

Money Supply Process

Economics 301: Money and Banking

Goals and Learning Outcomes

1 / 17

- Goals:
 - Understand balance sheets of Federal Reserve system and banking system.
 - Understand how money is created and multiplied.
 - Understand determinants of money supply.
- Learning Outcomes:
 - LO4: Explain the structure of the Federal Reserve System and the mechanisms in which it controls the money supply.

Goals and Learning Outcomes

1 / 17

- Goals:
 - Understand balance sheets of Federal Reserve system and banking system.
 - Understand how money is created and multiplied.
 - Understand determinants of money supply.
- Learning Outcomes:
 - LO4: Explain the structure of the Federal Reserve System and the mechanisms in which it controls the money supply.

Reading

2 / 17

- Read Hubbard and O'Brien, Chapter 14.

Federal Reserve Balance Sheet

Federal Reserve System

Assets	Liabilities
Government securities	Currency in circulation
Discount loans	Reserves
Corporate securities	
Mortgage backed securities	

- Assets: securities purchased by the Federal Reserve.
- Reserves:
 - Banks have accounts at the Fed in which they hold deposits to be used to meet their own depositors needs.
 - Reserves = Deposits of banks at Fed + currency physically held by banks in vaults.

Federal Reserve Balance Sheet

Federal Reserve System

Assets	Liabilities
Government securities	Currency in circulation
Discount loans	Reserves
Corporate securities	
Mortgage backed securities	

- Assets: securities purchased by the Federal Reserve.
- Reserves:
 - Banks have accounts at the Fed in which they hold deposits to be used to meet their own depositors needs.
 - Reserves = Deposits of banks at Fed + currency physically held by banks in vaults.

Federal Reserve Balance Sheet

Federal Reserve System

Assets	Liabilities
Government securities	Currency in circulation
Discount loans	Reserves
Corporate securities	
Mortgage backed securities	

- Assets: securities purchased by the Federal Reserve.
- Reserves:
 - Banks have accounts at the Fed in which they hold deposits to be used to meet their own depositors needs.
 - Reserves = Deposits of banks at Fed + currency physically held by banks in vaults.

Federal Reserve Balance Sheet

Federal Reserve System

Assets	Liabilities
Government securities	Currency in circulation
Discount loans	Reserves
Corporate securities	
Mortgage backed securities	

- Assets: securities purchased by the Federal Reserve.
- Reserves:
 - Banks have accounts at the Fed in which they hold deposits to be used to meet their own depositors needs.
 - Reserves = Deposits of banks at Fed + currency physically held by banks in vaults.

Banking System Balance Sheet

Banking System

Assets	Liabilities
Government securities	Checkable deposits
Personal/Corporate Loans	Other types of deposits
Loaned federal funds	Borrowed federal funds
Reserves	Discount Loans
Physical Collateral on Defaults	

Open Market Operations

- Monetary base = currency in circulation + total reserves in banking system ($MB=C+R$).
- Open market purchase of \$100 in Treasury Bills from Banking system.

Banking System

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

Federal Reserve System

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

Open Market Operations

- Monetary base = currency in circulation + total reserves in banking system ($MB=C+R$).
- Open market purchase of \$100 in Treasury Bills from Banking system.

Banking System

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

Federal Reserve System

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

Open Market Operations

- Monetary base = currency in circulation + total reserves in banking system ($MB=C+R$).
- Open market purchase of \$100 in Treasury Bills from Banking system.

Banking System

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

Federal Reserve System

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

Open Market Operations

- Monetary base = currency in circulation + total reserves in banking system ($MB=C+R$).
- Open market purchase of \$100 in Treasury Bills from Banking system.

Banking System

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

Federal Reserve System

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

Open Market Purchase from Public

- Open market purchase of \$100 from non-bank public.
- Suppose public deposits \$80 of proceeds in banks and holds \$20 currency.

Non-bank Public

Assets		Liabilities
Government Securities	-\$100	
Checkable Deposits	+\$80	
Currency	+\$20	

Open Market Purchase from Public

- Open market purchase of \$100 from non-bank public.
- Suppose public deposits \$80 of proceeds in banks and holds \$20 currency.

Non-bank Public

Assets		Liabilities
Government Securities	-\$100	
Checkable Deposits	+\$80	
Currency	+\$20	

Open Market Purchase from Public

- Open market purchase of \$100 from non-bank public.
- Suppose public deposits \$80 of proceeds in banks and holds \$20 currency.

Non-bank Public

Assets		Liabilities
Government Securities	-\$100	
Checkable Deposits	+\$80	
Currency	+\$20	

Open Market Purchase from Public (continued)

- Open market purchase of \$100 from non-bank public.
- Suppose public deposits \$80 of proceeds in banks and holds \$20 currency.

Banking System

Assets		Liabilities	
Reserves	+\$80	Checkable Deposits	+\$80

Federal Reserve System

Assets		Liabilities	
Government Securities	+\$100	Reserves	+\$80
		Currency in circulation	+\$20

Open Market Purchase from Public (continued)

- Open market purchase of \$100 from non-bank public.
- Suppose public deposits \$80 of proceeds in banks and holds \$20 currency.

Banking System

Assets		Liabilities	
Reserves	+\$80	Checkable Deposits	+\$80

Federal Reserve System

Assets		Liabilities	
Government Securities	+\$100	Reserves	+\$80
		Currency in circulation	+\$20

Open Market Purchase from Public (continued)

- Open market purchase of \$100 from non-bank public.
- Suppose public deposits \$80 of proceeds in banks and holds \$20 currency.

Banking System

Assets		Liabilities	
Reserves	+\$80	Checkable Deposits	+\$80

Federal Reserve System

Assets		Liabilities	
Government Securities	+\$100	Reserves	+\$80
		Currency in circulation	+\$20

Discount Loan

- **Discount loan:** loan in which a bank or financial institution borrows funds directly from the Federal Reserve.
- Suppose Acme Bank makes a \$200 discount loan.

Banking System

Assets		Liabilities	
Reserves	+\$200	Discount Loans	+\$200

Federal Reserve System

Assets		Liabilities	
Discount Loans	+\$200	Reserves	+\$200

Discount Loan

- **Discount loan:** loan in which a bank or financial institution borrows funds directly from the Federal Reserve.
- Suppose Acme Bank makes a \$200 discount loan.

Banking System

Assets		Liabilities	
Reserves	+\$200	Discount Loans	+\$200

Federal Reserve System

Assets		Liabilities	
Discount Loans	+\$200	Reserves	+\$200

Discount Loan

- **Discount loan:** loan in which a bank or financial institution borrows funds directly from the Federal Reserve.
- Suppose Acme Bank makes a \$200 discount loan.

Banking System

Assets		Liabilities	
Reserves	+\$200	Discount Loans	+\$200

Federal Reserve System

Assets		Liabilities	
Discount Loans	+\$200	Reserves	+\$200

Discount Loan

- **Discount loan:** loan in which a bank or financial institution borrows funds directly from the Federal Reserve.
- Suppose Acme Bank makes a \$200 discount loan.

Banking System

Assets		Liabilities	
Reserves	+\$200	Discount Loans	+\$200

Federal Reserve System

Assets		Liabilities	
Discount Loans	+\$200	Reserves	+\$200

Deposit Creation

9 / 17

- Suppose **required reserve ratio** is 5% and banks hold no excess reserves.
- Suppose Fed makes a \$100 open market purchase of bonds.
- Increases banks' reserves by \$100, they in turn loan full amount to non-bank public.
- Non-bank public borrows \$100 and spends it.
- \$100 expenditure becomes \$100 income for others in non-bank public.
- Suppose non-bank public holds zero currency, puts full amount in checkable deposits.

Deposit Creation

9 / 17

- Suppose **required reserve ratio** is 5% and banks hold no excess reserves.
- Suppose Fed makes a \$100 open market purchase of bonds.
- Increases banks' reserves by \$100, they in turn loan full amount to non-bank public.
- Non-bank public borrows \$100 and spends it.
- \$100 expenditure becomes \$100 income for others in non-bank public.
- Suppose non-bank public holds zero currency, puts full amount in checkable deposits.

Deposit Creation

9 / 17

- Suppose **required reserve ratio** is 5% and banks hold no excess reserves.
- Suppose Fed makes a \$100 open market purchase of bonds.
- Increases banks' reserves by \$100, they in turn loan full amount to non-bank public.
- Non-bank public borrows \$100 and spends it.
- \$100 expenditure becomes \$100 income for others in non-bank public.
- Suppose non-bank public holds zero currency, puts full amount in checkable deposits.

Deposit Creation

9 / 17

- Suppose **required reserve ratio** is 5% and banks hold no excess reserves.
- Suppose Fed makes a \$100 open market purchase of bonds.
- Increases banks' reserves by \$100, they in turn loan full amount to non-bank public.
- Non-bank public borrows \$100 and spends it.
- \$100 expenditure becomes \$100 income for others in non-bank public.
- Suppose non-bank public holds zero currency, puts full amount in checkable deposits.

Deposit Creation

9 / 17

- Suppose **required reserve ratio** is 5% and banks hold no excess reserves.
- Suppose Fed makes a \$100 open market purchase of bonds.
- Increases banks' reserves by \$100, they in turn loan full amount to non-bank public.
- Non-bank public borrows \$100 and spends it.
- \$100 expenditure becomes \$100 income for others in non-bank public.
- Suppose non-bank public holds zero currency, puts full amount in checkable deposits.

Deposit Creation

9 / 17

- Suppose **required reserve ratio** is 5% and banks hold no excess reserves.
- Suppose Fed makes a \$100 open market purchase of bonds.
- Increases banks' reserves by \$100, they in turn loan full amount to non-bank public.
- Non-bank public borrows \$100 and spends it.
- \$100 expenditure becomes \$100 income for others in non-bank public.
- Suppose non-bank public holds zero currency, puts full amount in checkable deposits.

Deposit Creation (continued)

- Banks deposits increase by \$100.
- Put puts $(0.05)(\$100) = \5 in reserves (minimum required), loans out remaining \$95.
- Non-bank public borrows \$95, this becomes income for others, which ends up in deposits.
- Banks put $(0.05)(\$95) = \4.75 in reserves, loans out remaining \$90.25.
- Non-bank public borrows \$90.25, this becomes income for others, which ends up in deposits again.
- Banks put $(0.05)(\$90.25) = \4.51 in reserves, loans out remaining \$85.74...

Deposit Creation (continued)

- Banks deposits increase by \$100.
- Put puts $(0.05)(\$100) = \5 in reserves (minimum required), loans out remaining \$95.
- Non-bank public borrows \$95, this becomes income for others, which ends up in deposits.
- Banks put $(0.05)(\$95) = \4.75 in reserves, loans out remaining \$90.25.
- Non-bank public borrows \$90.25, this becomes income for others, which ends up in deposits again.
- Banks put $(0.05)(\$90.25) = \4.51 in reserves, loans out remaining \$85.74...

Deposit Creation (continued)

- Banks deposits increase by \$100.
- Put puts $(0.05)(\$100) = \5 in reserves (minimum required), loans out remaining \$95.
- Non-bank public borrows \$95, this becomes income for others, which ends up in deposits.
- Banks put $(0.05)(\$95) = \4.75 in reserves, loans out remaining \$90.25.
- Non-bank public borrows \$90.25, this becomes income for others, which ends up in deposits again.
- Banks put $(0.05)(\$90.25) = \4.51 in reserves, loans out remaining \$85.74...

Deposit Creation (continued)

- Banks deposits increase by \$100.
- Put puts $(0.05)(\$100) = \5 in reserves (minimum required), loans out remaining \$95.
- Non-bank public borrows \$95, this becomes income for others, which ends up in deposits.
- Banks put $(0.05)(\$95) = \4.75 in reserves, loans out remaining \$90.25.
- Non-bank public borrows \$90.25, this becomes income for others, which ends up in deposits again.
- Banks put $(0.05)(\$90.25) = \4.51 in reserves, loans out remaining \$85.74...

Deposit Creation (continued)

- Banks deposits increase by \$100.
- Put puts $(0.05)(\$100) = \5 in reserves (minimum required), loans out remaining \$95.
- Non-bank public borrows \$95, this becomes income for others, which ends up in deposits.
- Banks put $(0.05)(\$95) = \4.75 in reserves, loans out remaining \$90.25.
- Non-bank public borrows \$90.25, this becomes income for others, which ends up in deposits again.
- Banks put $(0.05)(\$90.25) = \4.51 in reserves, loans out remaining \$85.74...

Deposit Creation (continued)

- Banks deposits increase by \$100.
- Put puts $(0.05)(\$100) = \5 in reserves (minimum required), loans out remaining \$95.
- Non-bank public borrows \$95, this becomes income for others, which ends up in deposits.
- Banks put $(0.05)(\$95) = \4.75 in reserves, loans out remaining \$90.25.
- Non-bank public borrows \$90.25, this becomes income for others, which ends up in deposits again.
- Banks put $(0.05)(\$90.25) = \4.51 in reserves, loans out remaining \$85.74...

Money Multiplier

11 / 17

- A single \$100 open market purchase of bonds created an increase of deposits equal to...

$$\Delta D = \$100 + 95 + 90.25 + 85.74 + \dots$$

- Let ΔR denote initial change in reserves (\$100), r denote required reserve ratio.

$$\Delta D = \Delta R + (1 - r)\Delta R + (1 - r)^2\Delta R + (1 - r)^3\Delta R + \dots$$

- Can you simplify this expression? How much larger is change in deposits compared to open market purchase?

Money Multiplier

11/ 17

- A single \$100 open market purchase of bonds created an increase of deposits equal to...

$$\Delta D = \$100 + 95 + 90.25 + 85.74 + \dots$$

- Let ΔR denote initial change in reserves (\$100), r denote required reserve ratio.

$$\Delta D = \Delta R + (1 - r)\Delta R + (1 - r)^2\Delta R + (1 - r)^3\Delta R + \dots$$

- Can you simplify this expression? How much larger is change in deposits compared to open market purchase?

Money Multiplier

11 / 17

- A single \$100 open market purchase of bonds created an increase of deposits equal to...

$$\Delta D = \$100 + 95 + 90.25 + 85.74 + \dots$$

- Let ΔR denote initial change in reserves (\$100), r denote required reserve ratio.

$$\Delta D = \Delta R + (1 - r)\Delta R + (1 - r)^2\Delta R + (1 - r)^3\Delta R + \dots$$

- Can you simplify this expression? How much larger is change in deposits compared to open market purchase?

Money Multiplier Algebra

12 / 17

- Required reserves = (required reserve ratio)(deposits).
- Recall, we assume Actual reserves = Required Reserves.

$$R = rD$$

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

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

- Money multiplier = $m = \frac{1}{r}$.
- Money Supply = (money multiplier) (monetary base).

Money Multiplier Algebra

12/ 17

- Required reserves = (required reserve ratio)(deposits).
- Recall, we assume Actual reserves = Required Reserves.

$$R = rD$$

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

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

- Money multiplier = $m = \frac{1}{r}$.
- Money Supply = (money multiplier) (monetary base).

Money Multiplier Algebra

12/ 17

- Required reserves = (required reserve ratio)(deposits).
- Recall, we assume Actual reserves = Required Reserves.

$$R = rD$$

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

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

- Money multiplier = $m = \frac{1}{r}$.
- Money Supply = (money multiplier) (monetary base).

Money Multiplier Algebra

12 / 17

- Required reserves = (required reserve ratio)(deposits).
- Recall, we assume Actual reserves = Required Reserves.

$$R = rD$$

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

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

- Money multiplier = $m = \frac{1}{r}$.
- Money Supply = (money multiplier) (monetary base).

Money Multiplier Algebra

12/ 17

- Required reserves = (required reserve ratio)(deposits).
- Recall, we assume Actual reserves = Required Reserves.

$$R = rD$$

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

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

- Money multiplier = $m = \frac{1}{r}$.
- Money Supply = (money multiplier) (monetary base).

Money Multiplier Algebra

12/ 17

- Required reserves = (required reserve ratio)(deposits).
- Recall, we assume Actual reserves = Required Reserves.

$$R = rD$$

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

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

- Money multiplier = $m = \frac{1}{r}$.
- Money Supply = (money multiplier) (monetary base).

Money Multiplier Algebra

12/ 17

- Required reserves = (required reserve ratio)(deposits).
- Recall, we assume Actual reserves = Required Reserves.

$$R = rD$$

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

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

- Money multiplier = $m = \frac{1}{r}$.
- Money Supply = (money multiplier) (monetary base).

General Money Multiplier

13 / 17

- Suppose people do hold currency, banks hold excess reserves.
- Notation:
 - C: Currency holdings.
 - D: Deposits.
 - RR: Required reserves.
 - ER: Excess reserves.
 - R: Actual reserves.
 - MB: Monetary base.
- For simplicity, assume ratios of currency holdings and excess reserves are constant:
 - $c = C/D =$ currency ratio.
 - $e = ER/D =$ excess reserves ratio.
- Use $MB = R+C$ and $M1 = C+D$ to derive money multiplier.

General Money Multiplier

13 / 17

- Suppose people do hold currency, banks hold excess reserves.
- Notation:
 - C: Currency holdings.
 - D: Deposits.
 - RR: Required reserves.
 - ER: Excess reserves.
 - R: Actual reserves.
 - MB: Monetary base.
- For simplicity, assume ratios of currency holdings and excess reserves are constant:
 - $c = C/D =$ currency ratio.
 - $e = ER/D =$ excess reserves ratio.
- Use $MB = R+C$ and $M1 = C+D$ to derive money multiplier.

General Money Multiplier

13 / 17

- Suppose people do hold currency, banks hold excess reserves.
- Notation:
 - C: Currency holdings.
 - D: Deposits.
 - RR: Required reserves.
 - ER: Excess reserves.
 - R: Actual reserves.
 - MB: Monetary base.
- For simplicity, assume ratios of currency holdings and excess reserves are constant:
 - $c = C/D =$ currency ratio.
 - $e = ER/D =$ excess reserves ratio.
- Use $MB = R+C$ and $M1 = C+D$ to derive money multiplier.

General Money Multiplier

13 / 17

- Suppose people do hold currency, banks hold excess reserves.
- Notation:
 - C: Currency holdings.
 - D: Deposits.
 - RR: Required reserves.
 - ER: Excess reserves.
 - R: Actual reserves.
 - MB: Monetary base.
- For simplicity, assume ratios of currency holdings and excess reserves are constant:
 - $c = C/D =$ currency ratio.
 - $e = ER/D =$ excess reserves ratio.
- Use $MB = R+C$ and $M1 = C+D$ to derive money multiplier.

General Money Multiplier

14 / 17

General Money Multiplier

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

Impact on Money Supply?

- If there is a *decrease* in the currency ratio (suppose from a fraction of total money that people hold in currency)?
- If there is an *increase* in the fraction of deposits that banks keep in excess reserves?
- If there is an *increase* in the required reserve ratio?

General Money Multiplier

14 / 17

General Money Multiplier

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

Impact on Money Supply?

- If there is a *decrease* in the currency ratio (suppose from a fraction of total money that people hold in currency)?
- If there is an *increase* in the fraction of deposits that banks keep in excess reserves?
- If there is an *increase* in the required reserve ratio?

General Money Multiplier

14 / 17

General Money Multiplier

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

Impact on Money Supply?

- If there is a *decrease* in the currency ratio (suppose from a fraction of total money that people hold in currency)?
- If there is an *increase* in the fraction of deposits that banks keep in excess reserves?
- If there is an *increase* in the required reserve ratio?

General Money Multiplier

14 / 17

General Money Multiplier

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

Impact on Money Supply?

- If there is a *decrease* in the currency ratio (suppose from a fraction of total money that people hold in currency)?
- If there is an *increase* in the fraction of deposits that banks keep in excess reserves?
- If there is an *increase* in the required reserve ratio?

General Money Multiplier

14 / 17

General Money Multiplier

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

Impact on Money Supply?

- If there is a *decrease* in the currency ratio (suppose from a fraction of total money that people hold in currency)?
- If there is an *increase* in the fraction of deposits that banks keep in excess reserves?
- If there is an *increase* in the required reserve ratio?

General Money Multiplier Problem

Suppose the required reserve ratio is 5%, banks hold an extra 8% of deposits in excess reserves, and consumers hold currency balances that are about 2% of what they hold in deposits in banks. Suppose the Fed makes an open market purchase of \$100 million of government bonds.

- 1 Compute the impact on the monetary base.
- 2 Compute the impact on the M1 money supply.
- 3 Compute the impact on the amount of deposits held in the banking sector.
- 4 Compute the impact on required reserves, excess reserves, and total reserves held by banks.
- 5 Describe and illustrate the impact on the equilibrium interest rate.

Determinants of Money Supply

Factors affecting money supply:

- Open market operations (affect non-borrowed monetary base).
- Changes in required reserve ratio.
- Changes in banks desire to hold excess reserves.
- Changes in consumers' desire to hold currency versus deposits.
- Changes in borrowed reserves.

Determinants of Money Supply

16 / 17

Factors affecting money supply:

- Open market operations (affect non-borrowed monetary base).
- Changes in required reserve ratio.
- Changes in banks desire to hold excess reserves.
- Changes in consumers' desire to hold currency versus deposits.
- Changes in borrowed reserves.

Determinants of Money Supply

Factors affecting money supply:

- Open market operations (affect non-borrowed monetary base).
- Changes in required reserve ratio.
- Changes in banks desire to hold excess reserves.
- Changes in consumers' desire to hold currency versus deposits.
- Changes in borrowed reserves.

Determinants of Money Supply

16 / 17

Factors affecting money supply:

- Open market operations (affect non-borrowed monetary base).
- Changes in required reserve ratio.
- Changes in banks desire to hold excess reserves.
- Changes in consumers' desire to hold currency versus deposits.
- Changes in borrowed reserves.

Determinants of Money Supply

Factors affecting money supply:

- Open market operations (affect non-borrowed monetary base).
- Changes in required reserve ratio.
- Changes in banks desire to hold excess reserves.
- Changes in consumers' desire to hold currency versus deposits.
- Changes in borrowed reserves.

Endogenous Money Supply

17 / 17

- Typical assumption: central bank exogenously influences money supply through open market operations.
- Typical assumption implication for money supply function?
- How might excess reserves be influenced by interest rate?
- What is the implication for the money supply function?

Endogenous Money Supply

17 / 17

- Typical assumption: central bank exogenously influences money supply through open market operations.
- Typical assumption implication for money supply function?
- How might excess reserves be influenced by interest rate?
- What is the implication for the money supply function?

Endogenous Money Supply

17 / 17

- Typical assumption: central bank exogenously influences money supply through open market operations.
- Typical assumption implication for money supply function?
- How might excess reserves be influenced by interest rate?
- What is the implication for the money supply function?

Endogenous Money Supply

17 / 17

- Typical assumption: central bank exogenously influences money supply through open market operations.
- Typical assumption implication for money supply function?
- How might excess reserves be influenced by interest rate?
- What is the implication for the money supply function?