Lecture 6 and 7

Multiple Deposit Creation and the Money Supply Process

Roadmap

This lecture aims to explore:

- **How money supply is determined?**
  Who controls it?
  What cause it to change?

- We answer these questions by studying the money supply process, and explore mechanism that determines the level of money supply.

Three Players in the Money Supply Process

1. Central bank
2. Banks (deposit corporation)
3. Depositors/borrowers

Commercial bank's balance Sheet (simplified version)

Assets	Liabilities
Securities Reserves Loans	Deposits Bank capital

- **Reserves** consists of

1. required reserve (reserves that Fed requires bank to hold)

2. excess reserve (additional reserves the bank choose to hold)

- **Required reserve ratio:** for every dollar of deposits at banks, a certain fraction must be held as reserves

The Fed's Balance Sheet (simplified version)

Assets	Liabilities
Securities *(mainly government securities)* Discount loans *(Loans to financial inst.)*	Currency in circulation (C) Reserves (R)

Monetary Base, MB = C + R

Currency in circulation means amount of currency in hands of public. Currency held by banks is counted as part of **reserve.**

Fed makes billion of dollar every year

Assets	Liabilities
Securities *(mainly government securities)* Discount loans *(Loans to financial inst.)*	Currency in circulation (C) Reserves (R)

Holding securities earn interest

Currency in circulation (Fed's liability) pay no interest

How do Fed provides money (reserves) to banking system?

Assets	Liabilities
Securities *(mainly government securities)*	**Currency in circulation (C)**
Discount loans *(Loans to financial inst.)*	**Reserves (R)**

There are 2 channels:

1.Purchase securities from financial institutions (OMO):

Securities ↑, reserve ↑, money supply ↑

2.Giving loans to financial institutions: (w/ interest rates called discount rate.

Loan ↑, reserve ↑, money supply↑

This is the way Fed control over monetary base.
Monetary base is also called high-powered money.

Control of the Monetary Base: OMO (1)

Open Market Purchase from Bank-*a purchase of bond by the Fed*

The Banking System

Assets	Liabilities
Securities – $100 Reserves + $100	

The Fed

Assets	Liabilities
Securities + $100	Reserves + $100

Hence, MB↑ $100

Open Market Purchase from Public (non-bank): deposit checks

Public

Assets	Liabilities
Securities – $100 Deposits + $100	

Banking System

Assets	Liabilities
Reserves + $100	Checkable Deposits + $100

***Result:* R ↑ $100, *MB* ↑ $100**

The Fed

Assets	Liabilities
Securities + $100	Reserves + $100

Hence, MB↑ $100

In this case, public deposit checks received from Fed in their local banks. Bank then credit depositor account and deposit checks in their account with the Fed

If person cashes check

Open Market Purchase from Public (non-bank): cash checks

Public	
Assets	Liabilities
Securities – $100	
Currency + $100	

The Fed	
Assets	Liabilities
Securities + $100	Currency + $100

Hence, MB↑ $100

Result*: *Balance sheet of bank is unchanged.
***Result*: *R* unchanged, *MB*↑ $100**
Effect on *MB* certain, on *R* uncertain

In this case, public cash the Fed's checks

Control of the Monetary Base: OMO (2)

Open Market sale to Bank:

The Banking System

Assets	Liabilities
Securities + $100 Reserves - $100	

The Fed

Assets	Liabilities
Securities - $100	Reserves - $100

Hence, MB↓ $100

Open Market sale to Public (non-bank): public pay for bond by checks

Public

Assets	Liabilities
Securities + $100 Deposits - $100	

The Fed

Assets	Liabilities
Securities - $100	Reserves - $100

Hence, MB↓ $100

Banking System

Assets	Liabilities
Reserves - $100	Checkable Deposits - $100

***Result:* R↓ $100, *MB*↓ $100**

Effect on *MB* certain, on *R* uncertain. Fed can control MB with OMO more effectively than it can control reserve.

If person pays for bond by check

Open Market sale to Public (non-bank): public pay for bond by cash

Public

Assets	Liabilities
Securities + $100	
Currency - $100	

The Fed

Assets	Liabilities
Securities - $100	Currency - $100

Hence, MB↓ $100

Result*: *Balance sheet of bank is unchanged.
***Result*: *R* unchanged, *MB*↓ $100**
Effect on *MB* certain, on *R* uncertain

Shifts From Deposits into Currency

- A shift from deposits to currency will affect reserves in the banking system.
- The shift has no effect on monetary base, another reason why the Fed has more control over the monetary base than over reserves.
- The example for this case is that public wants to hold more Currency to buy gifts during Christmas season → withdraw money from bank.

Public

Assets	Liabilities
Deposits – $100	
Currency + $100	

The Fed

Assets	Liabilities
	Currency + $100
	Reserves – $100

Banking System

Assets	Liabilities
Reserves – $100	Deposits – $100

***Result*: *R* ↓ $100, *MB* unchanged**

Monetary base is more stable variable

Control of the Monetary Base: Discount Loans

Bank borrowed money from Fed

Banking System

Assets	Liabilities
Reserves + $100	Discount loan + $100

The Fed

Assets	Liabilities
Discount loan + $100	Reserves + $100

Result: ***R*** **↑ $100,** ***MB*** **↑ $100**

Bank pay off the loan from Fed

Banking System

Assets	Liabilities
Reserves - $100	Discount loan - $100

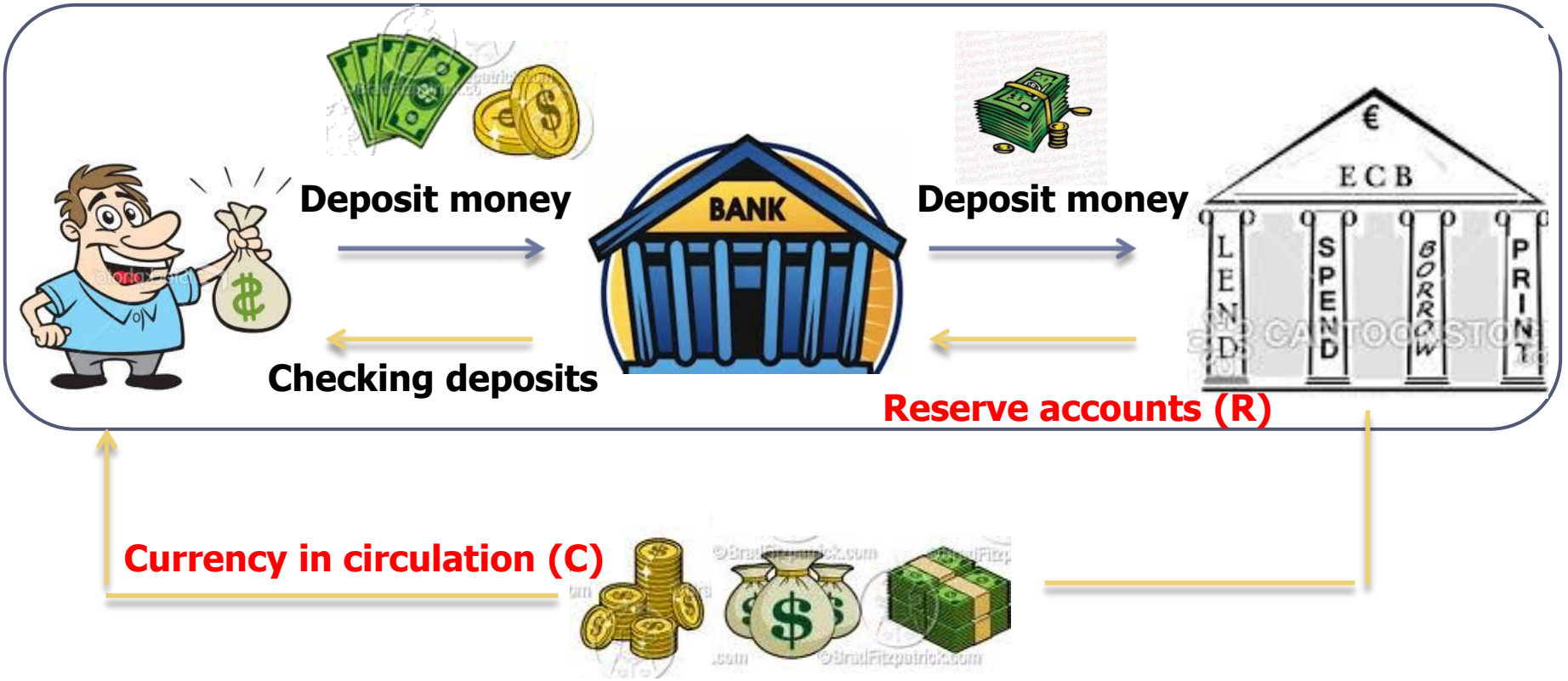
The Fed

Assets	Liabilities
Discount loan - $100	Reserves - $100

Result: ***R*** **↓ $100,** ***MB*** **↓ $100**

The MB changes one-for-one with the change in the borrowings from Fed

Relationship of 3 players:



Open market Purchase

Fed purchase bond from Bank

Fed purchase bond from Non-bank public: cash check

Fed purchase bond from Non-bank public : deposit check

Open market Sale

Fed sell bond to Bank

Non-bank public purchase bond from Fed : pay by cash

Non-bank public purchase bond from Fed : pay by check

Fed gives discount loan to bank

Bank borrowed money from Fed

Bank pay off the loan from Fed

Multiple deposit creation

- When Fed supply banking system with $1 additional reserve, deposit increase by multiple of this amount.
- Main assumption: all banks hold no excess reserves (ER)
- ER earns little interest.
- If there is no change in the checkable deposit, the required reserve will be the same.
- If the bank's reserve increase, bank will make loan or invest in the security.
- Different results between the deposit creation for single bank versus the banking system as a whole.

Deposit Creation: Single Bank

What happens if Fed purchase bond from Bank?

First National Bank

Assets		Liabilities	
Securities	– $100		
Reserves	+ $100		

Hence, excess reserve ↑ → bank make loan to earn higher interest → put loan into borrower account

First National Bank

Assets		Liabilities	
Securities	– $100	Deposits	+ $100
Reserves	+ $100		
Loans	+ $100		

Hence, borrower purchase good and service by writing check → checkable deposit at other bank increase as checkable deposit (and reserve) leave first national bank

First National Bank

Assets		Liabilities	
Securities	– $100		
Loans	+ $100		

If required reserve ratio (rr) =10%→ required reserve=$10, excess reserve=$90→ make loan of $90

A bank cannot safely make a loan for an amount greater than the excess reserves it has before it makes the loan

Deposit Creation: Banking System

If the $100 loan from first natioanl bank is deposited at Bank A:

Bank A

Assets		Liabilities	
Reserves	+ $100	Deposits	+ $100

If required reserve ratio (rr) =10%→ required reserve=$10, excess reserve=$90→ make loan of $90

Bank A

Assets		Liabilities	
Reserves	+ $10	Deposits	+ $100
Loans	+ $90		

If the $90 loan from bank A is deposited at Bank B:

Bank B

Assets		Liabilities	
Reserves	+ $90	Deposits	+ $90

If required reserve ratio (rr) =10%→ required reserve=$9, excess reserve=$81→ make loan of $81

Bank B

Assets		Liabilities	
Reserves	+ $ 9	Deposits	+ $90
Loans	+ $81		

The $81 loan from bank B is deposited at Bank C and so on

Deposit Creation

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

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

Deposit Creation

If Bank A buys securities with $90 check

Bank A

Assets		Liabilities	
Reserves	+ $10	Deposits	+ $100
Securities	+ $90		

Seller deposits $90 at Bank B and process is same

Whether bank makes loans or buys securities, get same deposit expansion

Deposit Multiplier

Deposit Multiplier means the multiple increase in deposits generated from an increase in the banking system's reserve (= 1/rr)

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

R is reserve in the banking system
D is checkable deposit in the banking system
rr is required reserve ratio

Deriving the formula:

$R = RR+ER$, but we assume that ER=0 --> banking system is in equilibrium
R=RR
$R = rr \times D$

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

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

In our previous example, rr=10%, reserve increase by $100, we can find ΔD
ΔD=1/0.1 * 100 = $1,000

Deposit Creation: Banking System as a Whole

Banking System

Assets		Liabilities	
Securities	– $100	Deposits	+ $1000
Reserves	+ $100		
Loans	+ $1000		

Critique of Simple Model

Deposit creation stops if:

1. Proceeds from loan kept in cash

(money supply will not increase as much as our simple model example)

2.Bank holds excess reserves

(banks do not make loans or buy securities in the full amount of their excess reserves)

Factors that determine money supply

MB=MBN+BR

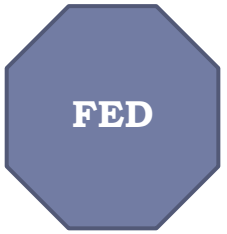
Monetary base(MB) has 2 components:

1.Non borrowed monetary base (MBN):

Created by open market operation

Fed can control completely

Example: Open market purchase → R ↑ → with multiple deposit creation MBN ↑↑



2.Borrowed reserve from the Fed (BR):

Created by loans from the Fed.

Fed is less tightly controlled

Example: Discount loan ↑ → R ↑ → with multiple deposit creation BR ↑↑

Factors that determine money supply

3.Required reserve ratio on checkable deposit, rr:

If monetary base and other variables constant, but rr ↑

→ multiple deposit creation ↓ →money supply ↓

4.Currency holdings:

If monetary base and other variables constant, but currency holding ↑

→ multiple deposit creation ↓ →money supply ↓

5.Excess reserves:

If bank holding of excess reserve ↑ →loan issued, security holding ↓

→ multiple deposit creation stop →money supply ↓

Money Multiplier

$M = m \times MB$

Deriving Money Multiplier

$R = RR + ER$

$RR = r \times D$

$R = (r \times D) + ER$

Adding C to both sides

$R + C = MB = (r \times D) + ER + C$

1. Tells us amount of MB needed support D, ER and C
2. \$1 of MB in ER, not support D or C

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

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

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

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

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

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

$m < 1/r$ because no multiple expansion for currency and because as $D \uparrow$ $ER \uparrow$

Full Model

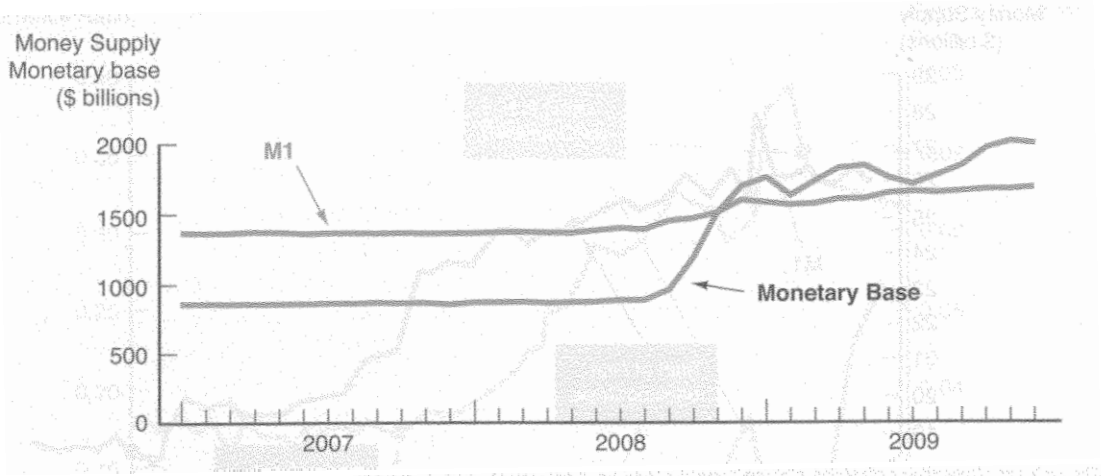
$$M = m \times (MB_n + DL)$$

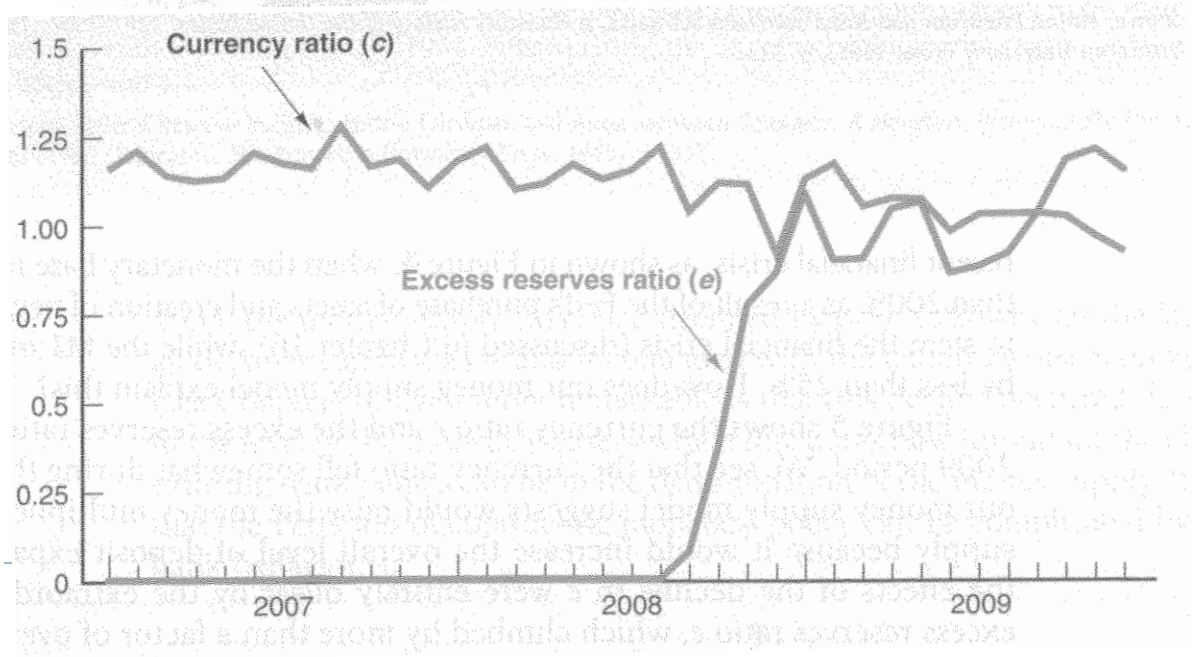
Factors Determining Money Supply

SUMMARY **Table 1 Money Supply (M1) Response**

Player	Variable	Change in Variable	Money Supply Response	Reason
Federal Reserve System	r	↑	↓	Less multiple deposit expansion
	MB_n	↑	↑	More MB to support D and C
	DL	↑	↑	More MB to support D and C
Depositors	c	↑	↓	Less multiple deposit expansion
Depositors and banks	Expected deposit outflows	↑	↓	e ↑ so fewer reserves to support D
Borrowers from banks and the other three players	i	↑	↑	e ↓ so more reserves to support D

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.


Money Supply
Monetary base
($ billions)
2000
1500
1000
500
0
M1
Monetary Base
2007
2008
2009


1.5
1.25
1.00
0.75
0.5
0.25
0
Currency ratio (c)
Excess reserves ratio (e)
2007
2008
2009