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# **Fed Policy and Money Markets**

# Outline

- How the banking system works?
- What is the Fed and how does it work?
- What is a monetary policy?
- What about the current credit crunch?

# Money Supply

- We have mentioned before that money supply is affected by:
  1. The **Central Bank** (the Federal Reserve System in the United States) is the government institution responsible for monetary policies
  2. **Depository Institutions** (Banks) are privately owned banks and thrift institutions that accept deposits from and make loans directly to the public
  3. The **public** includes every person or firm (except banks) that holds money in currency or deposits.

# The Banking System: An Introduction

Bank Assets and Liabilities:

**Assets:** Loans (TL) + Reserves (TR)

**Liabilities:** Deposits (TD).

**Reserves** = liquid assets held by the bank to meet the demand for withdrawals by depositors or to pay checks

How do banks make money? They Lend.

How much do they lend? Must keep a minimum amount of reserves (**required by law**).

# The Banking System: An Introduction

- **Fractional reserve banking:** banks hold only a fraction of their deposits in reserve.
- **Reserve-deposit ratio** = required reserves/deposits = **m**
- Fractional reserve banking  $\rightarrow m < 1$  (100% reserve banking  $\rightarrow m = 1$ )
- **Assume banks lend all they can:  $TR = m * TD$ ,**
- **$TD = TL + TR$**  (money held within the banking system)

$$\Delta TD = \Delta TL + \Delta TR$$

# The Banking System: An Example

Suppose I put \$500 in the bank (remove it from under my mattress).

We call the \$500 that starts the process the 'Initial Deposit' (ID)

\*\*\* Suppose that no one else in the economy holds cash.

\*\*\* Suppose banks lend to their limit.

Suppose that  $m = 0.1$ .

What happens in the banking system (assume nobody wants to hold currency):

Step 1: Deposits increase by \$500 (initial deposit).

Step 2: Then, Deposits increase by another \$450.

Step 3: Then, Deposits increase by another \$405.

Step 4: .....(keep increasing)

Step infinity: .....(keep increasing)

Why do deposits keep increasing? LOANS!!!!

# The Banking System: An Example

**Step 1:**

**Assets**  
**TR \$ 500**

**Liabilities**  
**TD \$500**

$$\text{TR}^* = .1 * 500 = 50 \rightarrow$$

$$\Delta\text{TL} = \text{TR} - \text{TR}^* = 450$$

**Step 2:**

**Assets**  
**TR \$ 500**  
**TL \$ 450**

**Liabilities**  
**TD \$950**

$$\text{TR}^* = .1 * 950 = 95 \rightarrow$$

$$\Delta\text{TL} = \text{TR} - \text{TR}^* = 405$$

**Step 3:**

**Assets**  
**TR \$ 500**  
**TL \$ 855**

**Liabilities**  
**TD \$ 1355**

$$\text{TR}^* = .1 * 1355 = 135.5 \rightarrow$$

$$\Delta\text{TL} = \text{TR} - \text{TR}^* = 364.5$$

**Loans and deposits expand up to a point  $\text{TR}^* = \text{TR}$ , that is,  $\text{TD} = \text{TR} / m = 5000$  !**

# The Money Multiplier

**Total Change in Deposits:**

$$\begin{aligned} &= ID + ID(1-m) + ID(1-m)^2 + \dots \\ &- ID(1 + (1-m) + (1-m)^2 + \dots) \\ &= ID(1/m) \end{aligned}$$

**Money Multiplier  $\mu_m = 1/m$**

$$TD = (1/m) ID$$

Some caveats:

- There are holding of currency out of the banking system
- Banks may hold excess reserves



# Money Supply and Monetary Base

- MS = Money Supply
- TC = Total Currency in Circulation (outside banking system)
- BASE = Monetary base
- **MS = TC + TD**

$$\Delta MS = \Delta TC + \Delta TD$$

$$\rightarrow \Delta MS = \Delta TC + \Delta TR + \Delta TL$$

- **BASE = TC + TR** (liabilities of the Central Bank that can be used as money + currency hold by the public)

**Central Bank controls directly the monetary base BUT not the money supply!**

# Money Supply and Monetary Base

- Combining the two definitions we get

$$MS/BASE = (TC + TD) / (TC + TR)$$

- **TC/TD = cu** = currency/deposit ratio depends on the amount of money the public wants to hold as currency vs deposits.
- The **public** can increase or reduce it, by withdrawing or depositing currency
- Recall **TR/TD = reserves/deposits ratio** determined by the **banks + regulation** (**assume = minimum required = m**)
- Then Money supply:

$$MS = [(cu + 1)/(cu + m)] * BASE$$

## The Money Multiplier (with currency)

- Money supply is a multiple of the monetary base!
- General Money multiplier  $\mu_m = (cu + 1)/(cu + m)$
- $\mu_m > 1$  as long as  $m < 1$ !
- The Money multiplier decreases with  $cu$ ! Role of the **public**
- The Money multiplier decreases with  $m$ ! Role of the **banks**

# The Fed in the Banking System

What is the Fed (central bank)?

How Can it Affect Money Supply/Interest Rates?

**By creating reserves.**

- a) **Open Market Operations**
- b) **Reserve Ratio** (not used very much)
- c) **Discount Rate** (not used very much)

# Notes on Central Banks

- The Central Bank is *The Banks' Bank*. The Central Bank operates a clearinghouse for bank checks. Each member bank has an account with the Central Bank. In the U.S. the deposits that banks have with the Fed are called *federal funds*.
- A closely related term, which is not specific to the U.S., is banks' *reserves* (which consist of **federal funds plus "vault cash"**, or currency in the bank's cash machines, teller drawers, and vault).
- A check written against private bank A and deposited with private bank B reduces bank A's federal funds and increases bank B's federal funds. **Thus banks want federal funds so they can honor check withdrawals. They want vault cash to honor cash withdrawals.**  
*Upshot: banks need reserves to honor withdrawals.*
- Neither the Fed nor other major Central Banks target growth rates of the *money supply* (which consists of currency plus various measures of liquid assets like deposits).
- Fed targets the **Federal Funds rate**.

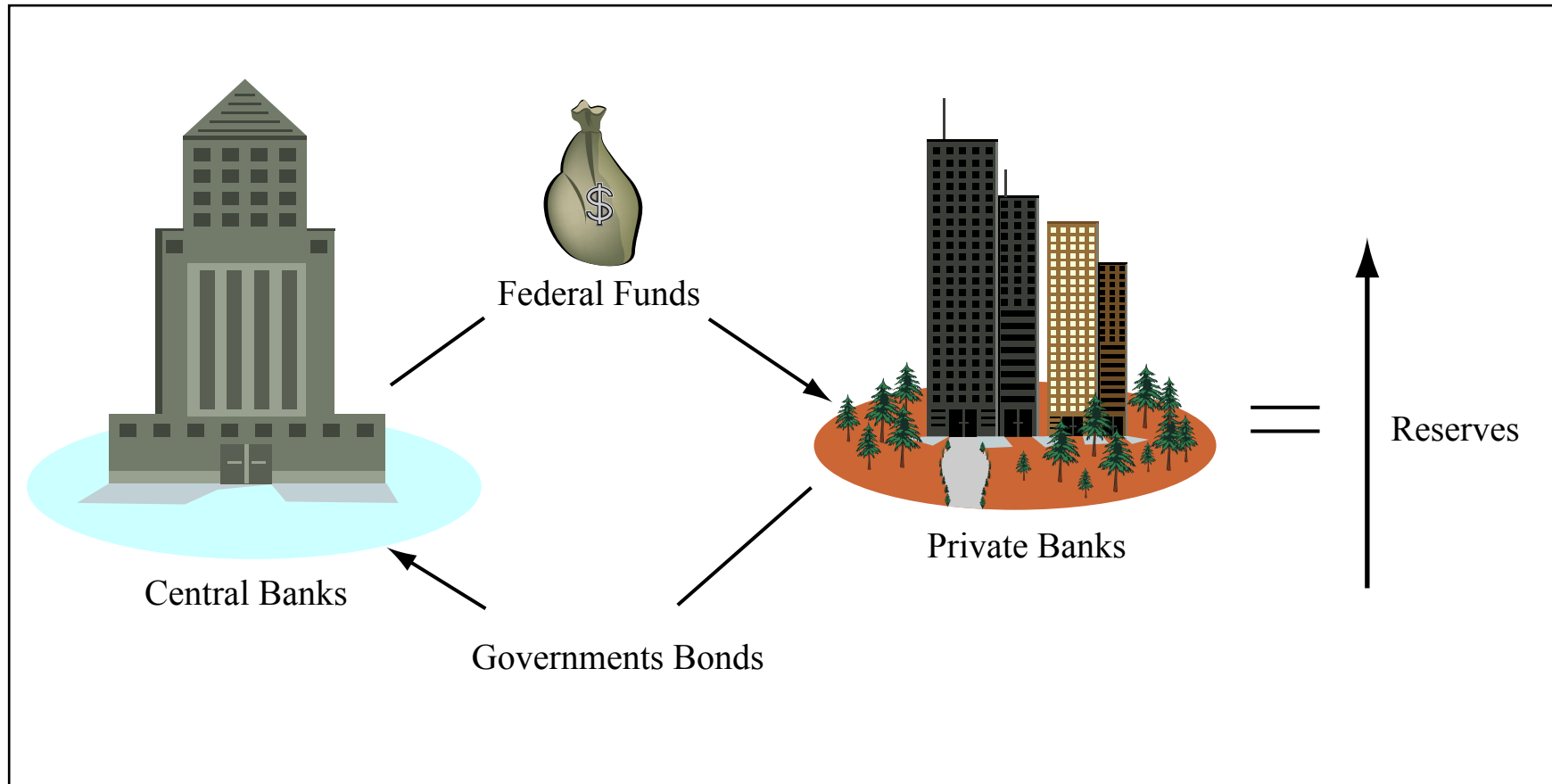
# What is the federal funds rate?

- Federal funds are the deposits of private banks with the Fed.
- The federal funds market consists of private banks borrowing and lending their federal funds amongst each other overnight.
- The federal funds rate is the interest rate on these overnight loans. It is set by supply and demand, not by the Fed.
- **The Fed can change the supply of federal funds through open market operations, exerting a powerful indirect effect on the fed funds rate.**
- The Fed targets the **federal funds rate** and carries out open market operations to keep the actual rate near the target rate.

# What are Open Market Operations?

**Open market operations** = Central Bank purchases and sales of government securities on the open market.

**Open market purchase (sale)** = Central Bank purchases (sells) government securities. The seller (buyer) receives (uses) federal funds as payment.



## A Fed purchase of government securities ...

- raises the supply of federal funds. **More federal funds** means they are cheaper to borrow, so a **lower federal funds rate**. (An increase in the supply of federal funds lowers their “price”);
- drives up the price of those securities, which lowers their yield. A **lower yield** means a lower interest rate on government securities;
- leaves banks flush with reserves. Banks find it profitable to convert some of their new zero-interest-earning reserves into loans (which in turn creates more deposits, *raising the money supply*). To get people/firms to borrow more (take the new loans they are offering), banks **lower the interest rate on the loans**.

*Bottom Line: A Fed purchase of government securities lowers  $i$ .*



## Notes on FOMC directives

The **Federal Reserve Open Market Committee** (FOMC) meets every 6 weeks and issues a directive to the **trading desk of the Federal Reserve Bank of New York**.

**Fed Time:** the Desk carries out open market operations between 11:30 and 11:45 ET each trading day to **keep the actual fed funds rate near the target**.

The FOMC directive is also asymmetric or symmetric:

**Symmetric:**

No bias. Neutral stance. Just as likely to raise as to lower the target next.

**Asymmetric:**

A bias toward easing (more likely to lower than raise the target next) or a bias toward tightening (more likely to raise than lower the target next).

The symmetry of the directive is not public until over **6 weeks** after each meeting. Look at the ***federal funds rate futures*** in the WSJ to see what the market thinks.

## Federal Reserve's Lending

- The *discount rate* is the interest rate on direct loans from the Fed to private banks. The Fed sets the discount rate.
- **Discount window loans** used to play a minor role in Fed policy (primary and secondary credit discount loan since 2003)
- With the recent crisis, more banks have used discount windows loans together with new borrowing channels.
- New Monetary Policy instruments: Term Auction Facility (TAF), Term Asset-Backed Securities Loan Facility (TALF), Commercial Paper Funding Facilities (CPFF), ...

# Reserves and Borrowing

|         | Monetary Base | Total reserves of<br>depository<br>institutions | Required reserves of<br>depository institutions | Total borrowings of<br>depository<br>institutions | Non borrowed<br>reserves of depository<br>institutions |
|---------|---------------|---|---|---|--|
| 2007-12 | 836,432       | 42,701  | 40,932  | 15,430  | 27,271   |
| 2008-01 | 831,104       | 44,065  | 42,425  | 45,660  | -1,595   |
| 2008-02 | 828,694       | 42,799  | 41,073  | 60,157  | -17,358  |
| 2008-03 | 832,358       | 42,714  | 39,735  | 94,523  | -51,810  |
| 2008-04 | 830,495       | 43,504  | 41,658  | 135,410   | -91,906  |
| 2008-05 | 833,974       | 45,106  | 43,093  | 155,780   | -110,674   |
| 2008-06 | 839,084       | 43,923  | 41,649  | 171,278   | -127,355   |
| 2008-07 | 846,455       | 44,106  | 2,129   | 165,664   | -121,558   |
| 2008-08 | 847,290       | 44,107  | 42,116  | 168,078   | -123,972   |
| 2008-09 | 908,029       | 102,568   | 42,517  | 290,105   | -187,537   |
| 2008-10 | 1,132,519     | 314,909   | 7,005   | 648,319   | -333,410   |
| 2008-11 | 1,441,048     | 609,506   | 50,453  | 698,786   | -89,280  |
| 2008-12 | 1,663,861     | 821,227   | 53,815  | 653,565   | 167,661  |

millions of US dollars

not seasonally adjusted

source: Federal Reserve Board

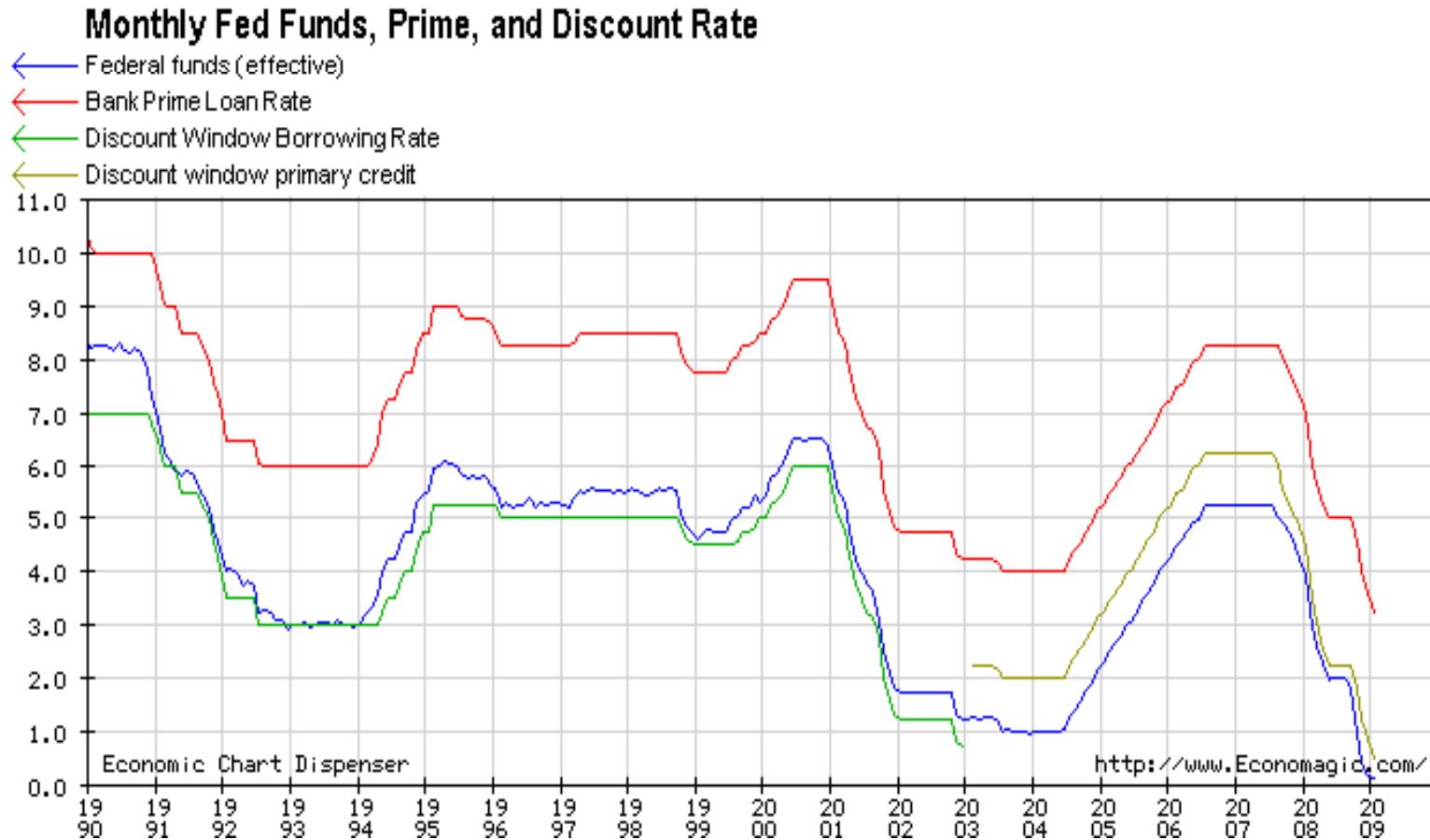
# Reserves and Borrowing

|         | Primary borrowings of depository institutions | Secondary borrowings of depository institutions | Seasonal borrowings of depository institutions | Term auction credit of depository institutions | Primary dealer and other broker-dealer credit | Other credit extensions | Asset-backed Commercial Paper Money Market Mutual Fund Liquidity Facility |
|---------|---|---|--|--|---|-------------------------|---|
| 2007-12 | 3,787   |   | 1  | 30   | 11,613  | NA                      | NA  |
| 2008-01 | 1,137   |   | 0  | 6  | 44,516  | NA                      | NA  |
| 2008-02 | 155   |   | 0  | 3  | 60,000  | NA                      | NA  |
| 2008-03 | 1,617   |   | 0  | 6  | 75,484  | 16,168                  | 1,249   |
| 2008-04 | 9,624   |   | 0  | 21   | 100,000                                       | 25,764                  | 0   |
| 2008-05 | 14,076  |   | 0  | 47   | 127,419                                       | 14,238                  | 0   |
| 2008-06 | 14,225  |   | 70   | 75   | 150,000                                       | 6,908                   | 0   |
| 2008-07 | 15,204  |   | 107  | 98   | 150,000                                       | 255                     | 0   |
| 2008-08 | 17,980  |   | 1  | 97   | 150,000                                       | 0                       | 0   |
| 2008-09 | 32,632  |   | 35   | 87   | 149,814                                       | 53,473                  | 0   |
| 2008-10 | 94,017  |   | 38   | 28   | 244,778                                       | 114,953                 | 0   |
| 2008-11 | 95,839  |   | 117  | 8  | 393,088                                       | 60,655                  | 0   |
| 2008-12 | 88,245  |   | 52   | 3  | 438,327                                       | 47,631                  | 0   |

millions of US dollars  
not seasonally adjusted

source: Federal Reserve Board

# The federal funds rate vs. the discount rate



## The Fed's Balance Sheet

- The Fed receives interest on its assets (U.S. government securities + loans to banks).
- The Fed pays no interest on its liabilities (currency and fed funds).
- The Fed is highly profitable, which fosters its independence. The Fed returns its profits to the Treasury.
- Hence the interest that the Treasury pays on securities held by the Fed is not a cost for the Government: that portion of public debt is effectively *monetized* (pays 0 interest)

# Monetizing Government Debt

**The Central Bank buys public debt with reserves.**

- When public debt is growing faster than GDP, there is political pressure on the Central Bank to **monetize some of the government debt** b/c
  - public debt pays interest, reserves do not;
  - fixed nominal debt is easier to pay off the higher is P.
- *Large budget deficits are the underlying cause of hyperinflations.* The debt and deficit limits in Europe's EMU are meant to prevent member countries from pushing for higher inflation.
- Central Bank independence from fiscal authorities can insulate it from pressure to monetize the public debt.

# CB Independence & Inflation

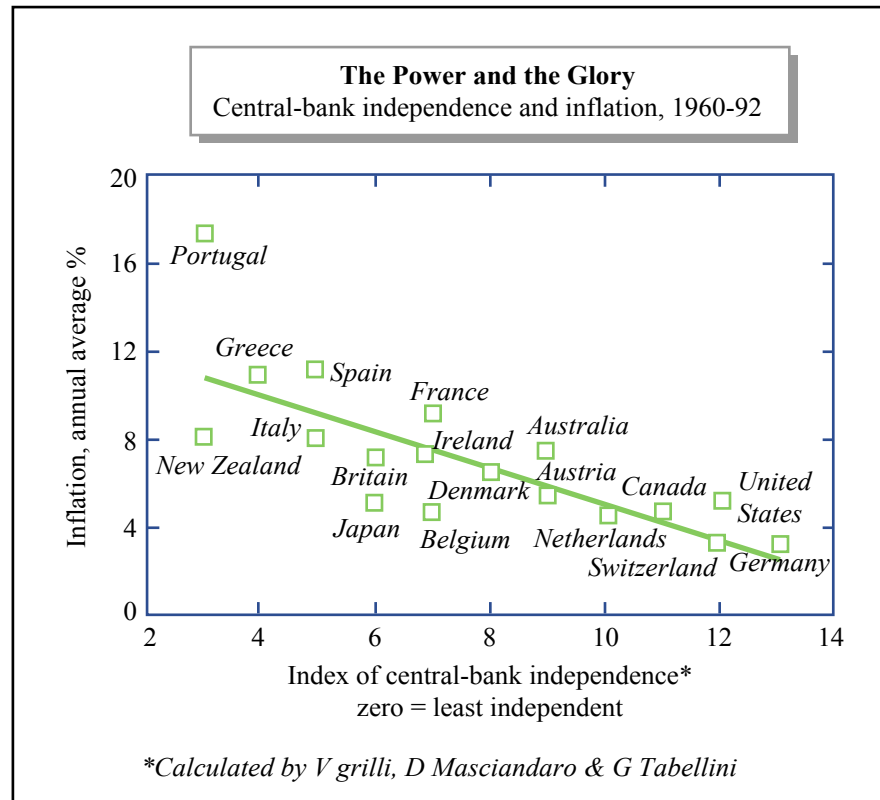


Figure by MIT OpenCourseWare.



# Why Do Governments Grow the Money Supply?

**Short Term Political Gains** - reduce unemployment (or raise output). If the economy is capacity constrained - prices must rise (however, this usually occurs with a lag!)

**Accommodating Supply Shocks** - The U.S. in the 70s! (as opposed to breaking the inflation cycle).

**Financing Government Deficits** by Printing Money!!!

We will deal with this more next week!

## Websites with more info

**The Fed and District Banks (see the Board of Governors website for FOMC minutes and speeches and testimony of FOMC members):**

**<http://www.newyorkfed.org/aboutthefed/fedpoint/fed46.html>**

**Foreign Central Banks: <http://www.bis.org/cbanks.htm>**

**Fed Points (each explains something, e.g. how currency gets into circulation):**

**<http://www.newyorkfed.org/aboutthefed/fedpoints.html>**

**Details on how open market operations work:**

**<http://www.newyorkfed.org/markets/openmarket.html>**

**Overview of the Fed: <http://www.federalreserve.gov>**

# Summing Up

*Nominal Money Supply ( $M_s$ ):*

*Affected By the Fed (and by the public and by other banks)*

*Fed conducts monetary policy to increase Money Supply:*

- **Open Market Purchases**
- **Decrease the reserve ratio**
- **Decrease the Discount Rate**

# Goals of the Fed

- The Fed wants to set  $r$  so that
  - **output/unemployment target**:  $Y = Y^*$  or  $U = U^*$
  - **inflation target**:  $\pi = \pi^*$  (2% inflation).
- The Fed wants to **raise  $r$**  when
  - $Y > Y^*$ ,  $U < U^*$ ,  $N > N^*$
  - $\pi > \pi^*$
- The Fed wants to **lower  $r$**  when the opposite conditions hold.

## Rules vs. Discretion

- Should a central bank have a specific policy rule?
- Rules may be **explicit** and mandated by law
  - Money should grow at 4% per year (Friedman preferred rule).
- Rules may be **implicit** and known by all economic agents
  - The Fed will target the inflation rate at 2-4% per year and naturalunemployment rate.
- **The Fed uses a discretionary rule.** The members of the bank vote on a monetary policy at each meeting. Policy is not dictated by some explicit rule.

## Benefits of Rules

- If the Central Bank is committed to keep inflation under control...
- Inflation Temptation is powerless!
- Creates a more stable economic situation: individuals and firms can anticipate the central bank actions. No surprises!
- Discretion may help the Central Bank to be more flexible ...
- BUT allows the Bank to think too much - the economy is so complex that Fed policy can have delayed impact and is usually initiated too late!  
Central Bank actions can often be 'destabilizing' (Freidman, Lucas: both prefer simple rules)

# The Taylor Rule

**John Taylor of Stanford University** said that the Fed's behavior under Greenspan (1987-2006) and Bernanke (today) is well-described by:

$$\text{Taylor Rule: } i = r^* + \pi^e + a_\pi (\pi^e - \pi^*) + a_y (Y - Y^*)/Y^*$$

with  $a_\pi + a_y = 1$ . In particular Taylor assumes  $a_\pi = a_y = .5$ .

$i$  = the nominal federal funds rate

$r^*$  = the real fed funds rate target (this is the  $r$  consistent with  $Y=Y^*$ )

$\pi^e$  = expected inflation

$\pi^*$  = target inflation

$Y$  = real GDP

$Y^*$  = potential real GDP

$(Y-Y^*)/Y^*$  is the *output gap* or *GDP gap*. A positive output gap means overheating and potentially rising inflation (labor markets will demand higher wages).

Taylor used  $r^* = 2\%$  and  $\pi^* = 2\%$ . **The Taylor Rule explains about 2/3 of quarterly variation in the fed funds rate since 1987.**

## Notes on the Taylor Rule

- This does NOT mean that Bernanke uses this ‘rule’, it is just that Fed behavior looks very similar to this rule.
- Furthermore, Fed tends to **smooth interest rates** relative to the Taylor Rule:

$$i = .6*(\text{last quarter's actual } i) + .4*(\text{Taylor Rule } i)$$

- Studies have found that other G7 Central Banks (e.g., the Bundesbank) have also followed versions of a smoothed Taylor Rule
- Read the speeches by Bernanke or Greenspan to see the Fed’s take on such subject
- The Fed has become quicker to act to gain credibility...in this recession, the Fed has acted preemptively!



# Fed Timing

## Recession Begins

## First Fed *nominal* rate cut

**December 1969**

**11 months later**

**November 1973**

**13 months later**

**July 1981**

**4 months later**

**July 1990**

**5 months later**

**December 2007**

**4 months earlier!**

# Hawks and Doves

- How does the Fed balance price stability ( $\pi = \pi^*$ ) and full employment ( $U = U^*$ ) when they conflict? (when  $\pi > \pi^*$  and  $U > U^*$  at the same time)
- **Hawks** put more weight on  $\pi^*$  (and have lower values for it):
  - U.K., Canada, New Zealand.
  - Bundesbank before; **European Central Bank now!**
- **Doves** put more weight on staying near  $U^*$  (and have higher  $\pi^*$ )
- Greenspan and Bernanke *tend* to put the same “weight” on each
- Current Recession: unusual shock to  $y \longrightarrow$  for almost any weight,  $i$  goes to 0!  
(Liquidity Trap)

## Did the Fed do something wrong?

- During the expansion after 2001, the economy did not seem to overheat, output was around potential  $Y^*$  and inflation was stable
- However, at the same time, housing prices were rising steadily ....
- Greenspan did not do anything, according to the Taylor Rule:  $i$  should not change if output and inflation are around target.
- **Should the Fed have reacted to the housing bubble? Should the Taylor rule include asset prices (S)?**

$$i = r^* + \pi^e + a_\pi^*(\pi^e - \pi^*) + a_y^*(Y - Y^*)/Y^* + a_S^*(S - S^*)$$

- Bernanke and Gertler answer: NO!

# Housing Bubble

- Bernanke and Gertler argument:
  - the Fed should care about asset prices only if they have macro effects
  - **if the housing bubble had macro effects you should see output or inflation react (standard demand shock)**
  - but then standard Taylor rule would suffice
- However, it seems that the housing bubble had macro impact when it burst!
- It could be that asset price bubbles are problematic because agents tend to **leverage too much** and then a crisis can occur if the bubble bursts
- Is monetary policy the right tool to control a bubble? Can you even do it?

## Worries about Deflation

- **Deflation can make borrowers - either consumers or firms, worse off.**
- As we saw early in the course, **unexpected inflation makes borrowers better off.** They expected to pay a certain real rate and when inflation is higher and the nominal rate is fixed, the real rate they pay is lower
- If the economy experiences **unexpected deflation**, the opposite happens: borrowers are paying more in terms of real purchasing power.
- **Borrowers, both consumers and firms, will essentially be poorer** (even though, there is another side of the market, this could have large effects on C and I)
- This demand side effect of deflation is called **'debt overhang' or 'debt deflation'**. <<Even the government pays higher than expected rates on their debt>>

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