Monetary Theory and Policy

Chapter 14：The Money Supply Process

Players in the Money Supply Process

- Central bank (Federal Reserve System)
- Banks (depository institutions; financial intermediaries)
- Depositors (individuals and institutions)

Fed's Balance Sheet

Federal Reserve System	
Assets	Liabilities
Government securities	Currency in circulation
Discount loans	Reserves

- Monetary Liabilities
  - Currency in circulation: in the hands of the public
  - Reserves: bank deposits at the Fed and vault cash
- Assets
  - Government securities: holdings by the Fed that affect money supply and earn interest
  - Discount loans: provide reserves to banks and earn the discount rate

Monetary Base

High-powered money

MB=C+R

C=currency in circulation

R=total reseres in the banking system

Open Market Purchase from a Bank

Banking System	
Assets	Liabilities
Securities -$100	
Reserves +$100	

Federal Reserve System	
Assets	Liabilities
Securities +$100	Reserves +$100

- Net result is that reserves have increased by $100
- No change in currency
- Monetary base has risen by $100

Open Market Purchase from Nonbank Public I

Banking System	
Assets	Liabilities
Reserves +$100	Checkable deposits +$100

Federal Reserve System	
Assets	Liabilities
Securities +$100	Reserves +$100

- Person selling bonds to the Fed deposits the Fed's check in the bank
- Identical result as the purchase from a bank

Open Market Purchase from Nonbank Public II

Nonbank Public	
Assets	Liabilities
Securities -$100	
Currency +$100	

Federal Reserve System	
Assets	Liabilities
Securities +$100	Currency in circulation +$100

- The person selling the bonds cashes the Fed's check
- Reserves are unchanged
- Currency in circulation increases by the amount of the open market purchase
- Monetary base increases by the amount of the open market purchase

Open Market Purchase: Summary

- The effect of an open market purchase on reserves depends on whether the seller of the bonds keeps the proceeds from the sale in currency or in deposits
- The effect of an open market purchase on the monetary base always increases the monetary base by the amount of the purchase

Open Market Sale

Nonbank Public	
Assets	Liabilities
Securities +$100	
Currency -$100	

Federal Reserve System	
Assets	Liabilities
Securities -$100	Currency in circulation -$100

- Reduces the monetary base by the amount of the sale
- Reserves remain unchanged
- The effect of open market operations on the monetary base is much more certain than the effect on reserves

Shifts from Deposits into Currency

Nonbank Public	
Assets	Liabilities
Checkable deposits -$100	
Currency +$100	

Banking System	
Assets	Liabilities
Reserves -$100	Checkable deposits -$100

Federal Reserve System	
Assets	Liabilities
	Currency in circulation +$100
	Reserves -$100

Net effect
on monetary liabilities
is zero
Reserves are changed
by random fluctuations
Monetary base
is a more stable variable

Making a Discount Loan to a Bank

Banking System	
Assets	Liabilities
Reserves +$100	Discount loans +$100
	(borrowing from Fed)

Federal Reserve System	
Assets	Liabilities
Discount loan +$100	Reserves +$100
(borrowing from Fed)	

- Monetary liabilities of the Fed have increased by $100
- Monetary base also increases by this amount

Paying Off a Discount Loan from the Fed

Banking System	
Assets	Liabilities
Reserves -$100	Discount loans -$100
	(borrowing from Fed)

Federal Reserve System	
Assets	Liabilities
Discount loans -$100	Reserves -$100
(borrowing from Fed)	

- Net effect on monetary base is a reduction
- Monetary base changes one-for-one with a change in the borrowings from the Federal Reserve System

Fed's Ability to Control the Monetary Base

- Open market operations are controlled by the Fed
- The Fed cannot determine the amount of borrowing by banks from the Fed
- Split the monetary base into two components

$$MB_n = MB - BR$$

- The money supply is positively related to both the non-borrowed monetary base MB_n and to the level of borrowed reserves, *BR,* from the Fed

Deposit Creation: Single Bank

First National Bank	
Assets	Liabilities
Securities -$100	
Reserves +$100	

First National Bank	
Assets	Liabilities
Securities -$100	Checkable deposits +$100
Reserves +$100	
Loans +$100	

First National Bank	
Assets	Liabilities
Securities -$100	
Loans +$100	

Excess reserves increase

Bank loans out the excess reserves

Creates a checking account

Borrower makes purchases

The money supply has increased

Deposit Creation: The Banking System

Bank A		Bank A	
Assets	Liabilities	Assets	Liabilities
Reserves +$100	Checkable deposits +$100	Reserves +$10	Checkable deposits +$100
		Loans +$90	

Bank B		Bank B	
Assets	Liabilities	Assets	Liabilities
Reserves +$90	Checkable deposits +$90	Reserves +$9	Checkable deposits +$90
		Loans +$81	

Table 1 Creation of Deposits (assuming 10% reserve requirement and a $100 increase in reserves)

TABLE 1 Creation of Deposits (assuming 10% reserve requirement and a $100 million increase in reserves)

Bank	Increase in Deposits ($)	Increase in Loans ($)	Increase in Reserves ($)
First National	0.00	100.00 m	0.00
A	100.00 m	90.00 m	10.00 m
B	90.00 m	81.00 m	9.00 m
C	81.00 m	72.90 m	8.10 m
D	72.90 m	65.61 m	7.29 m
E	65.61 m	59.05 m	6.56 m
F	59.05 m	53.14 m	5.91 m
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
Total for all banks	1,000.00 m	1,000.00 m	100.00 m

The Formula for Multiple Deposit Creation

- Assuming banks do not hold excess reserves

$$\text{Required Reserves } (RR) = \text{Total Reserves } (R)$$

$$RR = \text{Required Reserve Ratio } (r)$$

times the total amount of checkable deposits (D)

- Substituting

$$r \times D = R$$

- Dividing both sides by r

$$D = \frac{1}{r} \times R$$

- Taking the change in both sides yields

$$\Delta D = \frac{1}{r} \times \Delta R$$

Critique of the Simple Model

- Holding cash stops the process
  - Currency has no multiple deposit expansion
- Banks may not use all of their excess reserves to buy securities or make loans.
- Depositors' decisions (how much currency to hold) and bank's decisions (amount of excess reserves to hold) also cause the money supply to change.

Factors that Determine the Money Supply

- Changes in the nonborrowed monetary base MB_n
  - The money supply is positively related to the non-borrowed monetary base MB_n
- Changes in borrowed reserves from the Fed
  - The money supply is positively related to the level of borrowed reserves, *BR,* from the Fed

Factors that Determine the Money Supply

- Changes in the required reserves ratio
  - The money supply is negatively related to the required reserve ratio.
- Changes in currency holdings
  - The money supply is negatively related to currency holdings.
- Changes in excess reserves
  - The money supply is negatively related to the amount of excess reserves.

Summary Table 1 Money Supply Response

SUMMARY TABLE 1

Money Supply Response

Player	Variable	Change in Variable	Money Supply Response	Reason
Federal Reserve System	Nonborrowed monetary base, MB_n	↑	↑	More *MB* for deposit creation
	Required reserve ratio, *rr*	↑	↓	Less multiple deposit expansion
Banks	Borrowed reserves, *BR*	↑	↑	More *MB* for deposit creation
	Excess reserves	↑	↓	Less loans and deposit creation
Depositors	Currency holdings	↑	↓	Less multiple deposit expansion

Note: Only increases (↑) in the variables are shown. The effects of decreases on the money supply would be the opposite of those indicated in the "Money Supply Response" column.

The Money Multiplier

- Define money as currency plus checkable deposits: M1
- Link the money supply (*M*) to the monetary base (*MB*) and let *m* be the money multiplier

$$M = m \times MB$$

Deriving the Money Multiplier I

- Assume that the desired holdings of currency C and excess reserves ER grow proportionally with checkable deposits D.
- Then

$$c = \{C / D\} = currency\ ratio$$

$$e = \{ER / D\} = excess\ reserves\ ratio$$

Deriving the Money Multiplier II

$$c = \{C / D\} \Rightarrow C = c \times D \text{ and}$$

$$e = \{ER / D\} \Rightarrow ER = e \times D$$

Substituting in the previous equation

$$MB = (r \times D) + (e \times D) + (c \times D) = (r + e + c) \times D$$

Divide both sides by the term in parentheses

$$D = \frac{1}{r + e + c} \times MB$$

$$M = D + C \text{ and } C = c \times D$$

$$M = D + (c \times D) = (1 + c) \times D$$

Substituting again

$$M = \frac{1 + c}{r + e + c} \times MB$$

The money multiplier is then

$$m = \frac{1 + c}{r + e + c}$$

Intuition Behind the Money Multiplier

$r =$ required reserve ratio = 0.10

$C =$ currency in circulation = \$400B

$D =$ checkable deposits = \$800B

$ER =$ excess reserves = \$0.8B

$M =$ money supply ($M1$) = $C + D$ = \$1,200B

$$c = \frac{\$400B}{\$800B} = 0.5 \quad e = \frac{\$0.8B}{\$800B} = 0.001$$

$$m = \frac{1 + 0.5}{0.1 + 0.001 + 0.5} = \frac{1.5}{0.601} = 2.5$$

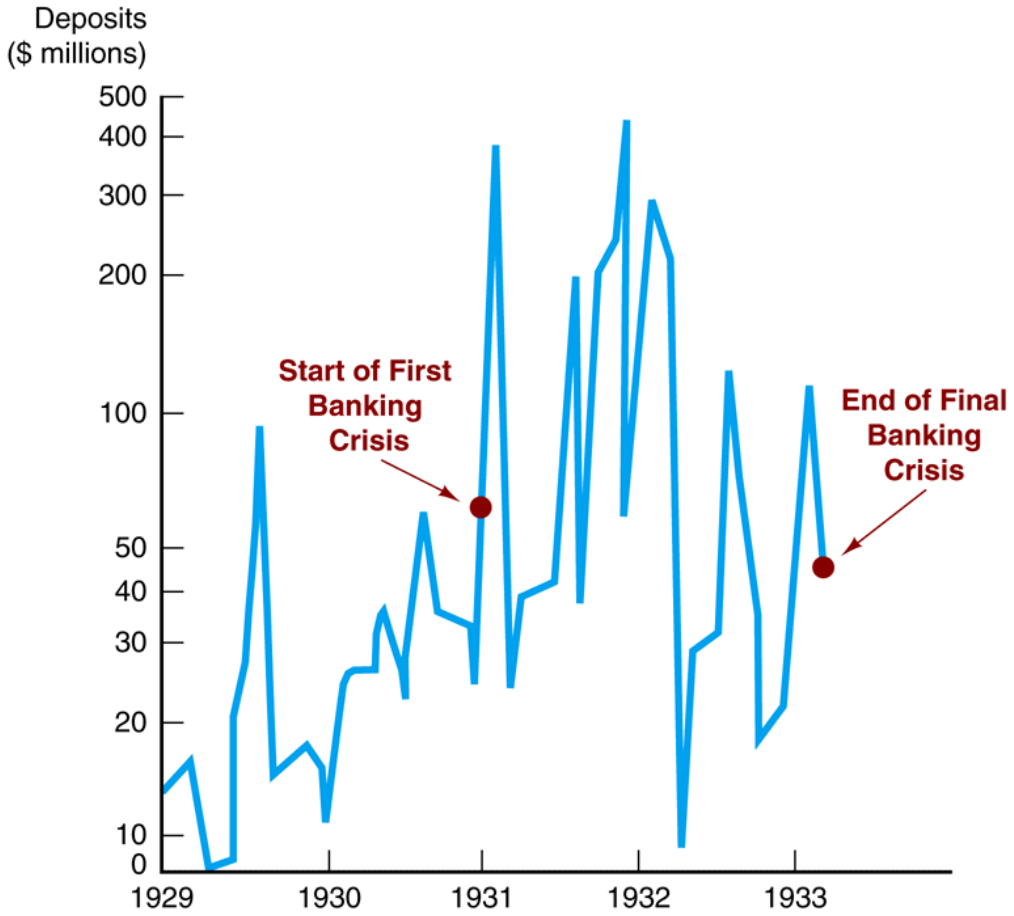
- This is less than the simple deposit multiplier

  Although there is multiple expansion of deposits, there is no such expansion for currency

Application: The Great Depression Bank Panics, 1930 - 1933.

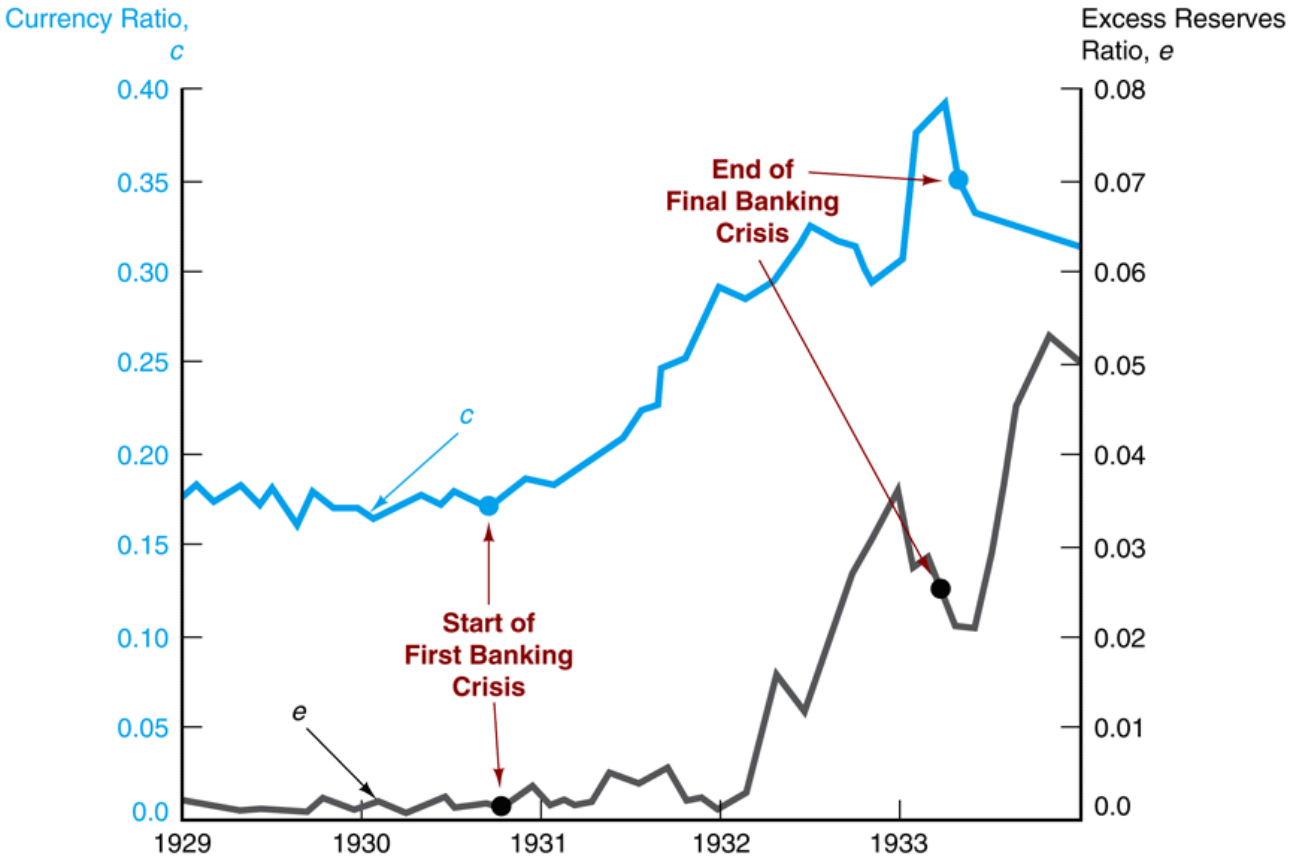
- Bank failures (and no deposit insurance) determined:
  - Increase in deposit outflows and holding of currency (depositors)
  - An increase in the amount of excess reserves (banks)
- For a relatively constant *MB*, the money supply decreased due to the fall of the money multiplier.

FIGURE 1 Deposits of Failed Commercial Banks, 1929–1933



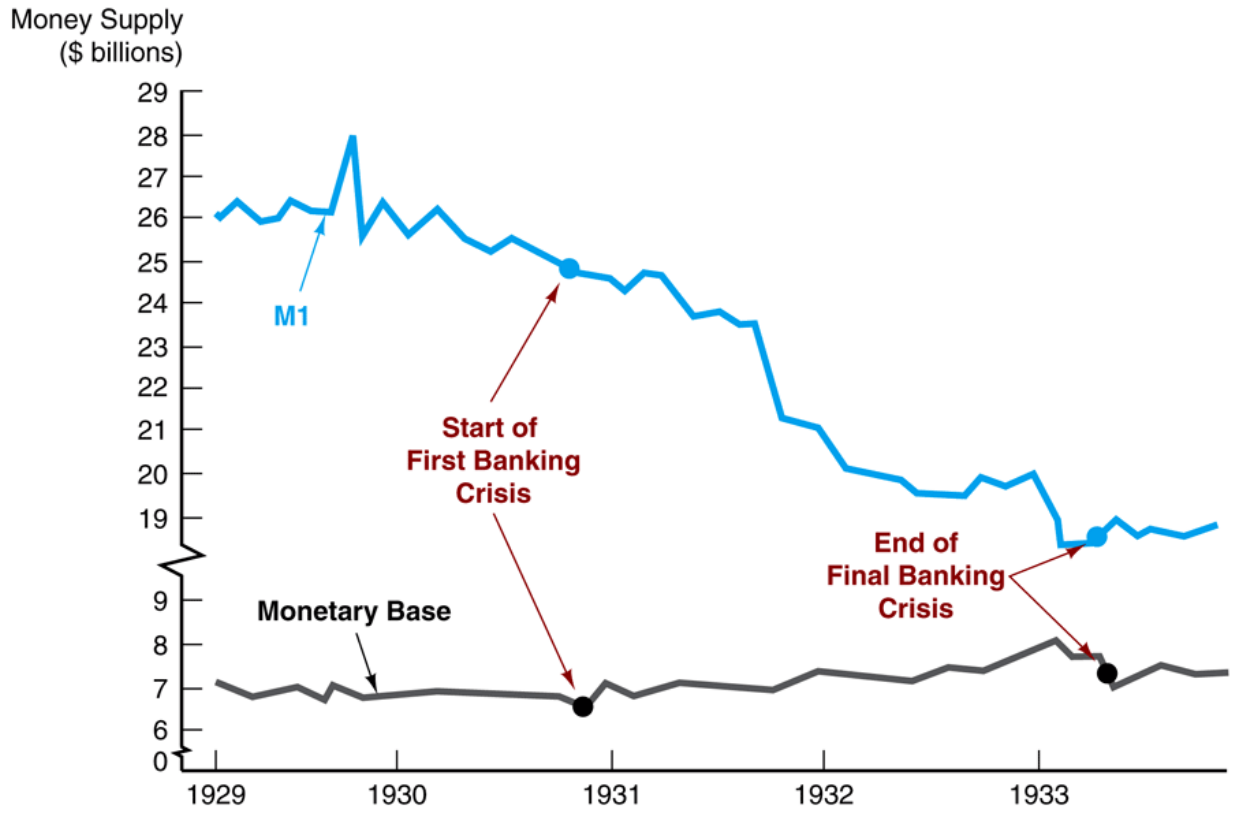
Source: Milton Friedman and Anna Jacobson Schwartz, *A Monetary History of the United States, 1867–1960* (Princeton, NJ: Princeton University Press, 1963), p. 309.

FIGURE 2 Excess Reserves Ratio and Currency Ratio, 1929–1933



Sources: Federal Reserve *Bulletin*; Milton Friedman and Anna Jacobson Schwartz, *A Monetary History of the United States, 1867–1960* (Princeton, NJ: Princeton University Press, 1963), p. 333.

FIGURE 3 M1 and the Monetary Base, 1929–1933



Source: Milton Friedman and Anna Jacobson Schwartz, *A Monetary History of the United States, 1867–1960* (Princeton, NJ: Princeton University Press, 1963), p. 333.

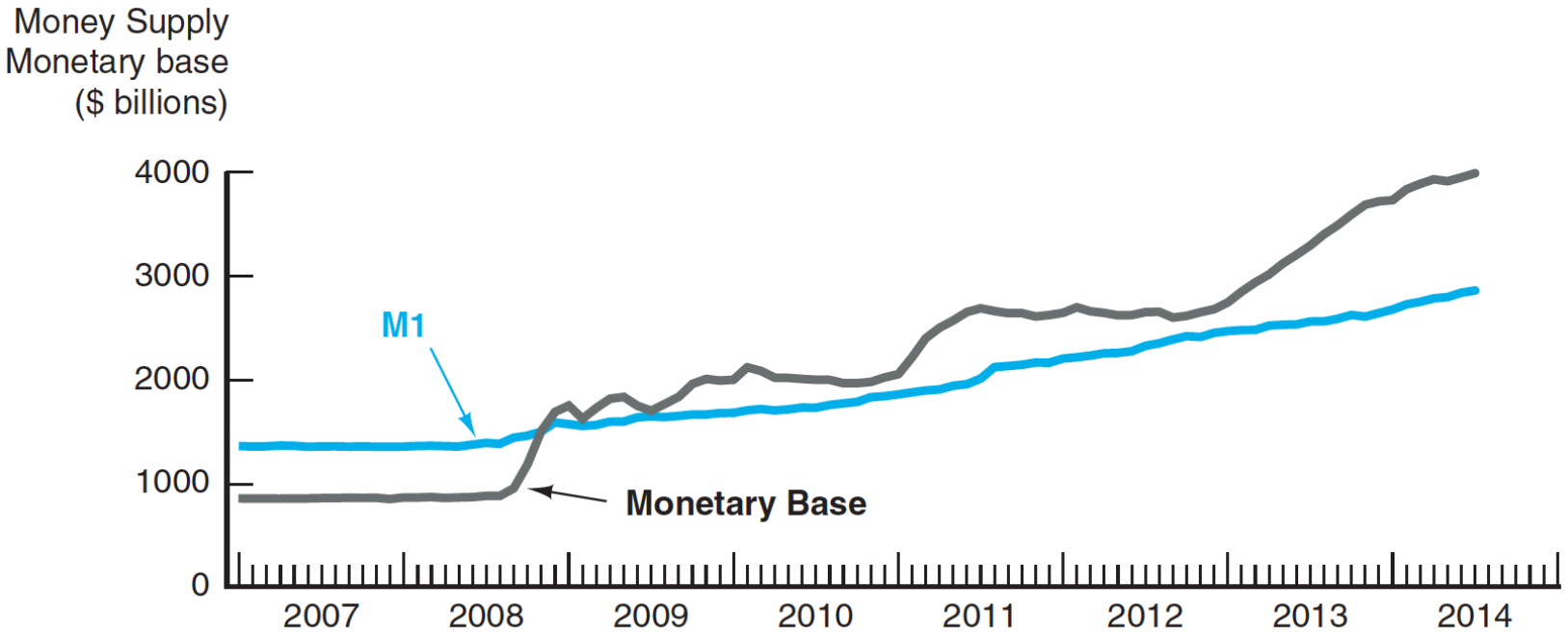
Quantitative Easing and the Money Supply, 2007-2014

- When the global financial crisis began in the fall of 2007, the Fed initiated lending programs and large-scale asset-purchase programs in an attempt to bolster the economy.
- By June 2014, these purchases of securities had led to a quintupling of the Fed's balance sheet and a 377% increase in the monetary base.

Quantitative Easing and the Money Supply, 2007-2014

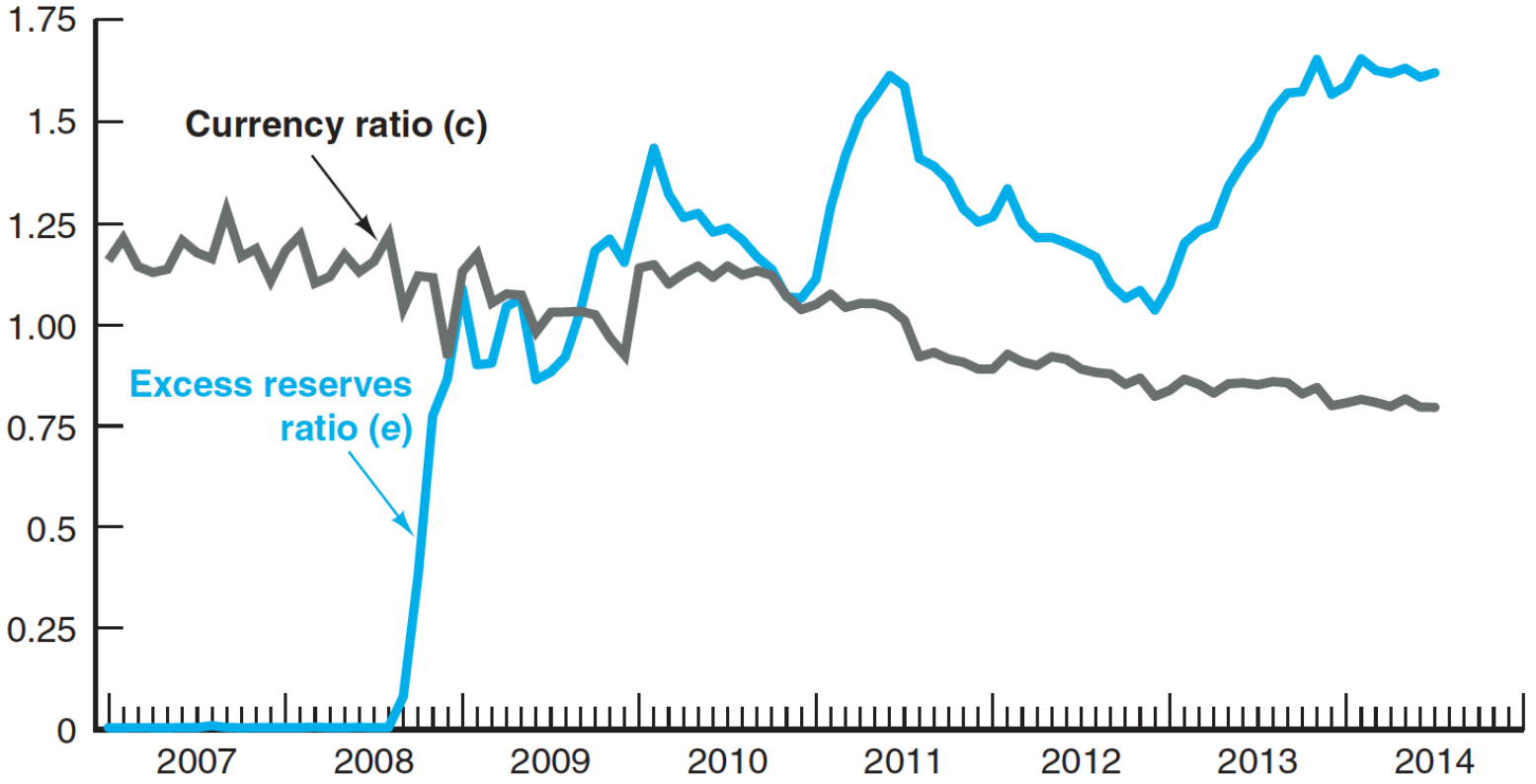
- These lending and asset-purchase programs resulted in a huge expansion of the monetary base and have been given the name “quantitative easing.”
- This increase in the monetary base did not lead to an equivalent change in the money supply because excess reserves rose dramatically.

Figure 4 M1 and the Monetary Base, 2007-2014



Source: Federal Reserve Bank of St. Louis, FRED database: http://research.stlouisfed.org/fred2/.

Figure 5 Excess Reserves Ratio and Currency Ratio, 2007-2014



Source: Federal Reserve Bank of St. Louis, FRED database: http://research.stlouisfed.org/fred2/.