



# Financial market institutions

## 6. Creation of Money

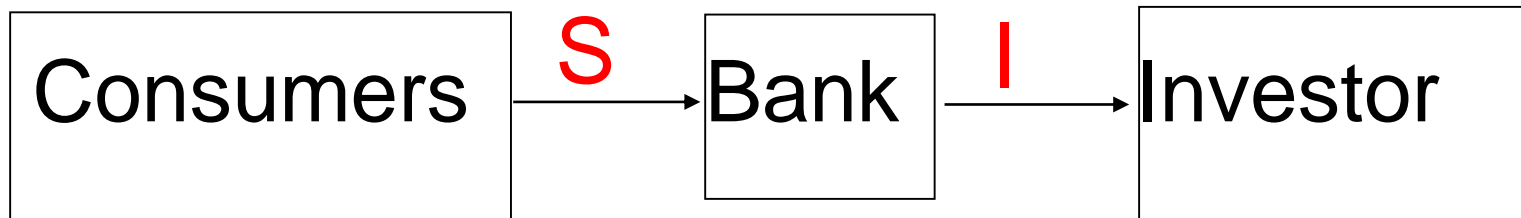


*Lecturer: Sayyora Abdirahimova*



# Outline

- In this chapter, we study the channel in circular flow diagram



- Money creation

# Money and Banking



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# Why we need money?

- Robinson-Crusoe Economy: autarky, do not need money
- Robinson + Friday: need exchange, **barter** economy
- Barter economy has a drawback: “*double coincidence of wants*”



# Why we need money?

- Introduce money  $\Rightarrow$  greases the wheel of exchange and make the whole economy more productive
- With money, market does not need to be “personal,” the extent of exchange is greatly increased



# The Functions of Money

- Money
  - Medium of exchange
    - Standard object - exchange goods & services
  - Unit of account
    - Standard unit – quoting prices
  - Store of value
    - Store wealth



# What serves as money?

- **Commodity** money – object
  - Used as medium of exchange
  - Substantial value in alternative uses



# What serves as money?

- Cattle: not divisible





# What serves as money?

- Micronesia Yap (Stone money): not divisible, not portable





# What serves as money?

- For a money, we need it
  - Divisible
  - Identical (uniform)
  - Storable and durable
  - Compact (easy to carry): high value per unit of volume or weight
  - Candidate: gold, silver, copper, ...



# What serves as money?

- Chinese coin





# What serves as money?

- Paper is even better...
- First paper money, 11<sup>th</sup> century in China
- Bank notes carried a guarantee that it could be traded at any time for coinage





# What serves as money?

- Money today: **Fiat money**
  - Decreed as money by government
  - Little value as commodity
  - Maintains value - medium of exchange because people have faith that the issuer will stand behind it





# How Quantity of Money is Measured

- Money supply **M1**
  - Narrowly defined
  - Coins and paper money in circulation (outside banks)
  - Traveler's checks
  - Conventional checking accounts
  - Certain other checkable deposits
    - Banks
    - Savings institutions

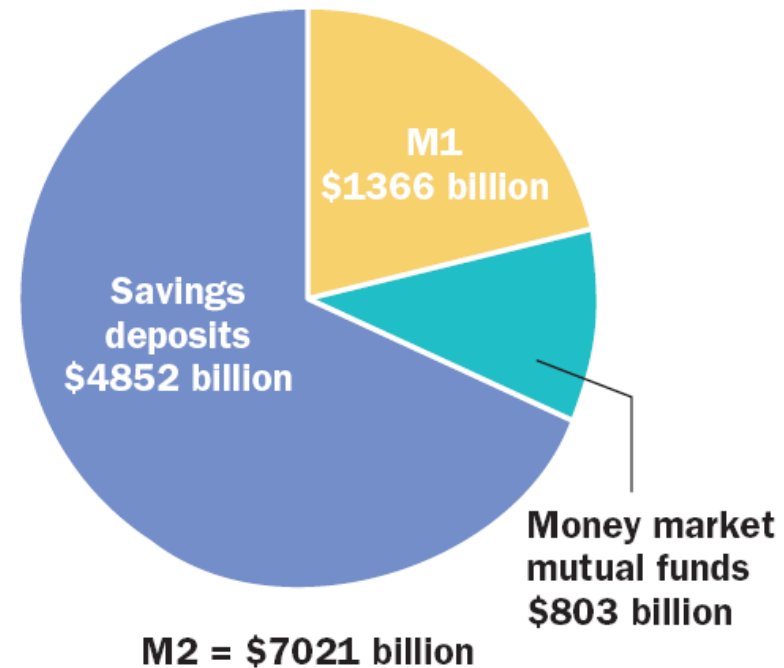
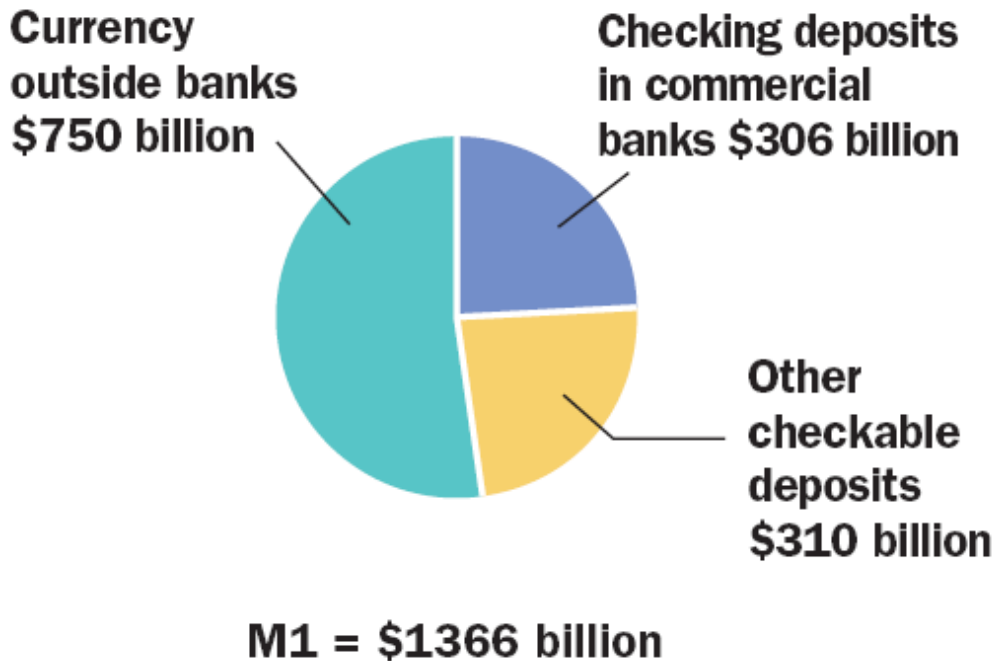


# How Quantity of Money is Measured

- Money supply **M2**
  - Broadly defined
  - M1
  - Money market deposit accounts
  - Money market mutual funds ( MMMFs )
  - Savings accounts
- **Near (Quasi) moneys**
  - Liquid assets
  - Close substitutes for money: CDs, T-bills, Euro-dollars, institutionally MMMFs

# Figure 2

## Two definitions of the money supply, December 2007





# How Quantity of Money is Measured

- Asset's liquidity
  - Ease – convert into cash
- Credit cards
  - Not included in money supply
- Convention: Money only includes
  - Coins
  - Paper money
  - Checkable deposits



# The Banking System

- Fractional reserve banking system
  - Bank keeps **reserves** only a **fraction** of deposits
  - Given depositors would not withdraw quite often
  - Features
    - Bank profitability
      - Banks earns the spread of interest rate
    - Bank discretion over money supply
      - Create money
    - Exposure to bank runs
      - Keep prudence and lend out money carefully



# Bank Run: American Union Bank, 1931



# Bank Run: Northern Rock, 2007





# Subprime Crisis and Bank Run

- 02/2007: Freddie Mac announces that it will stop buying subprime mortgages and related mortgage-backed securities
- 09/2007: Bank of England bails out Northern Rock (liquidity support); eventually Northern Rock is nationalized (February 2008)



# Subprime Crisis and Bank Run

- 06/2008: BOA takes over Countrywide Financial
- 07/2008: IndyMac fails
- 09/2008: Lehman Brothers fails; BOA purchases Merrill Lynch; Washington Mutual (WAMU) fails; JPMorgan Chase acquires WAMU's assets; Federal Reserve bails out AIG
- 10/2008: TARP is established



# Subprime Crisis and Bank Run

- 06/2009: GM files for bankruptcy



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# The Banking System

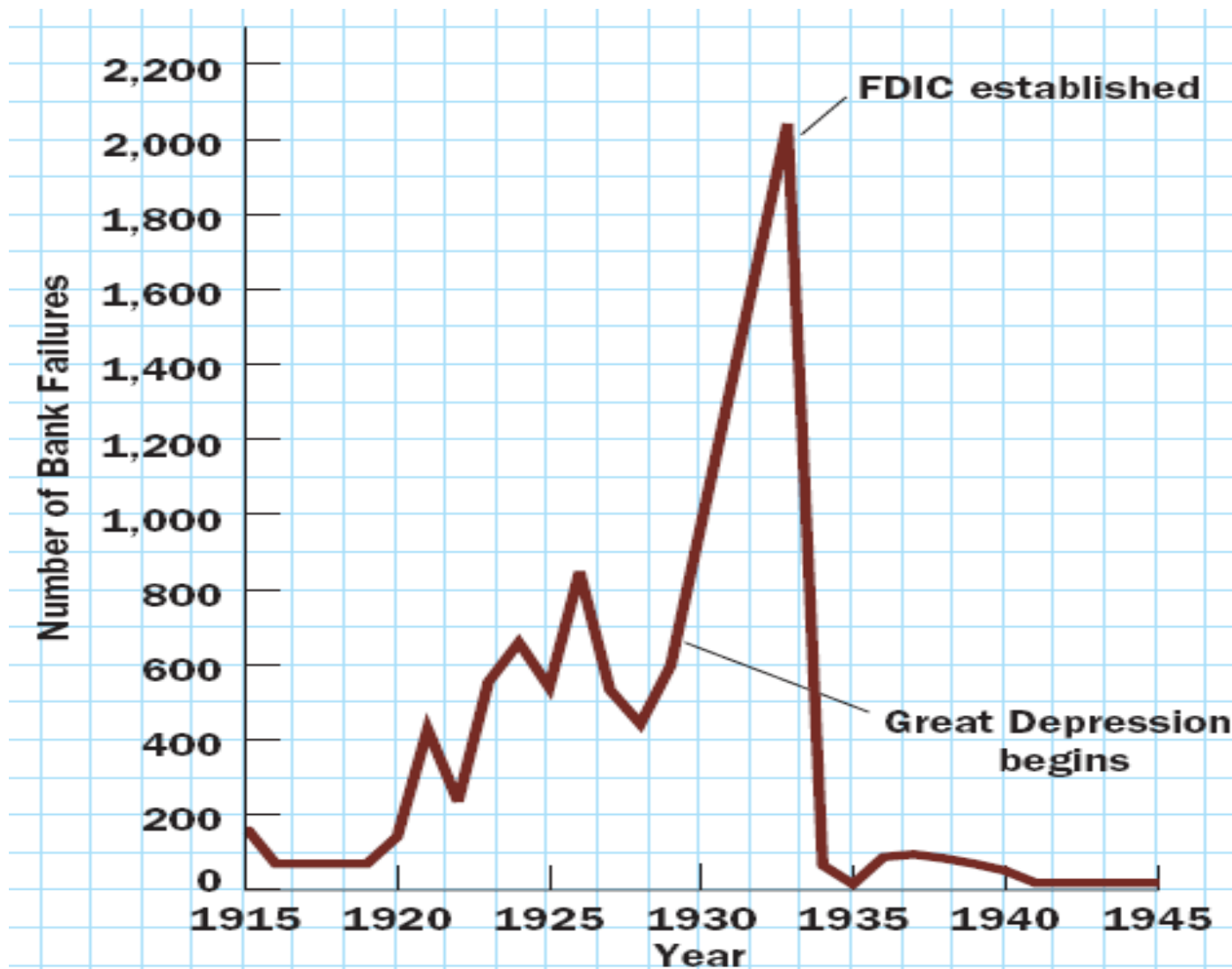
- Bankers - reputation for prudence
  - Checking deposits - pure fiat money
  - Sufficiently generous level of reserves
    - Minimize vulnerability to runs
  - Cautious - loans and investments
    - Large losses – undermine confidence
- Banking - inherently risky business
  - The art of bank management: trade-off between **profitability** and **safety**



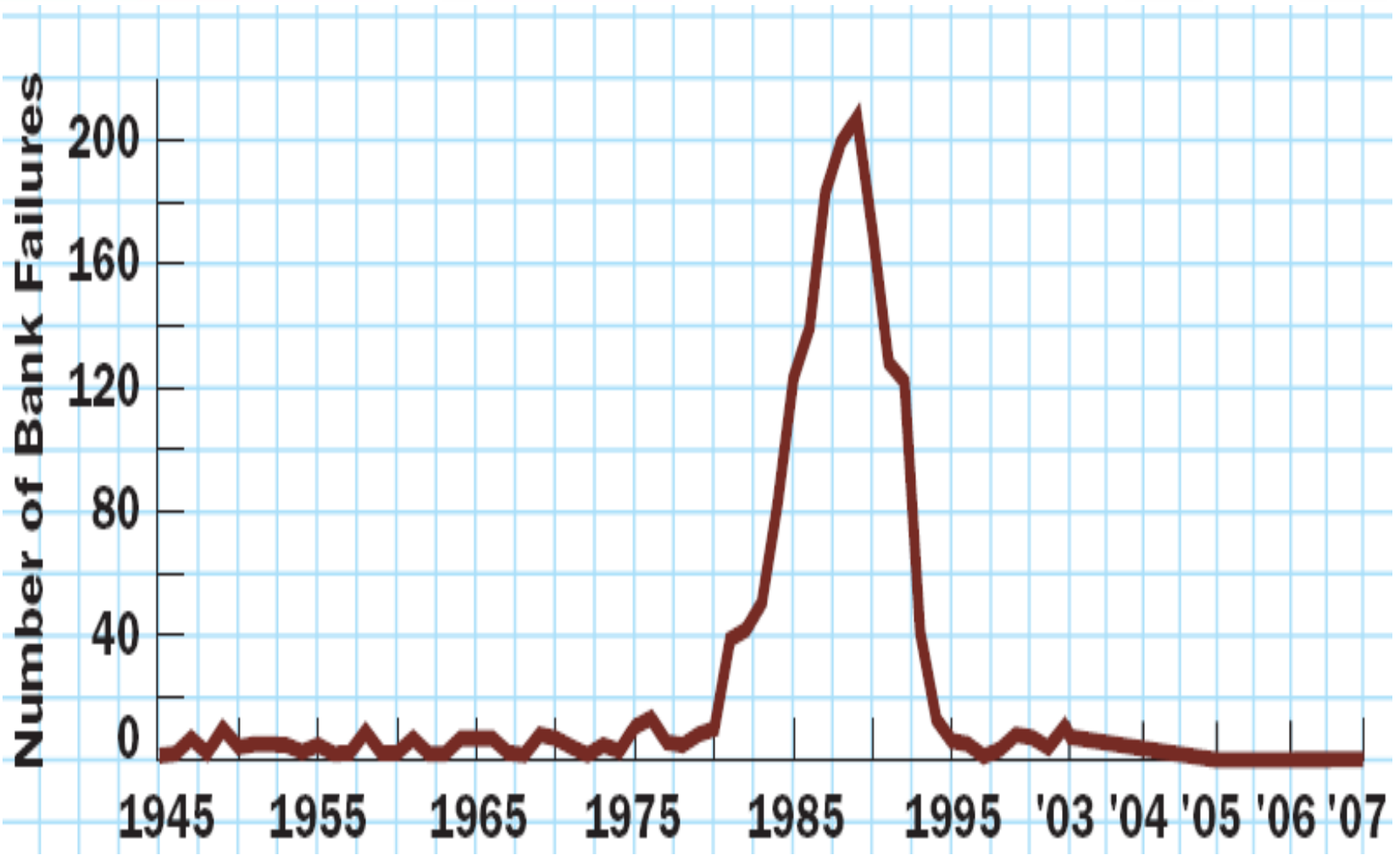
# The Banking System

- Bank regulations
  - Deposit insurance - guarantees deposits
    - Federal Deposit Insurance Corporation/ FDIC
    - **Moral hazard** problem
      - If insured against consequences of risk
      - Engage in riskier behavior
      - Example: **Savings and Loan (S&L) Crisis** in 1980s

# Bank failures in the United States, 1915–2007



# Bank failures in the United States, 1915–2007





# The Banking System

- Bank supervision - Bank examinations
  - Limit the kinds and quantities of assets banks can invest
- Reserve requirements
  - Minimum amount of reserves
    - Proportional to volume of deposits



# The Origins of the Money Supply

## T-account for a typical bank

- Asset - item of value owned
- Liability - item of value owed / debt
- Balance sheet - accounting statement
  - Left side: values of all assets
  - Right side: values of all liabilities & net worth
- Net worth = assets – liabilities
- **Assets = Liabilities + Net worth**

# Table 1

## Balance sheet of Bank-a-mythica, December 31, 2007

Assets		Liabilities and Net Worth	
<b>Assets</b>		<b>Liabilities</b>	
Reserves	\$1,000,000	Checking deposits	\$5,000,000
Loans outstanding	<u>\$4,500,000</u>		
Total	<b>\$5,500,000</b>	<b>Net Worth</b>	
<b>Addendum: Bank Reserves</b>		Stockholder's	<u>\$500,000</u>
Actual reserves	\$1,000,000	equity	<b>\$5,500,000</b>
Required reserves	<u>\$1,000,000</u>	Total	
Excess reserves	<b>0</b>		



# Banks and Money Creation

- Deposit creation – process
  - Fractional reserve banking system
  - Turns \$1 of bank reserves
  - Into several dollars of bank deposits
- Excess reserves
  - Reserves held in excess of legal minimum
  - Earn no interest

# Table 2

## Changes in Bank-a-mythica's balance sheet, January 2, 2008

Assets		Liabilities and Net Worth	
Reserves	+\$100,000	Checking deposits	+\$100,000
<b>Addendum: Changes in Reserves</b>			0
Actual reserves	+\$100,000		
Required reserves	<u>+\$ 20,000</u>		
Excess reserves	<b>+\$ 80,000</b>		



# Banks and Money Creation

- Multiple money creation
  - Initial deposit \$100,000
  - Increase reserves
    - Required reserves \$20,000
    - Excess reserves \$80,000
  - Extend more loans \$80,000
    - Increase deposits \$80,000
    - Increase reserves
      - Required reserves
      - Excess reserves
    - Extend more loans

# Table 3

## Changes in Bank-a-mythica's balance sheet, January 3–6, 2008

Assets		Liabilities and Net Worth
Loans outstanding	+\$80,000	No change
Reserves	-\$80,000	
<b>Addendum: Changes in Reserves</b>		
	-\$80,000	
Actual reserves	<u>No</u>	
Required reserves	<u>change</u>	
Excess reserves	<b>-\$80,000</b>	

# Table 4

## Changes in Bank-a-mythica's balance sheet, January 2–6, 2008

Assets		Liabilities and Net Worth	
Reserves	+\$20,000	Checking deposits	+\$100,000
Loans outstanding	+\$80,000		0
<b>Addendum: Changes in Reserves</b>			
	+\$20,000		
Actual reserves	<u>+\$20,000</u>		
Required reserves	<b>No</b>		
Excess reserves	<b>change</b>		

- Total increase in deposit =  $\$100,000 + \$80,000$   
=  $\$180,000$
- This is not the end though...



# Table 5

## Changes in First National Bank's balance sheet

Assets		Liabilities and Net Worth	
Reserves	+\$16,000	Checking deposits	+\$80,000
Loans outstanding	+\$64,000		
<b>Addendum: Changes in Reserves</b>			
	+\$16,000		
Actual reserves	<u>+\$16,000</u>		
Required reserves	<b>No</b>		
Excess reserves	<b>change</b>		



# Table 6

## Changes in Second National Bank's balance sheet

Assets		Liabilities and Net Worth	
Reserves	+\$12,800	Checking deposits	+\$64,000
Loans outstanding	+\$51,200		
<b>Addendum: Changes in Reserves</b>			
	+\$12,800		
Actual reserves	<u>+\$12,800</u>		
Required reserves	<b>No</b>		
Excess reserves	<b>change</b>		



# Banks and Money Creation

- Assumptions
  - Each bank
    - Holds exactly 20% required reserves
  - Each loan recipient
    - Redeposits proceeds - next bank
- Sum of infinite geometric progression

$$1 + R + R^2 + R^3 + \dots = \frac{1}{1 - R}$$

# Figure 3

## The chain of multiple deposit creation

		Running Sums		
		(1)	(2)	(3)
		Reserves	Deposits	Loans
\$100,000 deposit			\$100,000	
\$20,000 on reserve	\$80,000 lent out	\$20,000		\$80,000
\$80,000 deposit			\$180,000	
\$16,000 on reserve	\$64,000 lent out	\$36,000		\$144,000
\$64,000 deposit			\$244,000	
\$12,800 on reserve	\$51,200 lent out	\$48,800		\$195,200
\$51,200 deposit			\$295,200	
\$10,240 on reserve	\$40,960 lent out	\$59,040		\$236,160
\$40,960 deposit			\$336,160	
\$8,192 on reserve	\$32,768 lent out	\$67,232		\$268,928
And so on . . .				
		•	•	•
		•	•	•
		•	•	•
		\$100,000	\$500,000	\$400,000



# Banks and Money Creation

- Reserve ratio =  $m$  (=20% in the example)
  - $R=1-m$  is loan ratio (=80% in the example)
  - Deposits
    - Expand by  $1/m$  of each \$1 of new reserves
- Money multiplier
  - ratio of newly created bank deposits to new reserves
  - Change in money supply =  $(1/m) \times$  Change in reserves



# Money Multiplier

- Money multiplier  
=  $\Delta \text{deposit} / \Delta \text{reserve}$   
=  $1 / \text{legal reserve requirement (m)}$



# Banks and Money Creation

- Multiple contractions of money supply
  - Deposit destruction
  - Withdrawal \$100,000
  - Decrease reserves \$100,000
    - Need \$80,000 to meet reserve requirement
  - Outstanding loans – paid off \$80,000
    - Borrowers – withdrawal \$80,000
    - Decrease reserves
    - Loans – paid off

# Table 7

## Changes in the balance sheet of Bank-a-mythica

(a)

Assets		Liabilities and Net Worth	
Reserves	-\$100,000	Checking deposits	- \$100,000
<b>Addendum: Changes in Reserves</b>	-\$100,000		
Actual reserves	<u>-\$20,000</u>		
Required reserves	<b>-\$80,000</b>		
Excess reserves			

(b)

Assets		Liabilities and Net Worth	
Reserves	+\$80,000	No change	
Loans outstanding	-\$80,000		
<b>Addendum: Changes in Reserves</b>			
Actual reserves	+\$80,000		
Required reserves	<u>No change</u>		
Excess reserves	<b>+\$80,000</b>		

# Table 8

## Changes in the balance sheet of First National Bank

(a)

Assets		Liabilities and Net Worth	
Reserves	-\$80,000	Checking deposits	-\$80,000
<b>Addendum: Changes in Reserves</b>			
	-\$80,000		
Actual reserves	<u>-\$16,000</u>		
Required reserves	<b>-\$64,000</b>		
Excess reserves			

(b)

Assets		Liabilities and Net Worth	
Reserves	+\$64,000	No change	
Loans outstanding	-\$64,000		
<b>Addendum: Changes in Reserves</b>			
	+\$64,000		
Actual reserves	<u>No change</u>		
Required reserves	<b>+\$64,000</b>		
Excess reserves			



# Contractions of Money Supply

- Reverse of money creation ends up
  - Deposit shrinks by \$500,000
    - Loan falls by \$400,000
    - Bank reserve decreases by \$100,000
  - Money supply (M1) falls by \$400,000
- This is why the several bank runs can trigger such a huge financial crisis and spill over to the main street

# Money-Creation Formula Is Oversimplified

- Oversimplified money multiplier
  - Accurate - very particular circumstances:
    1. Every recipient of cash
      - Must redeposit cash - another bank
      - Doesn't hold cash
    2. Every bank
      - Must hold reserves - legal minimum



# Money-Creation Formula Is Oversimplified

- If individuals & business firms
  - Hold more cash
  - Limited
    - Multiple expansion of bank deposits
  - Fewer dollars of cash
    - Available for use as reserves
  - Smaller money supply



# Money-Creation Formula Is Oversimplified

- If banks
  - Keep excess reserves
  - Limited
    - Multiple expansion of bank deposits
  - Smaller supply of money



# The Need for Monetary Policy

- During a recession
  - Banks - reduce money supply
    - Increase excess reserves
    - Decrease lending
      - Less creditworthy applicants
  - Aggravate recession
  - Milton Friedman believed this is the cause of Great Depression
  - Need government intervention



# The Need for Monetary Policy

- During an economic boom
  - Banks – expand money supply
  - Undesirable momentum to economy
    - Inflation
  - Need government intervention



# Summary

- Money: origin, function, measurement
- Fractional reserve banking system
- Bank Regulations
- Money creation and money multiplier
- Need for monetary policy



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