or indirectly to a commodity. No more

Fiat money is currency and checkable deposits that are not backed by any commodity or precious metal

In other words, fiat money is not "convertible"

It is only backed by the "full faith and credit" of the issuer

Fiat Money and Fundamental Value

Fiat money has no "fundamental" value – it is only valuable because people accept it in exchange. For this reason, sometimes people say fiat money is a "bubble"

- Advantages: easily divisible, can be fully electronic, value does not fluctuate due to demand and supply of a commodity, easy for government to change quantity
- Potential problems: maybe too easy for government to manipulate quantity. Precarious in the sense of being a bubble – only has value because people believe it does

Measures of the Money Supply

Most basic definition of the money supply is "currency in circulation," C. Also called "M0"

Obviously currency isn't the only thing that can be used in exchange – checks (which result in shifting deposits) can as well

M1: currency in circulation plus demand deposits (deposits held in checking accounts), plus travelers check accounts, plus "other" checkable deposits (interest-bearing checking accounts). Again, think of this as "cash"

M2: M1 + savings deposits and money market deposit accounts, small time deposits (e.g. CDs), and money market accounts (i.e. M1 plus "near monies")

Descending in liquidity: M2 less liquid than M1

TABLE 1 Measures of the Monetary Aggregates

	Value as of August 18, 2014, ($ billions)
M1 = Currency	1,206.1
+ Traveler's checks	3.3
+ Demand deposits	1,089.9
+ Other checkable deposits	477.4
Total M1	2,776.7
M2 = M1	
+ Small-denomination time deposits	533.0
+ Savings deposits and money market deposit accounts	7,338.2
+ Money market mutual fund shares (retail)	642.5
Total M2	11,290.4

Source: http://www.federalreserve.gov/releases/h6/hist.

Money Supply

We often think of the central bank (e.g. the Federal Reserve) as setting the money supply

This is not quite accurate, though in normal times it is not a bad approximation

Why? Money supply includes privately-created assets

Central Bank can't even perfectly control M0: it can print more currency, but cannot ensure it stays in circulation – i.e., it could be deposited in a bank

- Reserves: currency not in circulation ("vault cash") plus bank deposits at the central bank

Private and Public Creation of Money

Absent mandating reserve ratio of 1, central bank also cannot prevent banks from creating deposits, which we think of as constituting money in terms of M1

The money supply is jointly set by three actors:

1. Central bank
2. Commercial banks
3. Depositors

T-Accounts

It is useful to use T-Accounts, which are tabular depictions of an institution's/individual's balance sheet (stock concept)

A balance sheet shows the assets and liabilities of an institution

Asset: a piece of property, note, or electronic entry that is valuable and entitles the holder to some payout (e.g., stock, bond, cash)

Liability: an obligation that requires the holder to pay at some point in the future as a result of some past transaction

For example, if I make you a loan, the loan is an asset to me (it's a piece of paper that says you have to pay me back), but a liability for you

Equity (or sometimes "net worth") is the difference between the values of assets and liabilities. If you liquidated all assets and paid off all liabilities, how much would you be left with

Example T-Account for a Homeowner

Assets		Liabilities + Equity	
Value of Home	\$100,000	Mortgage	\$80,000
Checking account	\$10,000	Student loans	\$50,000
Stocks	\$50,000	Credit card debt	\$10,000
		Equity	\$20,000

Equity and Capital

Equity is just the difference between total value of assets and total value of liabilities for an agent (household, firm, etc.)

In an aggregate sense, household equity is equal to the total value of non-financial assets, what we call physical capital

Financial assets (stocks, bonds, deposits) are just contractual claims – one person's asset is another's liability, and hence these are not net assets (capital) in an aggregate sense

Balance Sheet for the Fed

Assets	Liabilities
Securities	Currency in circulation
Loans	Reserves

Fed Assets and Liabilities

Monetary liabilities are not really liabilities in the formal sense – these are IOUs to be paid off with other IOUs

Monetary liabilities of the Fed: monetary base (currency plus reserves)

It can freely create these liabilities, and hence controls the monetary base

Reserves: deposits banks hold at the Fed plus currency in bank vaults

Securities: holdings of US government bonds and private sector stocks and bonds

Loans: loans made to financial institutions

Don't worry about equity – Fed is "owned" by Treasury and remits profits

Balance Sheet for the Banking System as a Whole

Assets	Liabilities
Loans	Demand deposits
Securities	Savings deposits
Reserves	Borrowings
	Equity

Bank Assets and Liabilities

Loans are assets for banks because they are IOUs that promise the bank back its money

Deposits are liabilities: banks have to pay out cash on demand

Reserves: vault cash and deposits at central bank

Borrowings: loans bank has taken out from Fed or other institution

The Monetary Base

The monetary base is the sum of currency in circulation plus reserves:

$$MB = C + R$$

The Fed can affect the base through open market operations and loans to financial institutions

The split between currency and reserves is determined by the public's desire to hold cash versus deposits – central bank cannot perfectly control split between C and R, but can control MB

An open market operation involves the purchase (or sale) of securities (typically short term government securities like Treasury Bills)

Open market operations create (or eliminate) monetary liabilities and alter the asset composition of the banking system

Open Market Purchase: the Fed

Suppose that the Fed decides to purchase \$100 of securities from the banking system

To do this, the Fed simply creates reserves – it credits the banking system with reserves in exchange for the securities

Fed balance sheet:

Assets		Liabilities	
Securities	+\$100	Reserves	+\$100

In a sense, what is special about a central bank is that it can expand or contract the size of its balance sheet arbitrarily. Private sector cannot do this.

Open Market Purchase: the Banking System

Assets		Liabilities
Securities	-$100	
Reserves	+$100	

An open market purchase increases reserves (and hence the monetary base), while a sale does the opposite

Alters the composition of banking system assets

Loans to Financial Institutions: the Fed

Commercial banks can borrow directly from the Fed through the discount window or other lending facilities

Suppose the Fed loans the banking system \$100. Fed balance sheet:

Assets		Liabilities	
Loans	+\$100	Reserves	+\$100

Loans to Financial Institutions: the Banking System

Assets		Liabilities	
Reserves	+\$100	Borrowings	+\$100

Differently than a purchase, a loan expands the balance sheet of the banking system

Currency Withdrawal

The Fed cannot directly control reserves

Suppose that depositors want to withdraw \$100

Banking system has to meet this withdrawal demand by drawing down reserves and reducing the size of its balance sheet:

Assets		Liabilities	
Reserves	-\$100	Deposits	-\$100

Withdrawals reduce reserves, but increase currency in circulation, leaving monetary base unaffected

Fed can control MB, but not C or R directly

Borrowed vs. Non-Borrowed Reserves

Even though the Fed can completely control open market operations, there is some uncertainty about loans to financial institutions

It is therefore convenient to split the monetary base into two components: the non-borrowed monetary base and borrowed reserves:

$$MB = MB_n + BR$$

Where MB_n is the non-borrowed monetary base and BR is borrowed reserves (e.g. discount loans)

Because the Fed has complete control of MB_n through open market operations, it can always adjust MB_n given fluctuations in BR to hit a target MB

We therefore think of the Fed as directly controlling the monetary base

From Monetary Base to Money Supply

The Fed can directly control the monetary base

But what about the money supply?

For these purposes, think of the money supply as currency in circulation plus demand deposits (i.e., M1)

There exists a relationship between the monetary base and the money supply, but it is not directly controlled by the Fed

Multiple Deposit Creation

In a "fractional reserve" banking system, banks do not hold the total value of deposits in reserves

Historically, the Fed stipulated by law a minimum fraction of total outstanding deposits that commercial banks must hold

Call this the required reserve ratio, or rr (it's actually now zero and has been since onset of COVID-19)

Suppose, for simplicity, $rr > 0$ and that banks do not hold any "excess reserves" (reserves in excess of what is required by the Fed)

A Hypothetical Bank Balance Sheet

Suppose a bank, call it Bank A, has the following balance sheet:

Assets		Liabilities	
Loans	\$1000	Deposits	\$1000
Securities	\$100		
Reserves	\$100		

Assume that $rr = 0.1$. So deposits are a multiple of reserves. Bank equity in this example is \$200

The bank makes profit (return on equity) by earning returns on its loans and securities. Reserves (i.e., cash in vault) earn nothing (at least traditionally, before payment of interest on reserves in last decade) and hence do not create equity in a dynamic sense.

Open Market Operation

Suppose that the Fed purchases \$100 of securities from the bank. Balance sheet goes from:

Assets		Liabilities	
Loans	\$1000	Deposits	\$1000
Securities	\$100		
Reserves	\$100		

to:

Assets		Liabilities	
Loans	\$1000	Deposits	\$1000
Securities	\$0 (-\$100)		
Reserves	\$200 (+\$100)		

The direct effect of the open market operation is to alter the composition of assets at a bank

The central bank has expanded the size of its balance sheet by creating reserves

Excess Reserves

Now the bank is holding 20 percent of its deposits as reserves. This is more than $rr = 0.1$

Suppose bank makes a loan for \$100 (equal to the value of the excess reserves)

The bank creates a liability (deposit) at same time it creates an asset (loan). Can do this because of fractional reserve requirement

Assets		Liabilities	
Loans	\$1100 (+\$100)	Deposits	\$1100 (+\$100)
Securities	\$0		
Reserves	\$200		

A bank can expand the size of its balance (by creating liabilities) whenever it has excess reserves

Ex Nihilo

Does Bank A create money "out of thin air"?

No
What allows it to create deposits is that it holds (excess) reserves

Even if there were not an explicit reserve requirement, other parties wouldn't accept checks from Bank A if it wasn't known that Bank A had reserves (or more generally solid backing assets)

So the bank creates money, but it isn't out of thin air

Bank B

Suppose that Bank B has an initial balance sheet that looks just like Bank A's, but Bank B didn't sell securities to the Fed:

Assets		Liabilities	
Loans	\$1000	Deposits	\$1000
Securities	\$100		
Reserves	\$100		

The person getting the loan from Bank A isn't getting a loan to keep deposits with bank A. He/she is getting the loan to buy something

Suppose that person uses the \$100 deposit and buys something, and the seller then deposits the \$100 in Bank B

New Balance Sheets for Banks A and B

Bank A:

Assets		Liabilities	
Loans	\$1100	Deposits	\$1000 (-\$100)
Securities	\$0		
Reserves	\$100 (-\$100)		

Bank B:

Assets		Liabilities	
Loans	\$1000	Deposits	\$1100 (+\$100)
Securities	\$100		
Reserves	\$200 (+\$100)		

Bank A is back to its reserve requirement

Now bank B is holding reserves equal to 0.1818 of deposits, in excess of $rr = 0.1$

Bank B Makes Loans

Bank B makes a loan for \$90, equal to its excess reserves:

Assets		Liabilities	
Loans	\$1090 (+\$90)	Deposits	\$1190 (+\$90)
Securities	\$100		
Reserves	\$200		

The deposits created for Bank B will only temporarily be there. The borrower will deposit them in another bank, call it Bank C, and Bank B's balance sheet will revert to:

Assets		Liabilities	
Loans	\$1090	Deposits	\$1100 (-\$90)
Securities	\$100		
Reserves	\$110 (-\$90)		

Bank C

Initial balance sheet looks like all the others:

Assets		Liabilities	
Loans	\$1000	Deposits	\$1000
Securities	\$100		
Reserves	\$100		

After getting the deposit, its balance sheet will be:

Assets		Liabilities	
Loans	\$1000	Deposits	\$1090 (+\$90)
Securities	\$100		
Reserves	\$190 (+\$90)		

But now Bank C is sitting on \$81 in excess reserves. It will want to loan it out

Bank C Makes Loans

Bank C makes a loan for \$81, equal to its excess reserves:

Assets		Liabilities	
Loans	\$1081 (+\$81)	Deposits	\$1171 (+\$81)
Securities	\$100		
Reserves	\$190		

The deposits created for Bank C will only temporarily be there. The borrower will deposit them in another bank, call it Bank D, and Bank C's balance sheet will revert to:

Assets		Liabilities	
Loans	\$1081	Deposits	\$1090 (-\$81)
Securities	\$100		
Reserves	\$109 (-\$81)		

Multiple Deposit Creation

The open market operation increases (excess) reserves for Bank A

Bank A then makes a loan, which generates \$100 additional deposits for Bank B

Bank B then makes a loan, which generates \$90 additional deposits for Bank C

Bank C then makes a loan, which generates \$81 additional deposits for Bank D

And so on!

Simple Deposit Multiplier

Total change in deposits for a \$1 open market purchase:

$$\Delta D = 1 + (1 - rr) + (1 - rr)^2 + (1 - rr)^3 + \ldots$$

This simplifies to an expression called the "simple deposit multiplier":

$$\Delta D = \frac{1}{rr}$$

Deposit Creation and the Money Supply

Recall that we are thinking of the money supply as M1: currency in circulation plus deposits

An open market purchase of \$100 increases deposits by $\frac{1}{rr} \times \$100$ with no effect on currency in circulation

Hence, the change in the money supply is $\frac{1}{rr}$ times the change in reserves, or more generally times the change in the monetary base:

$$\Delta M = \frac{1}{rr} \Delta MB$$

We could call the money multiplier the simple deposit multiplier:

$$mm = \frac{1}{rr}$$

where:

$$M = mm \times MB$$

The Simple Model is too Simple

The simple model assumes the following:

1. Banks hold no excess reserves: they either make loans or buy securities to just satisfy the reserve requirement
2. Lenders who get loans deposit the entirety of the loan in a bank – there is no currency holding

Holding excess reserves or currency outside of a bank will "slow down" multiple deposit creation and lower the money multiplier

A More General Model

Let $c = \frac{C}{D}$ be the desired currency to deposit ratio and $e = \frac{ER}{D}$ be the excess reserve ratio held by banks

$rr = \frac{RR}{D}$ is the required reserve ratio, which the central bank can set.

Total reserves, $R = ER + RR$. Recall $MB = C + R$ and $M = C + D$. Then:

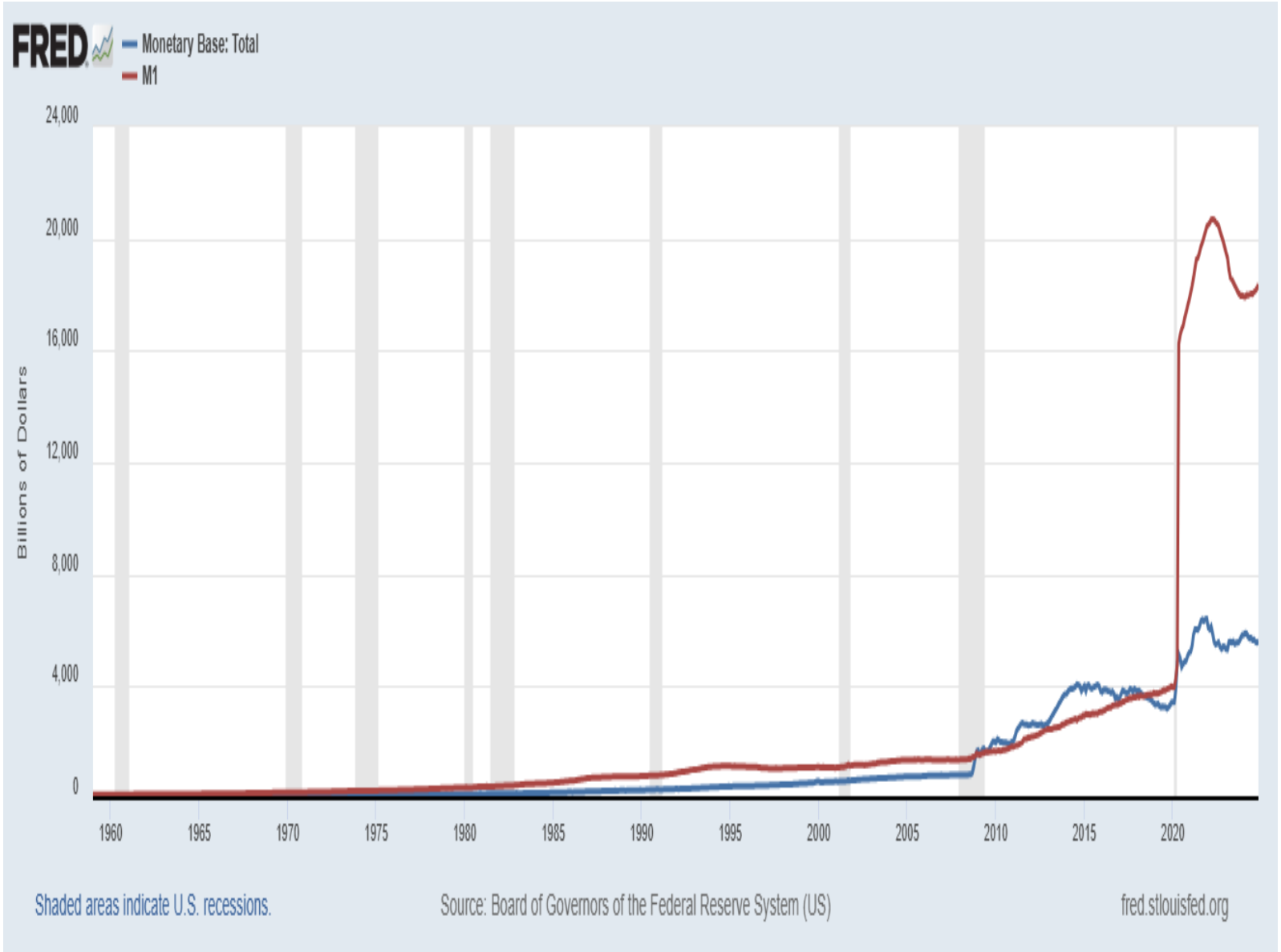
$$M = mm \times MB$$

where:

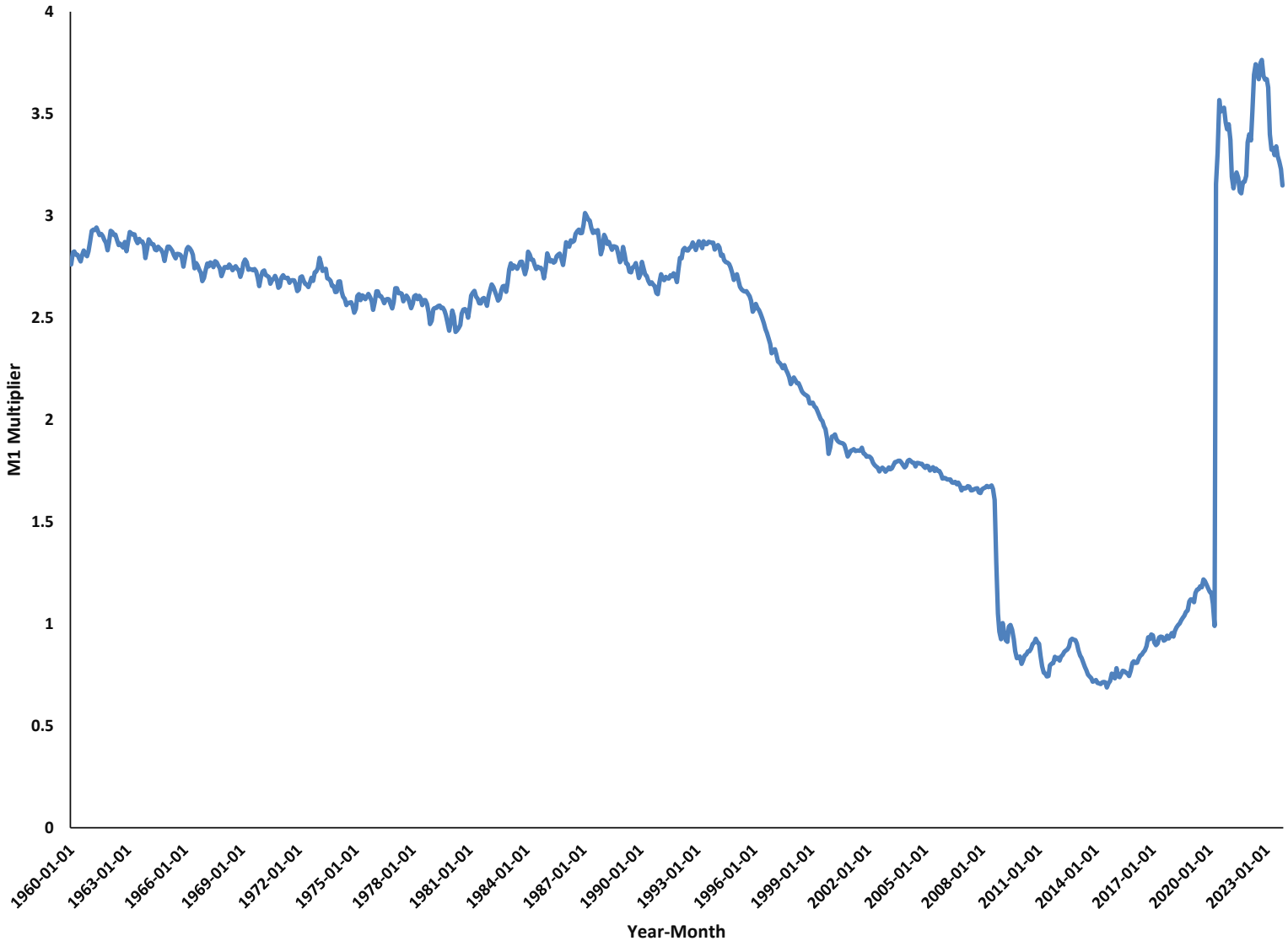
$$mm = \frac{1 + c}{rr + e + c}$$

If $c = e = 0$, this reduces to simple multiplier

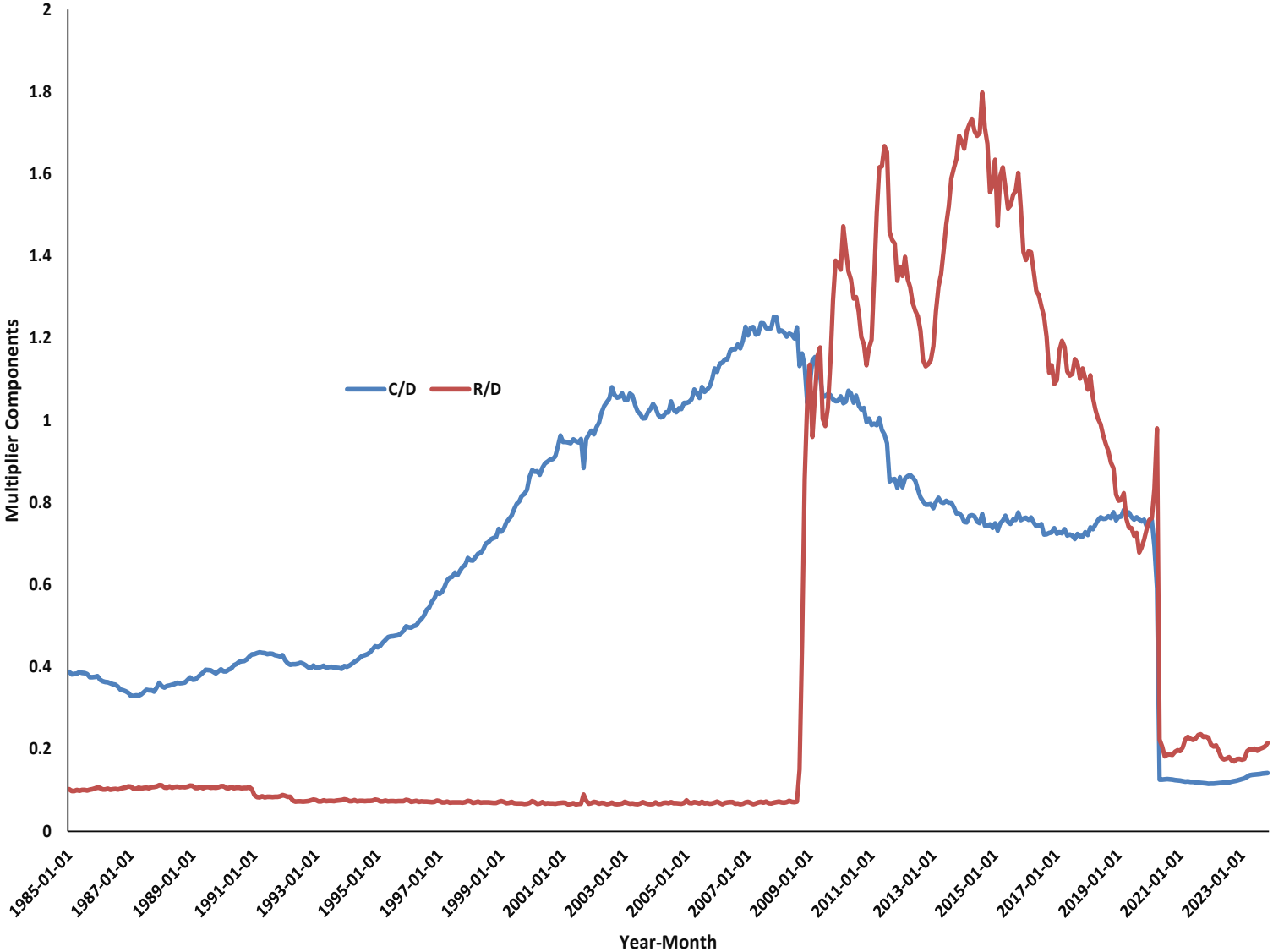
Monetary Aggregates



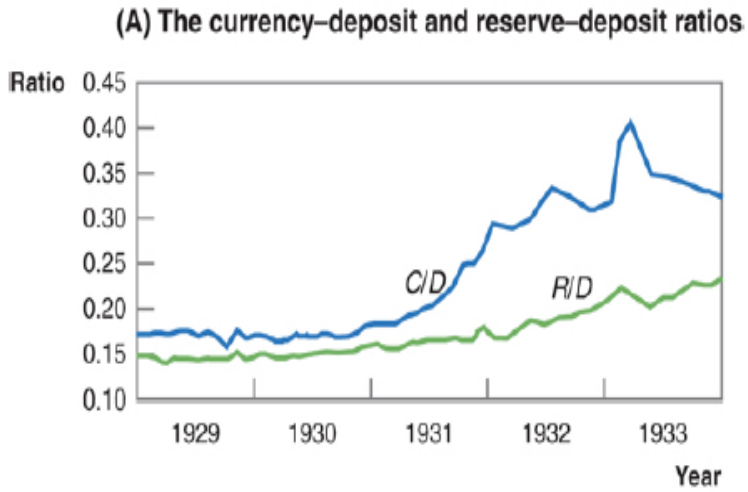
Money Multiplier

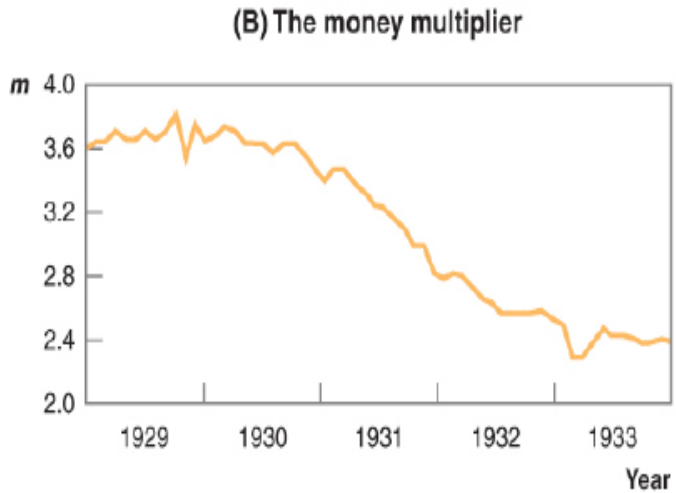


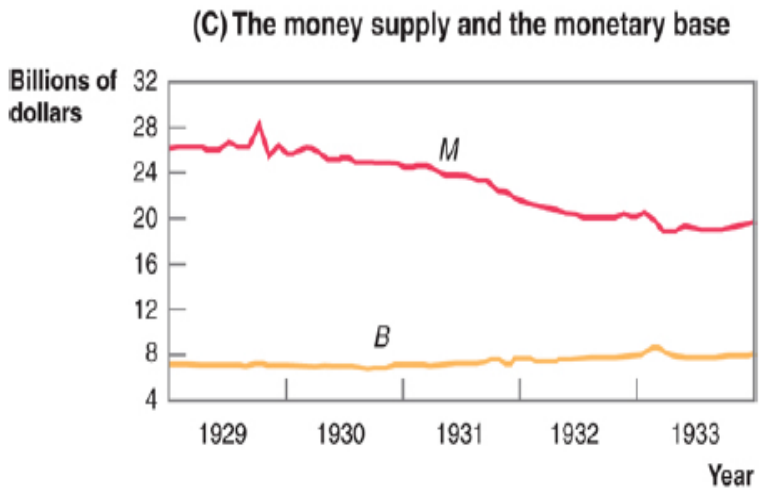
Components of Money Multiplier



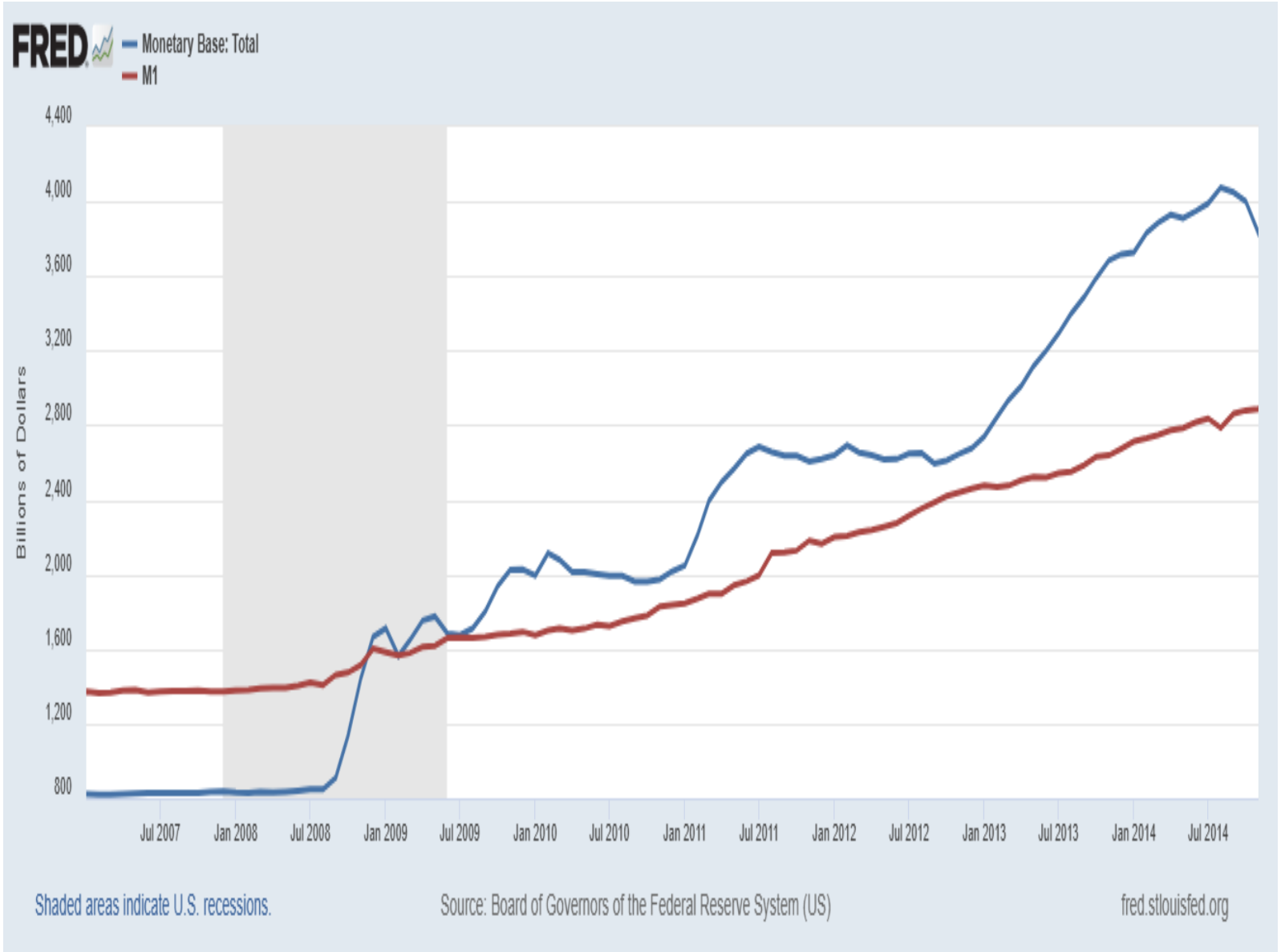
Monetary Aggregates During Great Depression







Monetary Aggregates During Great Recession



Monetary Aggregates During COVID-19