

Chapter 10: The Money Supply and Federal Reserve System

Week 6

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The Money Supply and Federal Reserve System

Figure 1: Government: of the people, by the people and for the people



Learning Objectives

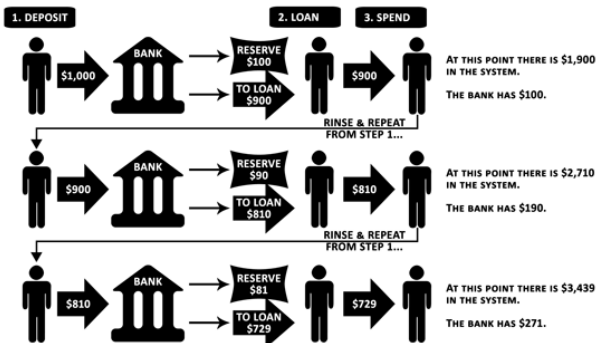
- Understanding the types and functions of Money.
(2012 Mid 2 *M1;M2;M3;M24*)
- Understanding the Creation of Commercial Bank Money and Money Multiplier effect through Fractional Banking System
(*PEQ6 Part 1 and 2* 2012 Mid 2 *M19;M20;M21;M25; E2*)
- Understanding the functions of the Federal Reserve and three tools it uses to control monetary supply. (*PEQ6 Part 3 and 4 ;2012 Final M58-62*)

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Fractional-reserve banking system

THE BASIC FRACTIONAL RESERVE BANKING CYCLE



[HTTP://CYNIC.ME](http://cynic.me)

Fractional-reserve banking system

There are two types of money in a fractional-reserve banking system operating with a central bank:

- (a) **Central Bank Money:** money created or adopted by the central bank regardless of its form – precious metals, commodity certificates, banknotes, coins, reserves of commercial banks(including bank notes and electronic money), or anything else the central bank chooses as its form of money. Reserves of commercial banks and currencies are M_0 or **Monetary Base**.
- (b) **Commercial Bank Money: demand deposits** in the commercial banking system (sometimes referred to as "checkbook money"). Demand deposits are claims against financial institutions that can be used for the purchase of goods and services. A demand deposit account is an account from which funds can be withdrawn at any time without giving the bank or financial institution any prior notice. (by checks or drafts, in person, ATM withdrawal etc), so its liquidity is about the same as **currency in circulation**. Demand Deposits are part of M_1 but not M_0 .

Fractional-reserve banking system

Figure 2: The Fed's Real Balance Sheet from 2007 to 2011

Federal Reserve Financial Statements

(US\$ billions)

Assets

	2011*	2010	2009	2008	2007
Loans to depository institutions	-	0.2	96.6	544.0	48.6
Treasury bills & GSE securities	1,768.7	1,219.9	973.3	502.2	745.6
Federal agency & GSE mortgage backed securities (MBS)	884.9	1,004.7	918.9	-	-
Central bank liquidity swaps	-	0.1	10.3	553.7	24.0
Investments held by consolidated variable interest entities	50.0	68.7	81.4	412.0	-
Others	163.4	134.2	154.5	233.8	96.6
	<u>2,867.0</u>	<u>2,427.8</u>	<u>2,235.0</u>	<u>2,245.7</u>	<u>914.8</u>

Liabilities & capital

Federal Reserve notes in circulation	998.2	941.6	887.8	853.2	791.7
Deposits					
Depository institutions	1,620.7	968.1	977.0	860.0	20.8
Treasury	16.1	340.7	191.6	365.4	16.1
Other liabilities	180.1	124.4	127.4	125.0	49.3
Total liabilities	<u>2,815.1</u>	<u>2,374.8</u>	<u>2,183.8</u>	<u>2,203.6</u>	<u>877.9</u>
Capital & surplus	51.9	53.0	51.2	42.1	36.9
	<u>2,867.0</u>	<u>2,427.8</u>	<u>2,235.0</u>	<u>2,245.7</u>	<u>914.8</u>

Fractional-reserve banking system

Let's see simplified version of the Fed's balance sheet by assuming Equities are zero because Equities do not affect our analysis.

Table 1: Simplified version of the Fed's Balance Sheet

ASSETS		LIABILITIES	
Securities	\$P	Reserves	\$X
Loans	\$Q	Currency	\$Y

Note: By accounting equation Assets = Liabilities so $P + Q = X + Y$
 Securities include: T-bills, T-bonds, Federal Agency or Mortgage-Backed Securities, repurchase agreement, etc.

Loans include: Seasonal Credits, Term Asset-Backed Securities Loan Facility, liquidity swaps, etc.

Currency: Bank notes (bills or paper money).

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Fractional-reserve banking system

Figure 3: A commercial Bank's Real Balance Sheet

ASSETS	NZ\$m	LIABILITIES	NZ\$m
Cash	201	Demand Deposits	25482
Balance with Central Bank	2809	Term Deposits and other borrowings	35231
Other Liquid Assets	1797	Due to Other Financial Institutions	3170
Due from other Financial Institutions	3563	Derivative financial instruments	4924
Trading Securities	1887	Payables and other liabilities	1351
Derivative financial instruments	4771	Provisions	165
Available for sale assets	48	Bonds and Notes	14607
Net loans and advances	87878	Related Party Funding	2775
Shares in controlled entities	206	[subordinated] Loan Capital	2062
Current Tax Assets	112	Total Liabilities	99084
Other assets	1045	Share Capital	5943
Deferred Tax Assets	11	[revaluation] Reserves	83
Premises and Equipment	232	Retained profits	2667
Goodwill and other intangibles	3297	Total Equity	8703
Total Assets	107787	Total Liabilities plus Net Worth	107787

Fractional-reserve banking system

Let's see simplified version of a commercial bank's balance sheet by assuming Equity is zero because Equity does not affect our analysis.

Table 2: Simplified version of Commercial Bank's Balance Sheet

ASSETS		LIABILITIES	
Reserves	\$X	Deposits	\$Z
Loans	\$Y		

Note: By accounting equation Assets = Liabilities so $X + Y = Z$

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Fractional-reserve banking system

Three steps for deposit multiplication to take effect

- 1 When a deposit of central bank money is made at a commercial bank, the central bank money is removed from circulation and added to the commercial banks' reserves.
- 2 Simultaneously, an equal amount of new commercial bank money is created in the form of bank deposits.
- 3 When a loan is made by the commercial bank (which keeps only a fraction of the central bank money as reserves), using the central bank money from the commercial bank's reserves, the M_1 money supply expands by the size of the loans.

Fractional-reserve banking system: Example

If Alice deposited five \$20 notes (\$100) in her commercial bank, then there are three cases when required reserve ratio is set at 10%

- (a) Assume all banks have loaned up their excess reserves, then money multiplier effect kicks in and a multiple of the initial amount of deposits is created in demand deposits through loans; *Balance Sheet Changes*.
For detailed information read Question 5 in Additional Reading 6.
- (b) Assume no bank has loaned up its excess reserve, then there is no multiplier effect. *Balance Sheet Changes*.
- (c) Assume only four banks (A B C D) have loaned up their excess reserves but E stopped loaning out excess reserves. *Balance Sheet Changes*.

Think about the accounting changes in the Fed and commercial banking system if someone borrows \$100 worth of loans from Bank A but holds cash on hand.

Fractional-reserve banking system: Example

Assuming **ALL** commercial banks have **loaned up** their reserves, the changes are recorded as

Table 3: The changes to the Fed and Commercial Banking system's Balance Sheet

the Federal Reserve			Commercial Banking System			
ASSETS		LIABILITIES	ASSETS			LIABILITIES
Securities	Reserves	\$X +\$100	Reserves	\$ X +\$100	Deposits	\$X+Y +\$1,000
Loans	Currency	-\$100	Loans	\$Y +\$900		

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Fractional-reserve banking system: Example

Assuming **NO** commercial bank has loaned its excess reserve, the changes are recorded as

Table 4: The changes to the Fed and Commercial Banking system's Balance Sheet

the Federal Reserve			Commercial Banking System			
ASSETS		LIABILITIES	ASSETS		LIABILITIES	
Securities	Reserves	\$X +\$ 100	Reserves	\$ X +\$ 100	Deposits	\$X+Y +\$ 100
Loans	Currency	-\$ 100	Loans	\$Y +\$ 0		

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Fractional-reserve banking system: Example

Assuming **Four** commercial banks have loaned up their excess reserves but the fifth bank stops loaning, the changes are recorded as

Table 5: The changes to the Fed and Commercial Banking system's Balance Sheet

the Federal Reserve			Commercial Banking System			
ASSETS	LIABILITIES		ASSETS	LIABILITIES		
Securities	Reserves	$\$X + \100	Reserves	$\$X + \100	Deposits	$\$X+Y + \409.51
Loans	Currency	$-\$100$	Loans	$\$Y + \309.51		

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Monetary Policy: History

- When gold was used as the main currency, the money supply can grow only if the supply of these metals is increased by mining.
- during periods of gold rushes and discoveries, the growth rate of money will accelerate such as when Columbus discovered the New World and brought back gold to Spain, or when gold was discovered in California in 1848. This causes inflation as the value of gold goes down.
- However, if the rate of gold mining cannot keep up with the growth of the economy, gold becomes relatively more valuable, and prices (denominated in gold) will drop, causing deflation. Deflation was the more typical situation for over a century when gold and paper money backed by gold were used as money in the 18th and 19th centuries.

Monetary Policy: Modern day

- Modern day monetary systems are based on **fiat money** and are no longer tied to the value of gold. The control of the amount of money in the economy is known as **monetary policy**.
- **Monetary policy** is the process by which a government, central bank, or monetary authority manages the money supply to achieve specific goals. Usually the goal of monetary policy is to promote "maximum employment, stable prices, and moderate long-term interest rates" that are written in Federal Reserve Act.
- A failed monetary policy can have significant detrimental effects on an economy and the society that depends on it. These include hyperinflation, stagflation, recession, high unemployment, shortages of imported goods, inability to export goods, and even total monetary collapse and the adoption of a much less efficient barter economy. This happened in Russia, for instance, after the fall of the Soviet Union.

Monetary Policy: Three Important Tools

- **Adjustment in Required Reserve Ratio:** Not often used by the central banks because it causes volatile changes in monetary supply due to the multiplier effect and it is ineffective in reducing the monetary supply because it is hard for the banks to unwind their loans in a short time. They can not increase their reserve balances until some of their loans mature. *PEQ6 Part 3*
- **Adjustment in Discount Rate:** Money supply can be changed by indirectly changing the nominal interest rate. In the US, this can be done by the Fed to change its **discount rate** and thus affect the incentives commercial banks have to borrow from the Fed. *PEQ6 Part 4*
- **Open Market Operation:** an activity by a central bank to buy or sell government bonds on the open market. They are the **primary means** of implementing monetary policy. The usual aim of open market operations is to manipulate the short term interest rate and the supply of base money in an economy, and thus indirectly control the total money supply. Normally, Buying(Selling) government securities $\Rightarrow M_1 \uparrow (\downarrow) \Rightarrow$ Lower(Higher) Nominal Interest Rate.

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1. The development of money as a medium of exchange has facilitated the expansion of trade because
- A holding money increases people's wealth.
 - B holding money increases people's income.
 - C money eliminates the "double coincidence of wants" problem.
 - D no other mediums of exchange are available.

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1. The development of money as a medium of exchange has facilitated the expansion of trade because
- A holding money increases people's wealth.
 - B holding money increases people's income.
 - C money eliminates the "double coincidence of wants" problem.**
 - D no other mediums of exchange are available.

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2. The main disadvantage of using money as a store of value is that
- A money is not portable.
 - B it requires a double coincidence of wants.
 - C currency is intrinsically worthless.
 - D the value of money actually falls when the prices of goods and services rise.

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- A money is not portable.
 - B it requires a double coincidence of wants.
 - C currency is intrinsically worthless.
 - D the value of money actually falls when the prices of goods and services rise.

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2012 Mid2 M3 Page 226

3. Which of the following is included in M2, but not included in M1?

- A Currency held outside banks.
- B Travelers checks.
- C Stocks and government bonds.
- D Money market accounts.

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3. Which of the following is included in M2, but not included in M1?

- A Currency held outside banks.
- B Travelers checks.
- C Stocks and government bonds.
- D Money market accounts.

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2012 Mid2 M19 Page 229

19. Suppose that the legal reserve requirement is 15%. If an initial deposit of 750 is made at one bank, and banks are able to loan out all excess reserves, what is the total amount of deposits in the banking system as a whole?

- A 4250.
- B 5000.
- C 6375.
- D 750.
- E 112.5.

$$\text{total deposits} = \text{intital deposit} \times \text{Money Multiplier} = 750 \times \frac{1}{15\%} = 5000$$

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2012 Mid2 M19 Page 229

19. Suppose that the legal reserve requirement is 15%. If an initial deposit of 750 is made at one bank, and banks are able to loan out all excess reserves, what is the total amount of deposits in the banking system as a whole?

- A 4250.
- B 5000.**
- C 6375.
- D 750.
- E 112.5.

$$\text{total deposits} = \text{intital deposit} \times \text{Money Multiplier} = 750 \times \frac{1}{15\%} = 5000$$

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2012 Mid2 M20 Page 229

20. Suppose that the Federal Reserve wishes to increase the money supply by 4 million, and the legal reserve requirement is 10%. What open market operation will accomplish this goal?

- A A purchase of 40 million in securities.
- B A purchase of 400,000 in securities.
- C A decrease of the discount rate to induce banks to borrow 500,000.
- D A sale of 400,000 in securities.
- E A decrease of the legal reserve requirement to 5%.

A purchase of 400,000 in securities would increase reserve balances(monetary base)by 400,000 and this would in turn translate into 4 million increase in Demand Deposit (part of M_1 money supply)

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A purchase of 400,000 in securities would increase reserve balances(monetary base)by 400,000 and this would in turn translate into 4 million increase in Demand Deposit (part of M_1 money supply)

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2012 Mid21 M21 Page 229

21. If the legal reserve ratio is decreased from 10% to 5%, the total amount of money created in the banking system by a deposit of 1000 will change by how much?

- A From 10,000 to 20,000, an increase of 10,000.
- B From 10,000 to 5,000, a decrease of 5,000.
- C From 100,000 to 200,000, an increase of 100,000.
- D From 10,000 to 50,000, and increase of 40,000.
- E From 5,000 to 15,000, an increase of 10,000.

The RRR is cut into half, then the total deposits have to be doubled from

$$\frac{1000}{10\%} = 10,000 \text{ to } \frac{1000}{5\%} = 20,000$$

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2012 Mid21 M21 Page 229

21. If the legal reserve ratio is decreased from 10% to 5%, the total amount of money created in the banking system by a deposit of 1000 will change by how much?

- A From 10,000 to 20,000, an increase of 10,000.
- B From 10,000 to 5,000, a decrease of 5,000.
- C From 100,000 to 200,000, an increase of 100,000.
- D From 10,000 to 50,000, and increase of 40,000.
- E From 5,000 to 15,000, an increase of 10,000.

The RRR is cut into half, then the total deposits have to be doubled from

$$\frac{1000}{10\%} = 10,000 \text{ to } \frac{1000}{5\%} = 20,000$$

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24. John transfers \$5,000 from his money market account to his checking account. This transaction will

- A increase both M1 and M2.
- B not change M1 and decrease M2.
- C increase M1 and not change M2.
- D increase M1 and decrease M2.
- E not change M1 and not change M2

It increases total deposits by $\frac{5000}{RRR}$ if all the banks loan up their excess reserves. The demand total deposits are part of M1 and of course part of M2 because M2 includes M1.

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24. John transfers \$5,000 from his money market account to his checking account. This transaction will

- A increase both M1 and M2.
- B not change M1 and decrease M2.
- C increase M1 and not change M2.
- D increase M1 and decrease M2.
- E not change M1 and not change M2

It increases total deposits by $\frac{5000}{RRR}$ if all the banks loan up their excess reserves. The demand total deposits are part of M1 and of course part of M2 because M2 includes M1.

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25. If the money multiplier is 4, the required reserve ratio is

- A 2.5%.
- B 20%.
- C 25%.
- D 40%.
- E Not enough information.

$$RRR = \frac{1}{\text{Money Multiplier}} = 25\%$$

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25. If the money multiplier is 4, the required reserve ratio is

A 2.5%.

B 20%.

C 25%.

D 40%.

E Not enough information.

$$RRR = \frac{1}{\text{Money Multiplier}} = 25\%$$

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1.[The Effect of an Increase in Deposits, Step by Step]

a. Table 1 below is partially filled in to show the T-account of Bank A immediately following a \$100,000 deposit by Prof. Petry. Assuming that the required reserve ratio is 10%, fill in the blanks, showing the required and excess reserves.

Table 6: Bank A's T-account after Professor Petry's deposit

ASSETS(D)		LIABILITIES(C)	
Total Reserves	\$100,000	Deposits	\$100,000
Required Reserves	\$10,000		
Excess Reserves	\$90,000		
Loans	\$0		

Note: **Total Reserve+Loans=Deposits**

Further, **Total Reserves=Required Reserves+Excess Reserves.**

Required Reserves = Total Reserves \times 10% = \$100,000 \times 10% = \$10,000

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b. Suppose that Bank A responds to Prof. Petry's deposit by making a loan as large as possible to your TA, taking into account the required reserve ratio. Fill in Table 2 below to represent the changes in Bank A's T-account after your TA has received his/her loan in cash.

Table 7: Bank A's T-account after loan to TA

ASSETS(D)		LIABILITIES(C)	
Total Reserves	\$10,000	Deposits	\$100,000
Required Reserves	\$10,000		
Excess Reserves	\$0		
Loans	\$90,000		

Note: **Total Reserve+Loans=Deposits**

Further, **Total Reserves=Required Reserves+Excess Reserves.**

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c. Your TA uses the money from the loan to buy a yacht, and the yacht dealer deposits this cash into Bank B. Suppose Bank B had no assets or liabilities before this deposit. Fill in Table 3 below to represent the changes in Bank B's T-account.

Table 8: Bank B's T-account after yacht dealer's deposit

ASSETS(D)		LIABILITIES(C)	
Total Reserves	\$90,000	Deposits	\$ 90,000
Required Reserves	\$ 9,000		
Excess Reserves	\$81,000		
Loans	\$0		

Note: **Total Reserve+Loans=Deposits**

Further, **Total Reserves=Required Reserves+Excess Reserves.**

Required Reserves = Total Reserves \times 10% = \$90,000 \times 10% = \$9,000

this point, by how much have total bank deposits increased?

100,000(A) + \$90,000(B) = 190,000.

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d. Suppose that Bank B makes as large a loan as it can to you. Fill in Table 4 below to represent the changes to Bank B's T-account after you have received your loan in cash.

Table 9: Bank B's T-account after your loan

ASSETS(D)		LIABILITIES(C)	
Total Reserves	\$9,000	Deposits	\$ 90,000
Required Reserves	\$9,000		
Excess Reserves	\$0		
Loans	\$81,000		

Note: **Total Reserve+Loans=Deposits**

Further, **Total Reserves=Required Reserves+Excess Reserves.**

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e. Suppose that you use the money from your loan to purchase a pet zebra from the San Diego Zoo, and the Zoo deposits this cash into Bank C. Suppose that Bank C has no assets or liabilities before this deposit. Fill in Table 5 below to represent the changes in Bank C's T-account.

Table 10: Bank C's T-account after San Diego Zoo's deposit

ASSETS(D)		LIABILITIES(C)	
Total Reserves	\$81,000	Deposits	\$ 81,000
Required Reserves	\$8,100		
Excess Reserves	\$72,900		
Loans	\$0		

Note: **Total Reserve+Loans=Deposits**

Further, **Total Reserves=Required Reserves+Excess Reserves.**

At this point, by how much have total bank deposits increased?

$$\text{\$100,000(A)} + \text{\$90,000(B)} + \text{\$81,000(C)} = \text{\$271,000.}$$

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f. Fill in the following sequence of deposits, starting with the initial increase in deposits at Bank A. As in the questions above, assume that each bank has no assets or liabilities before the deposit. Also, assume that each bank makes the largest possible loan.

- Increase in deposits at Bank A **\$100,000** (Petry's Initial Deposit \Rightarrow **Bank A**)
- Increase in deposits at Bank B **\$90,000** (**Bank A**' s loan \Rightarrow TA \Rightarrow Yacht Dealer \Rightarrow **Bank B**)
- Increase in deposits at Bank C **\$81,000** (**Bank B**' s loan \Rightarrow you \Rightarrow San Diego Zoo \Rightarrow **Bank C**)
- Increase in deposits at Bank D **\$72,900** (**Bank C**' s loan \Rightarrow ... \Rightarrow **Bank D**)
- Increase in deposits at Bank E **\$65,610** (**Bank D**' s loan \Rightarrow ... \Rightarrow **Bank E**)

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PEQ 6 Part 1 Page 172:Remark

- a Now we can see that the total increments in deposits are
 $100 + 100 \times 0.9 + 100 \times 0.9^2 + 100 \times 0.9^3 + 100 \times 0.9^4 = 409.51$ (Thousand Dollars).
- b If you sum up all the reserves from bank A through E, it has to equal the initial amount of deposit i.e. \$100,000.
 $100 \times 0.1 + 100 \times 0.9 \times 0.1 + 100 \times 0.9^2 \times 0.1 + 100 \times 0.9^3 \times 0.1 + 100 \times 0.9^4 \times 0.1 = 100$ (Thousand Dollars) Do this yourself at home and think about why.

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g. Notice that in part f, each increase in deposits in a bank is less than the increase in deposits at the previous bank, and that each deposit amount can be expressed as $(1 - 0.10) \times$ (the increase in deposits at the previous bank). Mathematically, this is an infinite geometric series with decreasing increments. If we repeated this loan and deposit process long enough, the total increase in bank deposits will approach a limit at $\$100,000 \times 1 \div 0.1$, or **\$1,000,000**. These questions exemplify the general principle that the multiplier for the total increase in deposits following an initial increase in bank reserves is $1 \div$ **Required Reserve Ratio** .

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Solution:. We denote Required Reserve Ratio as RRR then imagine there were an infinite number of banks like A,B,C,D,E, . . . in this economy and they have all loaned up their excess reserves.

Then the total increment in all the banks' deposits equals

$$\begin{aligned} \text{Initial Deposit} &\times (1 + (1 - RRR) + (1 - RRR)^2 + (1 - RRR)^3 + \dots) \\ &= \frac{\text{Initial Deposit}}{1 - (1 - RRR)} = \frac{\text{Initial Deposit}}{RRR} \end{aligned}$$

So, an initial deposit generates a multiple of this initial amount of money as deposits of banks which are part of *money* through banks' **fractional reserve banking behavior** regulated by the Federal Reserve.

PEQ 6 Part 2 Page 172

2. [The Effect of an Increase in Deposits on the Whole Banking System] Table 6 below is the T-account for the entire commercial bank system. Suppose that the banking system starts out with no assets or liabilities, and that the same reserve requirement ratio of 10% applies. Fill in the table to represent the T-account of the entire banking system following a \$100,000 deposit and the full money multiplier effect has occurred (i.e. the banking system is loaned up).

Table 11: The whole commercial banking system's combined Balance Sheet(RRR=10%)

ASSETS(D)		LIABILITIES(C)	
Total Reserves	\$100,000	Deposits	\$1,000,000
Required Reserves	\$0		
Excess Reserves	\$0		
Loans	\$900,000		

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3. [The Effect of a Change in the Required Reserve Ratio] Now, suppose that the Fed changes the required reserve ratio to 20%. Fill in Table 7 below to represent the T-account of the entire commercial banking system following this change in the required reserve ratio and the **full money multiplier effect has occurred.**

Table 12: The whole commercial banking system's combined Balance Sheet(RRR=20%)

ASSETS(D)		LIABILITIES(C)	
Total Reserves	\$100,000	Deposits	\$500,000
Required Reserves	\$0		
Excess Reserves	\$0		
Loans	\$400,000		

Note: Total Deposits are cut into one half compared to where RRR is 10% since the money multiplier is cut into one half after RRR is doubled.

The size of Balance sheet is contracted and money supply is decreased because deposit is part of M_1 . *Back*

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4. [The Effect of a Change in the Discount Rate] Instead of changing the required reserve ratio, suppose that the Fed decides to decrease the discount rate. Suppose that this decrease in the discount rate induces the commercial banks to borrow \$50,000 from the Fed. Table 8 shows the T-accounts for the Fed before the commercial banks have received their cash. Fill in Tables 9 and 10 to represent the changes in the Fed and commercial bank T-accounts, respectively, after the commercial banks have received their cash and the full money multiplier effect has occurred (i.e. the banking system is loaned up).

Table 13: The Fed's T-account before loan to the commercial bank

ASSETS		LIABILITIES	
Securities	\$200,000	Reserves	\$100,000
Loans	\$0	Currency	\$100,000

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Table 14: The Fed's T-account after loan to the commercial bank

ASSETS		LIABILITIES	
Securities	\$200,000	Reserves	\$100,000 +50,000
Loans	+\$50,000	Currency	\$100,000

The size of Balance sheet is expanded and money supply is increased because monetary base is relaxed

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Table 15: The whole commercial banking system's combined Balance Sheet(RRR=20%)

ASSETS			LIABILITIES	
Reserves	\$100,000	+\$50,000	Deposits	\$1,000,000 +\$500,000
Loans	\$1,000,000	+\$500,000	Loans owed to the Fed	\$0 +\$50,000

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How should I understand the increase in total loans by \$500,000 rather than \$450,000 =
 \$500,000(the increase in total deposits) – \$50,000(the increase in Reserves)
 You may argue that additional \$50,000 is used to balance the newly created liability account (owed to the Fed) on the right hand side. But it has deeper implications.

Table 16: The Balance Sheet of the commercial bank which borrows from The Fed

ASSETS			LIABILITIES		
Reserves	\$M	+\$50,000	Deposits		\$X
Loans		\$N	Loans owed to the Fed	\$Y	+\$50,000

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I claim that this commercial bank can loan out **ALL** of its newly added reserve balance by taking a loan from the Fed. The reason is that the loan owed to the Fed is different from the deposits owed to the public in the sense that loan to the Fed is not a **reservable** account because the Fed knows exactly when it wants to redeem its claim on this commercial bank's loan and does not need to require extra reserve against uncertain demand for payment like it did for those demand deposits. The loaned out \$50,000 start a new cycle of increasing demand deposits and loans which leads to the same story as in Part 1.

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Table 17: The Balance Sheet of the commercial bank which borrows from The Fed

ASSETS		LIABILITIES	
Reserves	\$M $+\$50,000 -\$50,000$	Deposits	\$X
Loans	\$N $+\$50,000$	Loans owed to the Fed	\$Y $+\$50,000$

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The Money Supply and Federal Reserve System

Refer to the following t-account that represents open market operation to answer questions 58-62. Panel one presents the initial state, panel two represents an intermediate state and panel three represents the final state.

Figure 4: Open Market Operation

Open Market Operations.

Panel 1

Federal Reserve		Commercial Banks		Jane Q. Public	
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
Securities \$100	\$20 Reserves \$80 Currency	Reserves \$20 Loans \$80	\$100 Deposits	Deposits \$5	\$0 Debts \$5 Net Worth

Money Supply = \$180

Panel 2

Federal Reserve		Commercial Banks		Jane Q. Public	
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
Securities \$95	\$15 Reserves \$80 Currency	Reserves \$15 Loans \$80	\$95 Deposits	Deposits \$0	\$0 Debts \$5 Net Worth

Money Supply = **SVV**

Panel 3

Federal Reserve		Commercial Banks		Jane Q. Public	
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
Securities YY	\$15 Reserves \$80 Currency	Reserves WW Loans \$60	XX Deposits	Deposits \$0	\$0 Debts \$5 Net Worth

Money Supply = \$155

The Money Supply and Federal Reserve System

- In panel 2 reserve balances of commercial banks at the Fed equal 15 which is less than 20 and the account of securities is also reduced by 5, this implies that the Fed sells some securities to the public as a means of contracting monetary base.

Thus, total monetary supply (VV) is $95 + 80 = 175$

- In panel 3, The reserve balances with the Fed(WW) the commercial banks hold are still 15 while the securities(YZ) the Fed holds is 95. However, when the money multiplier effect kicks in, commercial banks have to unwind 20 loans to make sure their remaining 15 reserves meet the required required ratio set by the Fed i.e. the minimum proportion of total assets the commercial banks have to hold as reserves against the demand deposits. In this case, $RRR = 20\%$ which can be calculated by looking at panel 1 $20/100 \times 100\% = 20\%$. So the total deposits(XX) are $15/20\% = 75$
- The securities(ZZ) the Jane Q. Public holds are obviously 5.