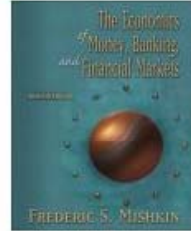


ECON 354 Money and Banking

Professor Yamin Ahmad

Lecture 5: Money Supply

- Understanding the Fed's Balance Sheet
- Open Market Operations
- Deposit Creation



Big Concepts

- The Bank Lending Channel of Monetary Policy
- How changes in the instruments affects the supply of money
 - Emphasis on **Open Market Operations**
- Deposit Creation
- Money Multiplier Process
- Non Borrowed Monetary Base and Discount Loans

Note: These lecture notes are incomplete without having attended lectures

Banks' role in the money supply

- The money supply equals currency plus demand (checking account) deposits:

$$M = C + D$$

- Since the money supply includes demand deposits, the banking system plays an important role.

Note: These lecture notes are incomplete without having attended lectures

The Four Players in the Money Supply Process

1. Central bank: the Fed
2. Banks
3. Depositors
4. Borrowers from banks

Note: These lecture notes are incomplete without having attended lectures

The Fed's Policy Tools

- Recall the Fed uses following monetary policy tools:
 - Required reserve ratios
 - The discount rate
 - Open market operations
 - Term Auction Facility
 - Primary Dealer Credit Facility
 - Term Securities Lending Facility

Note: These lecture notes are incomplete without having attended lectures

The Federal Reserve System

- The Fed sets **required reserve ratios**, which are the minimum percentages of deposits that depository institutions must hold as reserves.
- The Fed does not change these ratios very often.
- The **discount rate** is the interest rate at which the Fed stands ready to lend reserves to depository institutions.
- An **open market operation** is the purchase or sale of government securities—U.S. Treasury bills and bonds—by the Federal Reserve System in the open market.

Note: These lecture notes are incomplete without having attended lectures

The Fed's Balance Sheet

- On the Fed's balance sheet, the largest and most important asset is U.S. government securities.
- The most important liabilities are Federal Reserve notes in circulation and banks' deposits.
- The sum of Federal Reserve notes, coins, and banks' deposits at the Fed is the **monetary base**.

Note: These lecture notes are incomplete without having attended lectures

Understanding the Fed's Balance Sheet

July 2007

Assets		Liabilities	
Securities		Federal Reserve Notes	\$781.4
	Held Outright	Commercial Bank Reserve Balance	\$16.8
	Repos	Liabilities related to foreign official and US Treasury Deposits	\$42.4
Loans		Other Liabilities	\$5.7
	Primary Lending (Discount Window)		
	Foreign Exchange Reserves		\$20.8
	Gold		\$11.0
	Other Assets		\$27.5
Total Assets	\$880.4	Total Liabilities	\$846.3
Capital (= Total Assets - Total Liabilities)			\$34.1

Note: Numbers are in Billions of dollars

Note: These lecture notes are incomplete without having attended lectures

The Fed's Balance Sheet In June 2009

June 2009

Assets		Liabilities	
Securities Held Outright	\$1,115.8	Federal Reserve Notes	\$868.8
US Treasury	\$606.2	Commercial Bank Reserve Balance	\$844.7
Federal Agency Debt	\$82.0	Liabilities related to foreign official and US Treasury Deposits	\$313.8
Mortgage Backed	\$427.6	Other Liabilities	\$6.3
Repurchase Agreements	\$0		
Term Auction Credit	\$372.54		
Other Loans	\$124.2		
Primary Lending	\$42.1		
Asset Backed Commercial Paper	\$23.64		
Credit to AIG	\$43.1		
Term Security Loan Facility	\$15.4		
Commercial Paper Funding Facility	\$142.6		
Maiden Lane Assets	\$62.5		
Central Bank Liquidity Swaps	\$175.7		
Foreign Exchange Reserves	\$23.3		
Gold	\$11.0		
Other Assets	\$51.4		
Total Assets	\$2,079.0	Total Liabilities	\$2,033.5

Capital (= Total Assets - Total Liabilities) \$45.7

Note: Numbers are in Billions of dollars

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The Fed's Balance Sheet

Federal Reserve System

Assets	Liabilities
Government securities	Currency in circulation (C)
Discount loans	Reserves (R)

Monetary Base, $MB = C + R$

Note: These lecture notes are incomplete without having attended lectures

A few preliminaries

- **Reserves (R)**: the portion of deposits that banks have not lent.
- A bank's liabilities include deposits, assets include reserves and outstanding loans.
- **100-percent-reserve banking**: a system in which banks hold all deposits as reserves.
- **Fractional-reserve banking**: a system in which banks hold a fraction of their deposits as reserves.

Note: These lecture notes are incomplete without having attended lectures

Commercial Bank's Balance Sheet

June 2009

Assets	Percent	Liabilities	Percent
Reserves and Cash Items	7.75	Checkable Deposits	69.51
Securities	22.26	Nontransaction Deposits	62.49
U.S. Government and Agency state and local governments and other securities	10.58	Small -denomination Time deposits (<\$100,000) + savings deposits	44.74
Loans	59.1	Large Denomination time deposits	17.76
Commercial and Industrial	12.35	Transactions Deposits	7.01
Real Estate	32.36	Borrowings	22.49
Consumer	7.33	Bank Capital	8.0
Interbank	3.52		
Other	3.5		
Other Assets (for example, physical capital)	10.9		
Total Assets	100.0	Total Liabilities	100.0

Note: These lecture notes are incomplete without having attended lectures

Commercial Bank's Balance Sheet

Commercial Bank

Commercial Bank	
Assets	Liabilities
Reserves (R)	Deposits (D)
Outstanding loans	...
...	

Note: These lecture notes are incomplete without having attended lectures

Controlling the Quantity of Money

- How **Required Reserve Ratios** Work
 - An increase in the required reserve ratio boosts the reserves that banks must hold, decreases their lending, and decreases the quantity of money.
- How the **Discount Rate** Works
 - An increase in the discount rate raises the cost of borrowing reserves from the Fed and decreases banks' reserves, which decreases their lending and decreases the quantity of money.

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Controlling the Quantity of Money

- How an **Open Market Operation** Works
 - When the Fed conducts an open market operation by buying a government security, it increases banks' reserves.
 - Banks loan the excess reserves.
 - By making loans, they create money.
- The reverse occurs when the Fed sells a government security.

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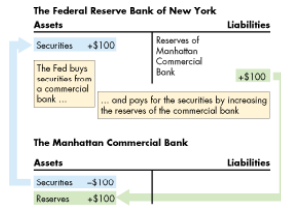
Controlling the Quantity of Money

- Although the details differ, the ultimate process of how an open market operation changes the money supply is the same regardless of whether the Fed conducts its transactions with a commercial bank or a member of the public.
- An open market operation that increases banks' reserves also increases the monetary base.

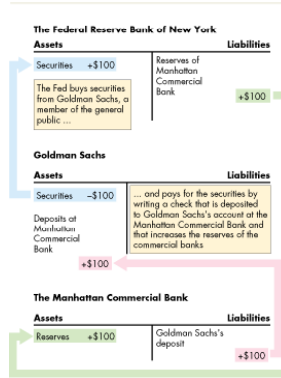
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Controlling the Quantity of Money

Figure 1 summarizes both types of open market operation. These are shown in more details on the following slides



(a) The Fed buys securities from a commercial bank

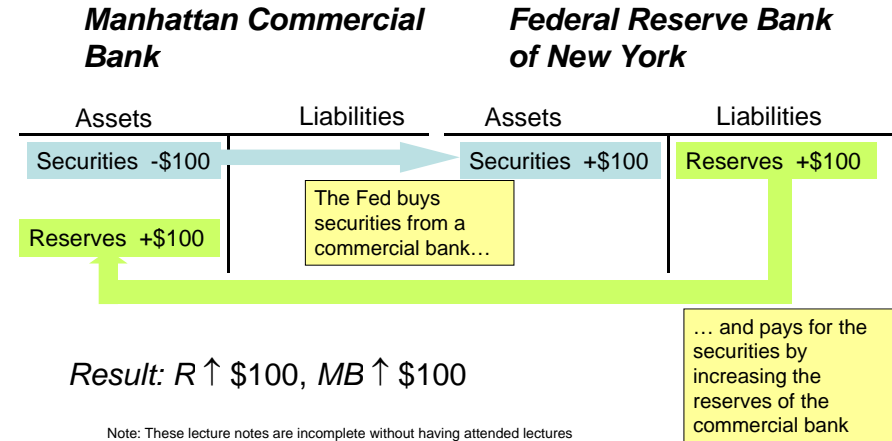


(b) The Fed buys securities from the public

Note: These lecture notes are incomplete without having attended lectures

Control of Monetary Base

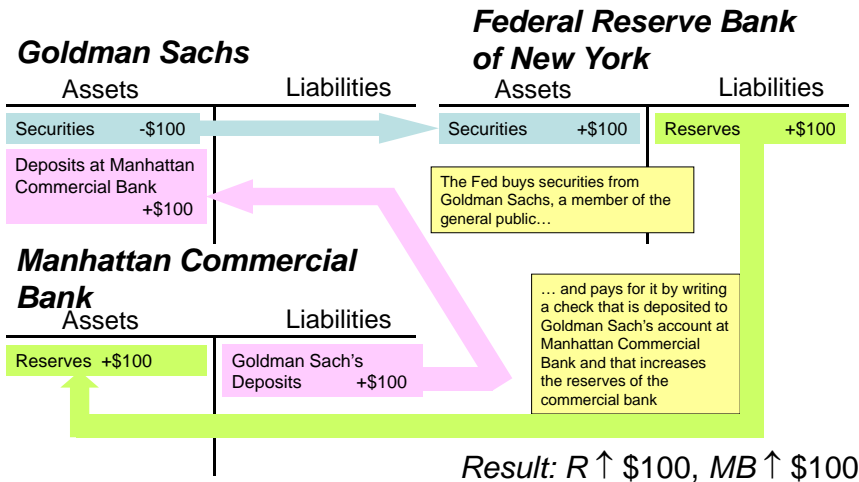
Open Market Purchase From a Bank:



Note: These lecture notes are incomplete without having attended lectures

Control of Monetary Base

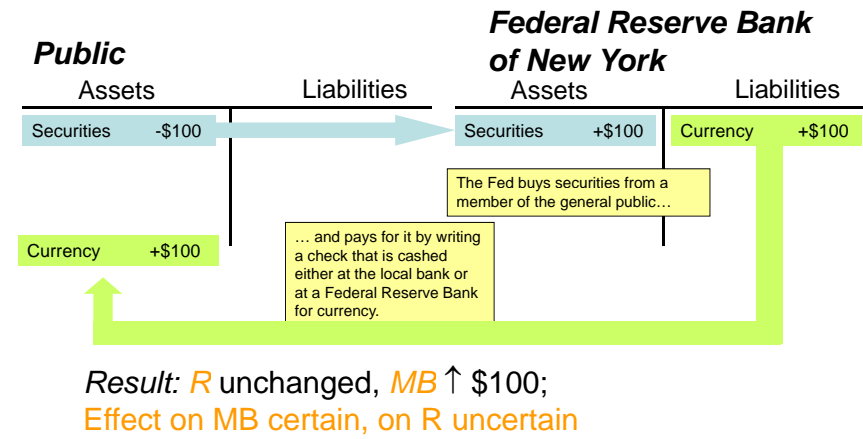
Open Market Purchase from Public



Note: These lecture notes are incomplete without having attended lectures

Control of Monetary Base

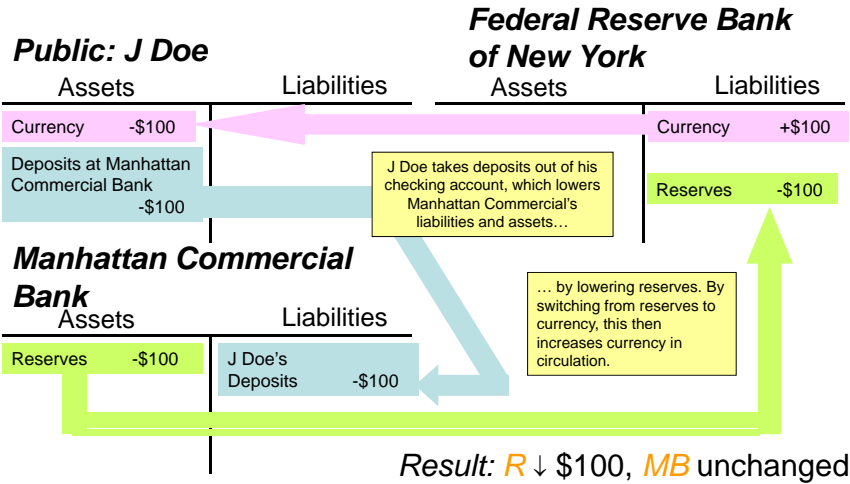
Open Market Purchase from Public: Cashing a Check



Note: These lecture notes are incomplete without having attended lectures

Control of Monetary Base

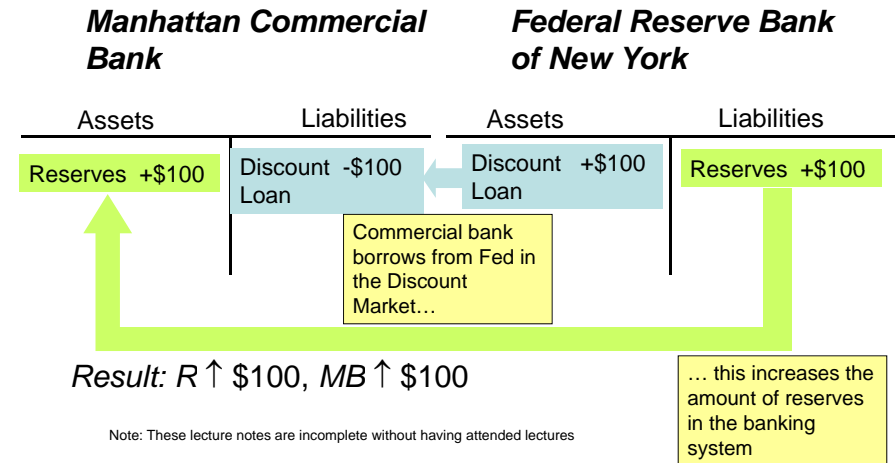
Shifts From Deposits into Currency



Note: These lecture notes are incomplete without having attended lectures

Control of Monetary Base

Discount Loans:



Note: These lecture notes are incomplete without having attended lectures

Conclusion...

Fed has a better ability to control monetary base (MB) than reserves (R)!

Note: These lecture notes are incomplete without having attended lectures

Bank Reserves, the Monetary Base, and the Money Multiplier

- The **money multiplier** is the amount by which a change in the monetary base is multiplied to calculate the final change in the money supply.
- An increase in currency held outside the banks is called a **currency drain**.
- Such a drain reduces the amount of banks' reserves, thereby decreasing the amount that banks can loan and reducing the money multiplier.

Note: These lecture notes are incomplete without having attended lectures

Controlling the Quantity of Money

- The **money multiplier** differs from the **deposit multiplier**.
- The **deposit multiplier** shows how much a change in reserves affects deposits.
- The **money multiplier** shows how much a change in the monetary base affects the money supply.

Note: These lecture notes are incomplete without having attended lectures

A Simpler Example...

- An Example of Deposit Creation!

Deposit Creation: Single Bank

Manhattan Commercial Bank:

Assets		Liabilities	
Securities	-\$100	Deposits	+\$100
Reserves	+\$100		
Loans	+\$100		

The diagram illustrates the flow of funds. A blue arrow points from the -\$100 in Securities to the +\$100 in Reserves. Another blue arrow points from the +\$100 in Reserves to the +\$100 in Loans. A green arrow points from the +\$100 in Loans to the +\$100 in Deposits, indicating that the loan creates a deposit.

Note: These lecture notes are incomplete without having attended lectures

Deposit Creation: Banking System

Fleet Bank			
Assets		Liabilities	
Reserves	+\$100	Deposits	+\$100

Fleet Bank			
Assets		Liabilities	
Reserves	+\$10	Deposits	+\$100
Loans	+\$90		

Bank One			
Assets		Liabilities	
Reserves	+\$90	Deposits	+\$90

Bank One			
Assets		Liabilities	
Reserves	+\$9	Deposits	+\$90
Loans	+\$81		

Note: These lecture notes are incomplete without having attended lectures

Deposit Creation

Creation of Deposits (assuming 10% Reserve Requirement and \$100 increase in reserves)

Bank	Increase in Deposits	Increase in Loans	Increase in Reserves
Manhattan Commercial	0.00	100.00	0.00
Fleet Bank	100.00	90.00	10.00
Bank One	90.00	81.00	9.00
Bank A	81.00	72.90	8.10
Bank B	72.90	65.61	7.29
Bank C	65.61	59.05	6.56
Bank D	59.05	53.14	5.91
.	.	.	.
.	.	.	.
.	.	.	.
Total For All Banks	1000.00	1000.00	100.00

Note: These lecture notes are incomplete without having attended lectures

Deposit Creation

If Fleet Bank buys securities with \$90 check

Fleet Bank			
Assets		Liabilities	
Reserves	+ \$10	Deposits	+ \$100
Securities	+ \$90		

Seller deposits \$90 at Bank One and process is same

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

Note: These lecture notes are incomplete without having attended lectures

Deposit Multiplier

Simple Deposit Multiplier

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

i.e. the change in reserves that arises is a multiple of the change in deposits.

Note: These lecture notes are incomplete without having attended lectures

Derivation of the Simple Deposit Multiplier

- Total Reserves = Required Reserves + Excess Reserves, i.e. $R = RR + ER$
- Assume that banks hold no excess reserves, i.e. $ER = 0$
- Then:

$$R = RR = r \times D$$

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

$$\Rightarrow \Delta D = \left(\frac{1}{r} \right) \times \Delta R$$

Note: These lecture notes are incomplete without having attended lectures

Deposit Creation: Banking System as a Whole

Banking System

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

Note: These lecture notes are incomplete without having attended lectures

Critique of Simple Model

From our simple model, deposit creation stops if:

1. Proceeds from loan kept in cash
2. Bank holds excess reserves

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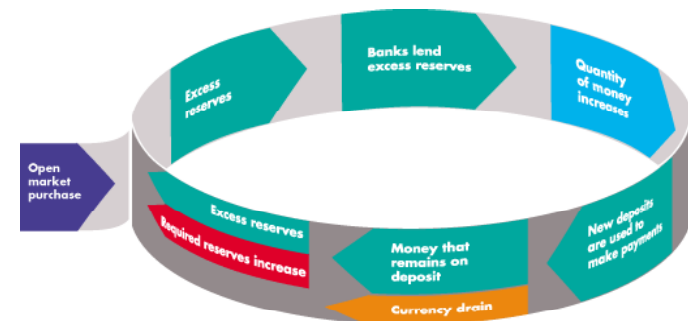
The Multiplier Effect of an Open Market Operation

- When the Fed conducts an open market operation, the ultimate change in the money supply is larger than the initiating open market operation.
- Banks use excess reserves from the open market operation to make loans so that the banks where the loans are deposited acquire excess reserves which they, in turn, then loan.

Note: These lecture notes are incomplete without having attended lectures

Controlling the Quantity of Money

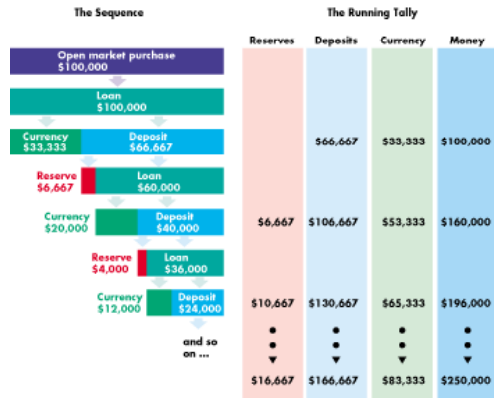
Figure 2 illustrates a round in the multiplier process following an open market operation.



Note: These lecture notes are incomplete without having attended lectures

Controlling the Quantity of Money

Figure 3 illustrates the multiplier effect of an open market operation.



Note: These lecture notes are incomplete without having attended lectures

Extending the model

What happens if:

- People convert loans to currency and hold cash? (Currency drain)
- Banks hold additional reserves beyond what they need to hold in the form of required reserves, i.e. they hold **excess reserves**.

Note: These lecture notes are incomplete without having attended lectures

Deriving The Money Multiplier

Money Multiplier:

$$M = m \times MB \quad ; \quad MB = \text{Monetary Base}$$

- Assume: ratio of currency to checkable deposits and ratio of excess reserves to checkable deposits are constant in equilibrium
i.e. $c = C/D$ and $e = ER/D$
- Implication: Desired level of currency and excess reserves grow proportionately with checkable deposits

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Deriving the Money Multiplier (cont.)

Examining the equation for reserves:

$$R = RR + ER \quad ; \quad R = \text{Reserves}, RR = \text{Required Reserves}$$

$$RR = r \times D \quad ; \quad D = \text{Deposits}$$

$$R = (r \times D) + ER \quad ; \quad ER = \text{Excess Reserves}$$

- Note: $r < 1$

Adding C to both sides

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

Note: These lecture notes are incomplete without having attended lectures

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

Equation above tells us three things:

1. Tells us amount of MB needed support D , ER and C
2. An increase of \$1 of MB in C , does not get multiplied, whilst those that go into supporting deposits (e.g. Reserves) does get multiplied.
3. An increase of \$1 of MB in ER , does not support D or C

$$\begin{aligned} MB &= (r \times D) + (e \times D) + (c \times D) \\ &= (r + e + c) \times D \end{aligned}$$

Note: These lecture notes are incomplete without having attended lectures

Deriving the Money Multiplier (cont.)

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

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

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

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

- Example: $r=0.2$, $M=\$1500$ billion, $C=\$500$ billion, $D=\$1000$ billion, $ER=\$1.2$ billion

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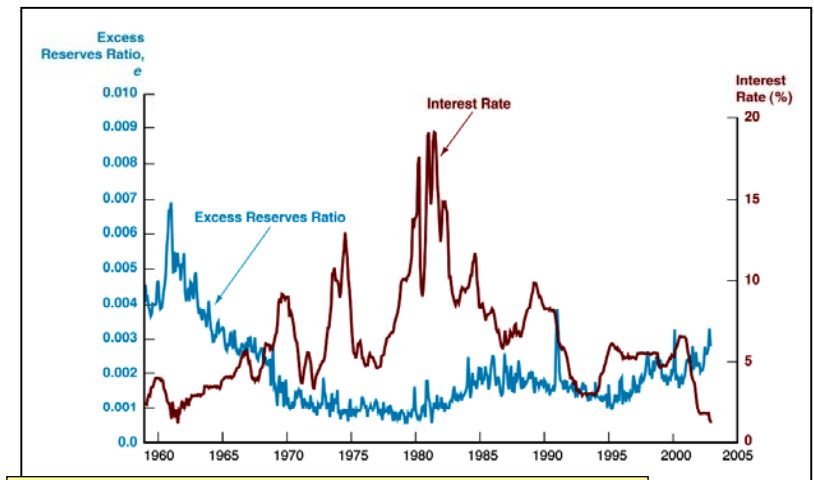
$$M = m \times MB = \frac{1+c}{r+e+c} \times MB$$

Note:

- $m < 1/r$ because no multiple expansion for currency and because as $D \uparrow$ $ER \uparrow$
- The money supply, M (and the money multiplier, m) is negatively related to
 - The required reserve ratio, r
 - The currency ratio, c
 - The excess reserve ratio, e
- The banking system's excess reserve ratio, e is negatively related to the market interest rate, i

Note: These lecture notes are incomplete without having attended lectures

Excess Reserves Ratio



Determinants of e

1. $i \uparrow$, relative R^e on $ER \downarrow$ (opportunity cost \uparrow), $e \downarrow$
2. Expected deposit outflows, ER insurance worth more, $e \uparrow$

Note: These lecture notes are incomplete without having attended lectures