

# CHAPTER 18

## Money Supply and Money Demand

MACROECONOMICS SIXTH EDITION

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PowerPoint® Slides by Ron Cronovich

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# In this chapter, you will learn...

- how the banking system “creates” money
- three ways the Fed can control the money supply, and why the Fed can’t control it precisely
- Theories of money demand
  - a portfolio theory
  - a transactions theory: the Baumol-Tobin model



# 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.



# 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.



## SCENARIO 1: No banks

With no banks,

$$D = 0 \quad \text{and} \quad M = C = \$1000.$$



## SCENARIO 2: 100-percent reserve banking

- Initially  $C = \$1000$ ,  $D = \$0$ ,  $M = \$1,000$ .
- Now suppose households deposit the \$1,000 at “Firstbank.”

### FIRSTBANK'S balance sheet

Assets	Liabilities
reserves \$1,000	deposits \$1,000

- After the deposit,  
 $C = \$0$ ,  
 $D = \$1,000$ ,  
 $M = \$1,000$ .
- 100%-reserve banking has no impact on size of money supply.



## SCENARIO 3: Fractional-reserve banking

- Suppose banks hold 20% of deposits in reserve, making loans with the rest.
- Firstbank will make \$800 in loans.

### FIRSTBANK'S balance sheet

Assets	Liabilities
reserves \$200	deposits \$1,000
loans \$800	

The money supply now equals \$1,800:

- Depositor has \$1,000 in demand deposits.
- Borrower holds \$800 in currency.



## SCENARIO 3: Fractional-reserve banking

*Thus, in a fractional-reserve banking system, banks create money.*

### FIRSTBANK'S balance sheet

Assets	Liabilities
reserves \$200	deposits \$1,000
loans \$800	

The money supply now equals \$1,800:

- Depositor has \$1,000 in demand deposits.
- Borrower holds \$800 in currency.



## SCENARIO 3: Fractional-reserve banking

- Suppose the borrower deposits the \$800 in Secondbank.
- Initially, Secondbank's balance sheet is:

### SECONDBANK'S balance sheet

Assets		Liabilities	
reserves	\$160	deposits	\$800
loans	\$640		

- Secondbank will loan 80% of this deposit.



## SCENARIO 3: Fractional-reserve banking

- If this \$640 is eventually deposited in Thirdbank,
- then Thirdbank will keep 20% of it in reserve, and loan the rest out:

### THIRDBANK'S balance sheet

Assets	Liabilities
reserves \$128	deposits \$640
loans \$512	



## Finding the total amount of money:

	Original deposit	= \$1000
+	Firstbank lending	= \$ 800
+	Secondbank lending	= \$ 640
+	Thirdbank lending	= \$ 512
+	other lending...	

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Total money supply =  $(1/rr) \times \$1,000$

where  $rr$  = ratio of reserves to deposits

In our example,  $rr = 0.2$ , so  $M = \$5,000$



# Money creation in the banking system

*A fractional reserve banking system creates money, but it doesn't create wealth:*

*Bank loans give borrowers some new money and an equal amount of new debt.*



# A model of the money supply

## exogenous variables

- **Monetary base**,  $B = C + R$   
*controlled by the central bank*
- **Reserve-deposit ratio**,  $rr = R/D$   
*depends on regulations & bank policies*
- **Currency-deposit ratio**,  $cr = C/D$   
*depends on households' preferences*



# Solving for the money supply:

$$M = C + D = \frac{C + D}{B} \times B = m \times B$$

where

$$m = \frac{C + D}{B}$$

$$= \frac{C + D}{C + R} = \frac{(C/D) + (D/D)}{(C/D) + (R/D)} = \frac{cr + 1}{cr + rr}$$



# The money multiplier

$$M = m \times B, \quad \text{where } m = \frac{cr + 1}{cr + rr}$$

- If  $rr < 1$ , then  $m > 1$
- If monetary base changes by  $\Delta B$ , then  $\Delta M = m \times \Delta B$
- $m$  is the **money multiplier**, the increase in the money supply resulting from a one-dollar increase in the monetary base.



## Exercise

$$M = m \times B, \quad \text{where } m = \frac{cr + 1}{cr + rr}$$

Suppose households decide to hold more of their money as currency and less in the form of demand deposits.

1. Determine impact on money supply.
2. Explain the intuition for your result.



## Solution to exercise

Impact of an increase in the currency-deposit ratio  
 $\Delta cr > 0$ .

1. An increase in  $cr$  increases the denominator of  $m$  proportionally more than the numerator. So  $m$  falls, causing  $M$  to fall.
2. If households deposit less of their money, then banks can't make as many loans, so the banking system won't be able to "create" as much money.



# Three instruments of monetary policy

1. Open-market operations
2. Reserve requirements
3. The discount rate



# Open-market operations

- *definition:*

The purchase or sale of government bonds by the Federal Reserve.

- *how it works:*

If Fed buys bonds from the public, it pays with new dollars, increasing ***B*** and therefore ***M***.



# Reserve requirements

- *definition:*  
Fed regulations that require banks to hold a minimum reserve-deposit ratio.
- *how it works:*  
Reserve requirements affect *rr* and *m*:  
If Fed reduces reserve requirements, then banks can make more loans and “create” more money from each deposit.



# The discount rate

- *definition:*

The interest rate that the Fed charges on loans it makes to banks.

- *how it works:*

When banks borrow from the Fed, their reserves increase, allowing them to make more loans and “create” more money.

The Fed can increase ***B*** by lowering the discount rate to induce banks to borrow more reserves from the Fed.



# Which instrument is used most often?

- Open-market operations:  
most frequently used.
- Changes in reserve requirements:  
least frequently used.
- Changes in the discount rate:  
largely symbolic.  
The Fed is a “lender of last resort,”  
does not usually make loans to banks  
on demand.



# Why the Fed can't precisely control $M$

$$M = m \times B, \quad \text{where} \quad m = \frac{cr + 1}{cr + rr}$$

- Households can change  $cr$ , causing  $m$  and  $M$  to change.
- Banks often hold **excess reserves** (reserves above the reserve requirement). If banks change their excess reserves, then  $rr$ ,  $m$ , and  $M$  change.



## **CASE STUDY:** **Bank failures in the 1930s**

- From 1929 to 1933,
  - Over 9,000 banks closed.
  - Money supply fell 28%.
- This drop in the money supply may have caused the Great Depression.

It certainly contributed to the severity of the Depression.



## CASE STUDY: Bank failures in the 1930s

$$M = m \times B, \quad \text{where } m = \frac{cr + 1}{cr + rr}$$

- Loss of confidence in banks  
 $\Rightarrow \uparrow cr \Rightarrow \downarrow m$
- Banks became more cautious  
 $\Rightarrow \uparrow rr \Rightarrow \downarrow m$



## CASE STUDY: Bank failures in the 1930s

	<i>August 1929</i>	<i>March 1933</i>	<i>% change</i>
<b><i>M</i></b>	26.5	19.0	-28.3%
<b><i>C</i></b>	3.9	5.5	41.0
<b><i>D</i></b>	22.6	13.5	-40.3
<b><i>B</i></b>	7.1	8.4	18.3
<b><i>C</i></b>	3.9	5.5	41.0
<b><i>R</i></b>	3.2	2.9	-9.4
<b><i>m</i></b>	3.7	2.3	-37.8
<b><i>rr</i></b>	0.14	0.21	50.0
<b><i>cr</i></b>	0.17	0.41	141.2



# Could this happen again?

- Many policies have been implemented since the 1930s to prevent such widespread bank failures.
- *E.g.*, Federal Deposit Insurance, to prevent bank runs and large swings in the currency-deposit ratio.



# Money Demand

## Two types of theories

- Portfolio theories
  - emphasize “store of value” function
  - relevant for  $M2$ ,  $M3$
  - not relevant for  $M1$ . (As a store of value,  $M1$  is dominated by other assets.)
- Transactions theories
  - emphasize “medium of exchange” function
  - also relevant for  $M1$



# A simple portfolio theory

$$(M/P)^d = L(r_s, r_b, \pi^e, W),$$

-            -            -            +

where

$r_s$  = expected real return on stocks

$r_b$  = expected real return on bonds

$\pi^e$  = expected inflation rate

$W$  = real wealth

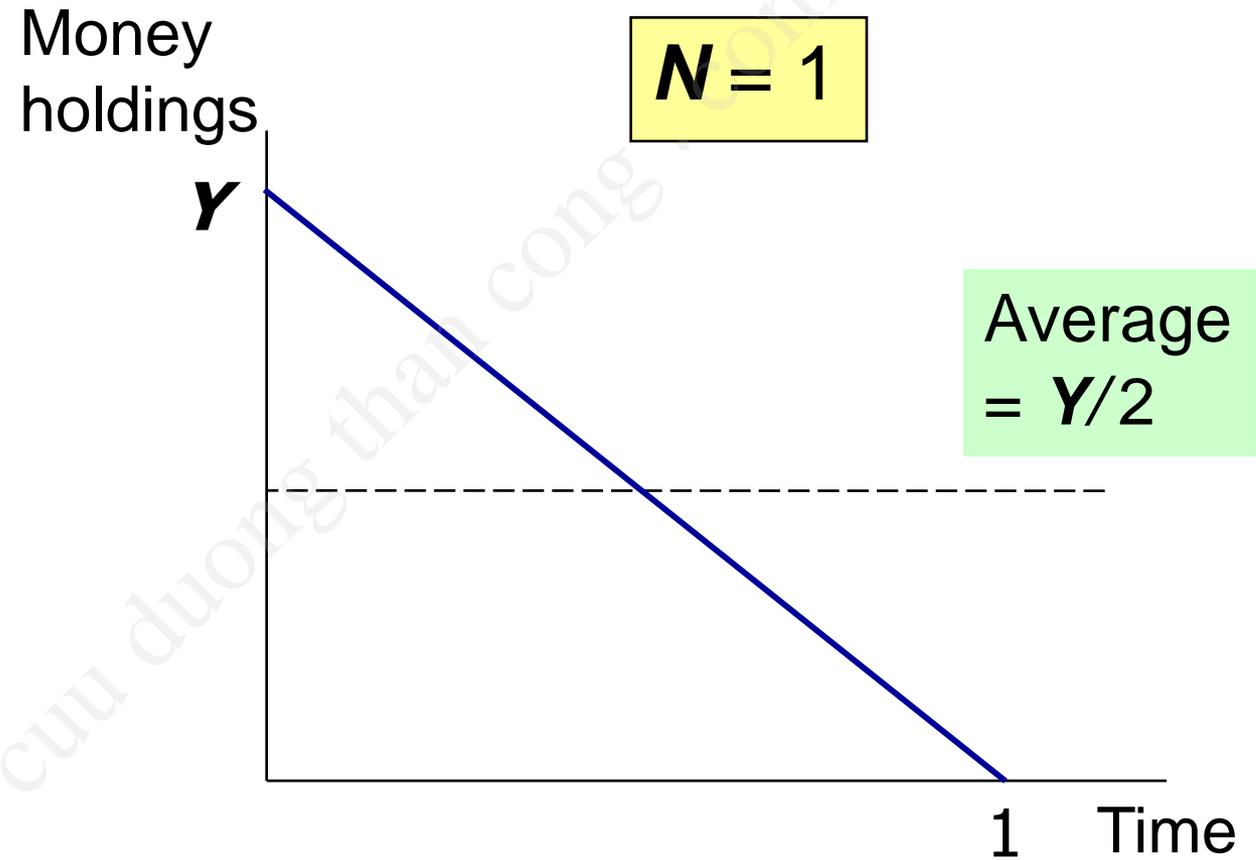


# The Baumol-Tobin Model

- a transactions theory of money demand
- notation:
  - $Y$  = total spending, done gradually over the year
  - $i$  = interest rate on savings account
  - $N$  = number of trips consumer makes to the bank to withdraw money from savings account
  - $F$  = cost of a trip to the bank  
(e.g., if a trip takes 15 minutes and consumer's wage = \$12/hour, then  $F = \$3$ )

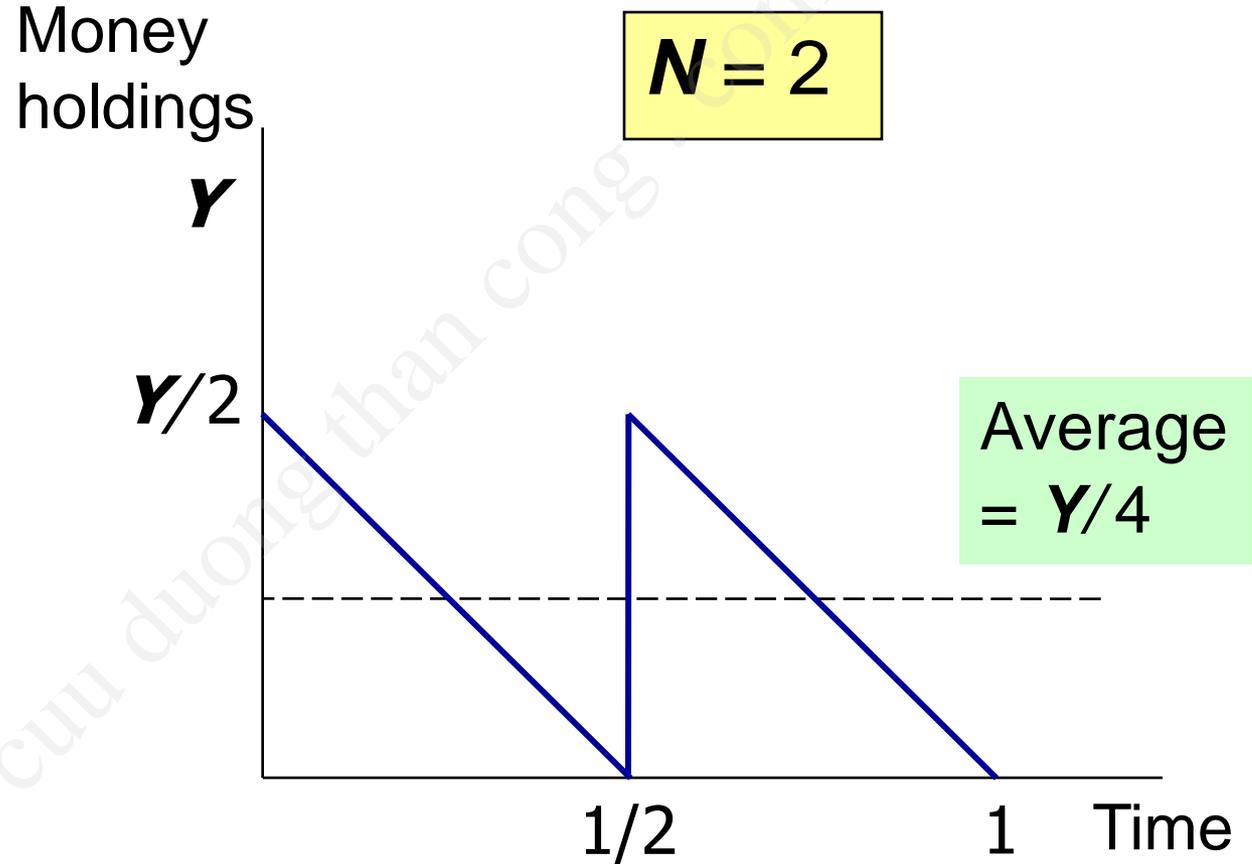


# Money holdings over the year



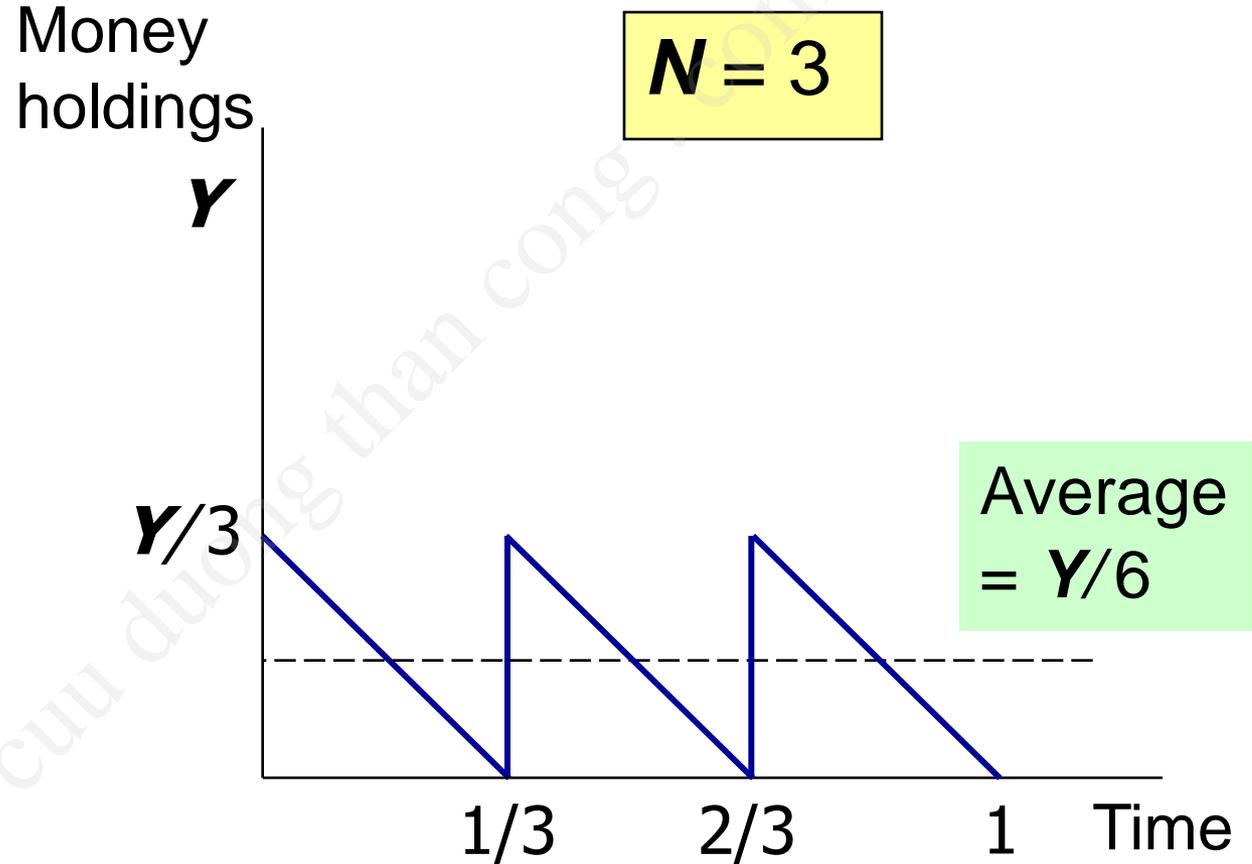


# Money holdings over the year





# Money holdings over the year





# The cost of holding money

- In general, average money holdings =  $Y/2N$
- Foregone interest =  $i \times (Y/2N)$
- Cost of  $N$  trips to bank =  $F \times N$

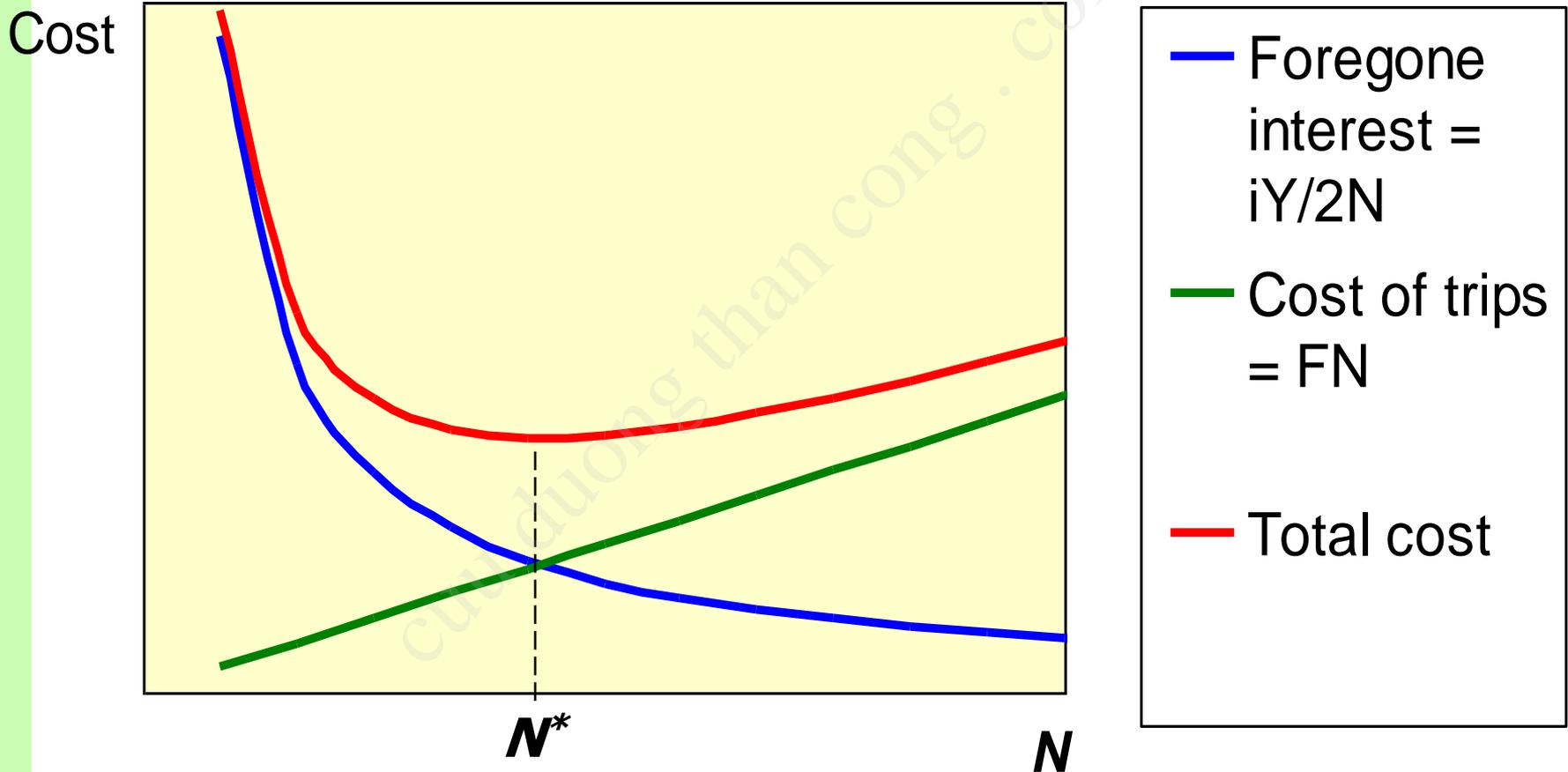
- Thus,

$$\text{total cost} = i \times \frac{Y}{2N} + F \times N$$

- Given  $Y$ ,  $i$ , and  $F$ ,  
consumer chooses  $N$  to minimize total cost



# Finding the cost-minimizing $N$





# The money demand function

- The cost-minimizing value of  $N$ :  $N^* = \sqrt{\frac{iY}{2F}}$
- To obtain the money demand function, plug  $N^*$  into the expression for average money holdings:

$$\text{average money holding} = \sqrt{\frac{YF}{2i}}$$

- Money demand depends positively on  $Y$  and  $F$ , and negatively on  $i$ .



# The money demand function

- The Baumol-Tobin money demand function:

$$(M/P)^d = \sqrt{\frac{YF}{2i}} = L(i, Y, F)$$

How this money demand function differs from previous chapters:

- B-T shows how  $F$  affects money demand.
- B-T implies:  
income elasticity of money demand = 0.5,  
interest rate elasticity of money demand =  $-0.5$



## EXERCISE:

# The impact of ATMs on money demand



During the 1980s, automatic teller machines became widely available.

How do you think this affected  $N^*$  and money demand? Explain.



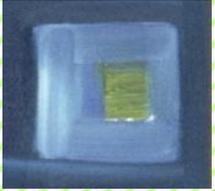
# Financial Innovation, Near Money, and the Demise of the Monetary Aggregates

- Examples of financial innovation:
  - many checking accounts now pay interest
  - very easy to buy and sell assets
  - mutual funds are baskets of stocks that are easy to redeem - just write a check
- Non-monetary assets having some of the liquidity of money are called near money.
- Money & near money are close substitutes, and switching from one to the other is easy.



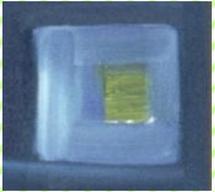
# Financial Innovation, Near Money, and the Demise of the Monetary Aggregates

- The rise of near money makes money demand less stable and complicates monetary policy.
- 1993: the Fed switched from targeting monetary aggregates to targeting the Federal Funds rate.
- This change may help explain why the U.S. economy was so stable during the rest of the 1990s.



# Chapter Summary

1. Fractional reserve banking creates money because each dollar of reserves generates many dollars of demand deposits.
2. The money supply depends on the
  - monetary base
  - currency-deposit ratio
  - reserve ratio
3. The Fed can control the money supply with
  - open market operations
  - the reserve requirement
  - the discount rate



# Chapter Summary

4. Portfolio theories of money demand
  - stress the store of value function
  - posit that money demand depends on risk/return of money & alternative assets
  
5. The Baumol-Tobin model
  - a transactions theory of money demand, stresses “medium of exchange” function
  - money demand depends positively on spending, negatively on the interest rate, and positively on the cost of converting non-monetary assets to money