Money

- In the absence of money, goods and services are exchanged in a barter system where individuals directly exchange the surplus from the fruits of their labor.
  - The following gives the number of barter prices there would be in an economy with N goods, with $x = 2$ because exchanges are done in pairs:
  - Among competing forms of money, the least marketable tend

    to be one by one rejected until at last only a single commodity remained, which was universally employed as a medium of exchange – Mises, 1953, pp. 32-33

    When the inhabitants of one country became more dependent on those of another, and they imported what they needed, and exported what they had too much of, money necessarily came into use – Aristotle's *Politics*
  - The winner of this contest is durable, divisible, transportable, and difficult to counterfeit.

Money

- **Commodity Money**:

Stone Money, Island of Yap

Gold coins in 1776-Colonial America

"Tiger Tongue" from Siam, Bronze Coin

Coat check tickets?

- *The Shawshank Redemption*: inmates exchanged cigs for posters, whiskey, and cards.
- *In Time*: time is money in the future, and is used to purchase immortality
- **Paper Money** is backed by a commodity
  - Iron Chinese coins were used as currency Szechwan, China (Lui, 1983)
  - In the 10th century, their bank receipts, *chiao-tzu*, circulated as paper money
  - *Chiao-tzu* became **fiat money** after the Szechwan gov't took it over in 1023

Money

- **Paper Money** backed by **Gold**

Money

- ***Fiat*** **Money** backed by **Gold**

Quantity Theory of Money

Irving Fisher's equation of exchange

$$M \cdot V = PL \cdot Y$$

Mainstream economics defines **inflation** as a general increase in the prices of products

$$\pi = (PL_{is} - PL_{was}) / PL_{was}$$

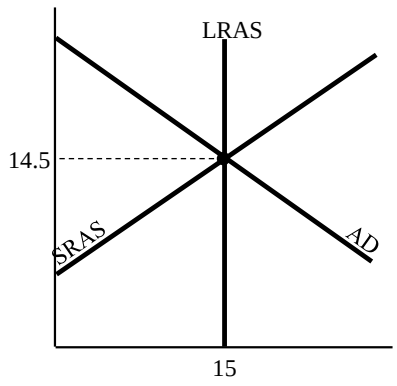
- Excessive growth in the quantity of money
- Demand-pull inflation
- Cost-push inflation

Quantity Theory of Money

Velocity of money is constant in short run, $u = u_n$ and the Fed lowers *i* to **increase** *M*

- Unemployment is too low
- *w* and *p* rise

$$M \cdot V = PL \cdot Y$$



Inflation is always and everywhere a monetary phenomenon in the sense that it is and can be produced only by a more rapid increase in the quantity of money than in output.
Milton Friedman

Quantity Theory of Money

Assuming V is constant in the short run gives the quantity theory of money (QTM)

$$PL \cdot Y = M \cdot \bar{V}$$

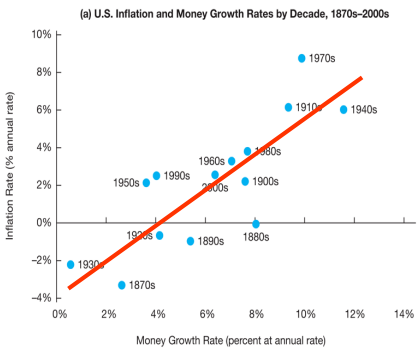
Nominal income is determined by changes in the quantity of money

The above can be written as follows

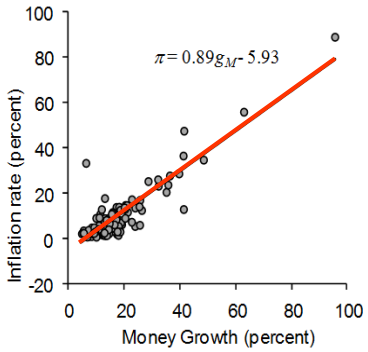
$$\%\Delta PL + \%\Delta Y = \%\Delta M + \%\Delta V$$

	PL	*Y*	*M*	*V*
2011	212	15.0	1590.0	2
2012	221	15.3	1690.7	2
%Δ				

Quantity Theory of Money

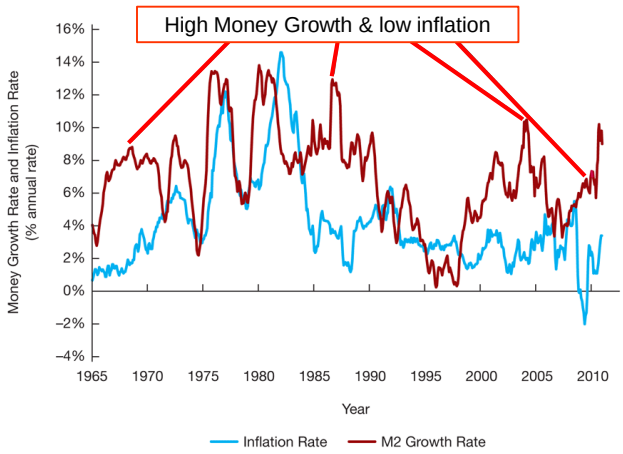


Sources: For panel (a), Milton Friedman and Anna Schwartz, Monetary trends in the United States and the United Kingdom: Their Relation to Income, Prices, and Interest Rates, 1867–1975, Federal Reserve Economic Database (FRED), Federal Reserve Bank of St. Louis, http://research.stlouisfed.org/fred2/categories/25 and Bureau of Labor Statistics at http://data.bls.gov/cgi-bin/surveymost?cu.



Source: IFS data for 120 countries, averaged over years 1996-2004

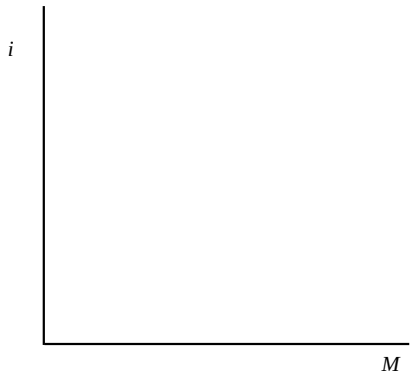
Quantity Theory of Money



Sources: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis; Bureau of Labor Statistics, http://research.stlouisfed.org/fred2/categories/25; accessed September 30, 2010.

Money Demand

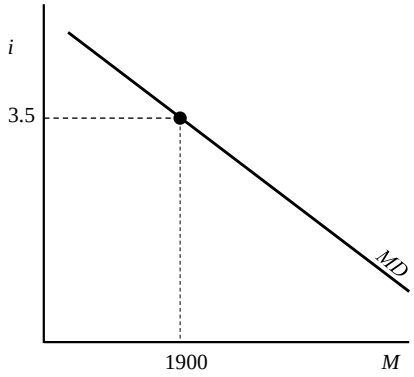
Fisher's money demand (from Quantity Theory of Money): Fisher's demand for money is not affected by *i*.



Money Demand

The consensus view:

- The ***lower*** the nominal interest rate, the lower the opportunity cost of holding money,



Money Supply

Historical Development of the Banking System

Assets	*Liabilities*
Reserves	Demand deposits
200	200 (John)

(a)

Assets	*Liabilities*
Reserves	Demand deposits
1000	200 (John)
	150 (Adam)
	250 (Sally)
	275 (Jane)
	125 (Tony)

(b)

Assets	*Liabilities*
Reserves	Demand deposits
100	200 (John)
Loans	150 (Adam)
900 (James)	250 (Sally)
	275 (Jane)
	125 (Tony)

(c)

Assets	*Liabilities*
Reserves	Demand deposits
1000	200 (John)
Loans	150 (Adam)
900 (James)	250 (Sally)
	275 (Jane)
	125 (Tony)
	400 (Bill)
	500 (Jill)

(d)

Money Supply

Historical Development of the Banking System

- Bank of North America chartered in 1782
- Controversy over the chartering of banks.
- National Bank Act of 1863 creates a new banking system of federally chartered banks
  - Office of the Comptroller of the Currency
  - Dual banking system

Government's perspective

The Mises Institutes' perspective

Free Banking (Lawrence White)

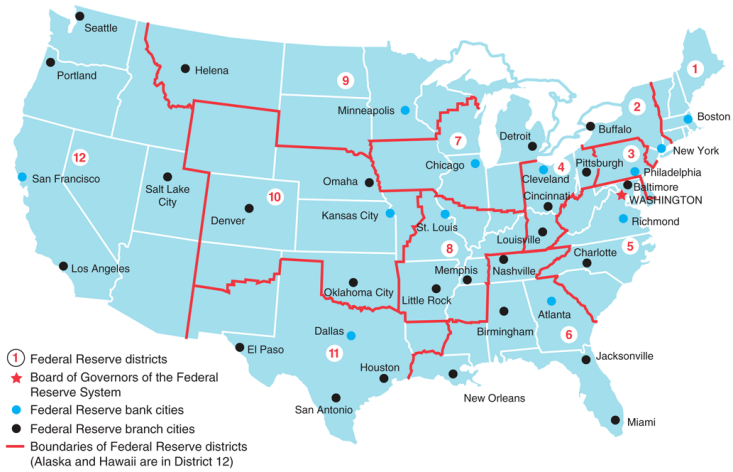
Free Banking (Lawrence White)

Free Banking

The Mises Institute's perspective

Money Supply

Historical Development of the Banking System



Federal Reserve System created in 1913

Money Supply

The Federal Reserve System (Fed) is

- managed by the Board of Governors (7 members)
  - appointed by the President & confirmed by the Senate
  - each serves for 14 years, cannot serve more than 1 complete term
  - terms are staggered every two years

- politically independent (to some degree)
  - Independence allows it to pursue policies that are 'best' for the economy, not the President or Congress
  - It is funded by check-clearing fees and the interest it collects from loans to commercial banks and government
  - Independence limited by

Money Supply

The Federal Open Market Committee (FOMC)

- Includes 7 BOG members, the NY Fed Bank president, & 4 of the 11 other district bank presidents
- meets once every six weeks (on Tuesdays) to set monetary policy for the Fed:
  - low steady inflation: 2-3 percent per year (but \$1 ≈ 1¢ after 100 years)
  - full-employment
    - $u = u_n \quad \rightarrow \quad Y \approx Y_p$
    - u declines because

The Chair is ***Oz: The Great and Powerful***

- Spokesperson for the Fed and negotiates with Congress and the President
- Sets the agenda for meetings
- Speaks and votes first about monetary policy
- Is it wise to have one person with this much power?

The curious task of economics
is to demonstrate to men
how little they really know
about what they imagine they can design.
F.A. Hayek

Money Supply

The Fed sets the **required reserves ratio** on **checkable demand deposits**

- This makes banks' T-accounts slightly different than the goldsmith's
- The bank has lent money to
  - Consumers
  - Businesses
  - Government
- The bank has lent out all but $10,000 of the $50,000 in checkable demand deposits.
  - Reserves equal the sum of required reserves (R_R) & excess reserves (R_E)

Goldsmith's Balance Sheet

Assets	*Liabilities*
Reserves 10,000 Loans 40,000	Demand deposits 50,000

Bank A's Balance Sheet

Assets	*Liabilities*
Reserves Loans	Demand deposits 50,000

Money Supply

Nonbank Public's Balance Sheet

Assets	*Liabilities*
Securities	

The Fed's Balance Sheet

Assets	*Liabilities*

Money Supply

Simple money multiplier

The Fed buys $100 million worth of First National's Treasury bonds and the reserve requirement ratio is 10%

Bank	Increase in Deposits ($)	Increase in Loans ($)	Increase in Reserves ($)
First National	0.00	100.00 m	0.00

Money Supply

The money multiplier:

$$m = \frac{c+1}{\rho+e+c}$$

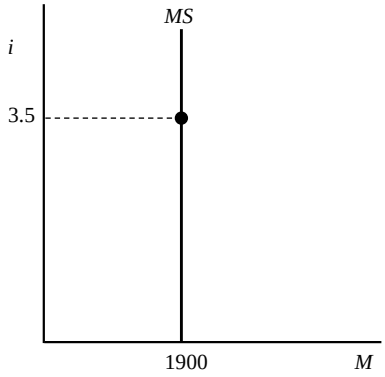
The simple money multiplier:

$$m = \frac{1}{\rho}$$

Money Supply

The consensus view:

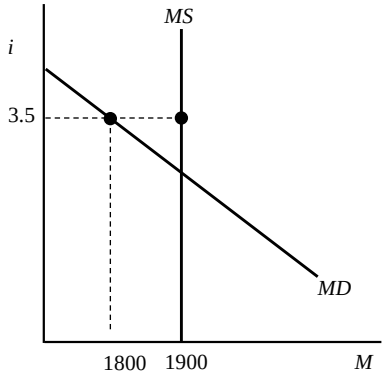
- It is the relationship between the quantity of money supplied and *i*.
- Quantity of money supplied is determined by
- On any given day, the quantity of money is



The Market for Money

Interest Rate Adjustment

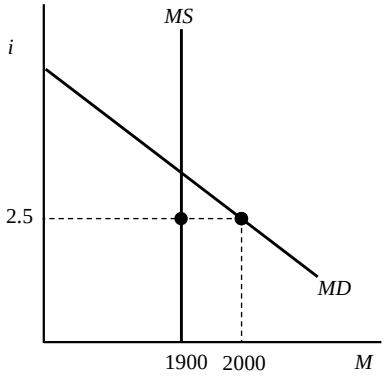
- When the interest rate is ***above*** its equilibrium level, the quantity of money supplied exceeds the quantity of money demanded (or needed).
- People hold too much money, so they try to get rid of it by
- The demand for financial assets increases, the prices of these



The Market for Money

Interest Rate Adjustment

- When the interest rate is ***below*** its equilibrium level, the quantity of money demanded (or needed) exceeds the quantity of money supplied.
- People are holding too little money, so they try to get more money by
- The demand for financial assets decreases, the prices of these assets



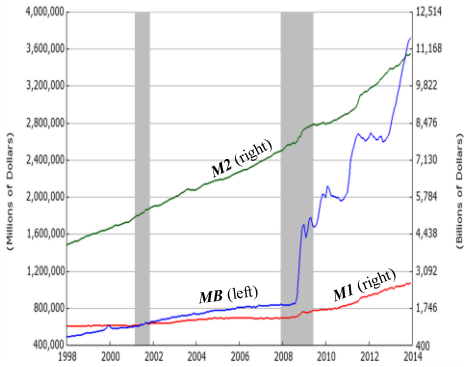
Equilibrium Quantity of Money

Measures of the Monetary Aggregates

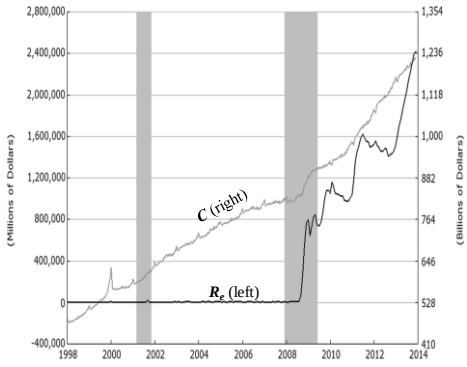
		Value as of May 16, 2011 ($ billions)
M1 =	Currency	958.8
+	Traveler's checks	4.6
+	Demand deposits	573.1
+	Other checkable deposits	399.0
	Total M1	
M2 =	M1	
+	Small-denomination time deposits	848.3
+	Savings deposits and money market deposit accounts	5,530.4
+	Money market mutual fund shares (retail)	688.4
	Total M2	

Source: www.federalreserve.gov/releases/h6/hist.

Equilibrium Quantity of Money



http://research.stlouisfed.org/fred2



http://research.stlouisfed.org/fred2

Demand for Reserves

- **Quantity Demanded for Excess Reserves** (Q^D_{ER}) provide banks with insurance against big withdrawals (caused by bank runs)
  - The federal funds interest rate (i_{ff}) is the cost of "big withdrawal" insurance.

The cost of excess reserves is

  - If i_{ff} falls, the cost of excess reserves falls (the cost of big withdrawal insurance). Thus banks are more willing to purchase more "big-withdrawal" insurance

  - **Demand for Excess Reserves:**

S = shock parameter, which increases if

- in government intervention (e.g., w & p controls) because
- in economic growth
- ρ is adjusted
- During bank panics

Demand for Reserves

- **Quantity of Required Reserves** (R_R)
  - The Federal Reserve (the Fed) requires banks to hold (not lend out) a percentage of the total amount of **checkable deposits** in their vaults (D)
  - The percentage required is called the **required reserves ratio** (ρ)
  - Thus the quantity of required reserves is

$$R_R = \rho \cdot D$$

- **Quantity Demanded for Reserves** (Q_R^D) is

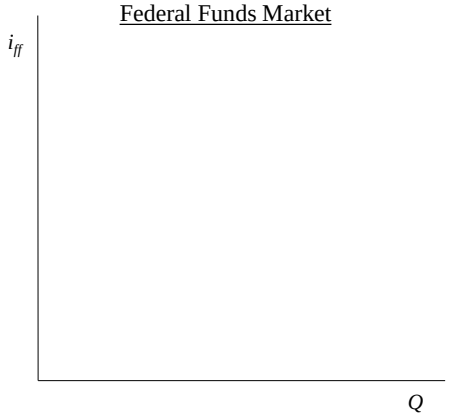
- **Demand for Reserves:**

$$i_{ff} = \left[\rho \cdot D + S\right] - \beta \cdot Q_R^D$$

Demand for Reserves

- **Example:** Suppose $\rho = 0.1$, $D = 50$ (billion \$), $S = 25$, and $\beta = 1$. Graph the demand for reserves in the graph below.

i_{ff} (percent)	Q_R^D (Billions \$)
2	
5	



Supply for Reserves

- A bank that can't meet its reserve requirement (R_R) borrows from a bank that has excess reserves in the federal funds market and Q^S remains unchanged.
- The **vertical part** of reserves supply curve is the amount of reserves the Fed supplies to the federal funds market.
  - When banks borrow from the Fed, discount loans rise, borrowed reserves (R_B) increase, the quantity of
  - When banks sell US Treasury securities to the Fed, non-borrowed reserves (R_N) increase, which increases the
  - Hence, the supply of reserves is the sum

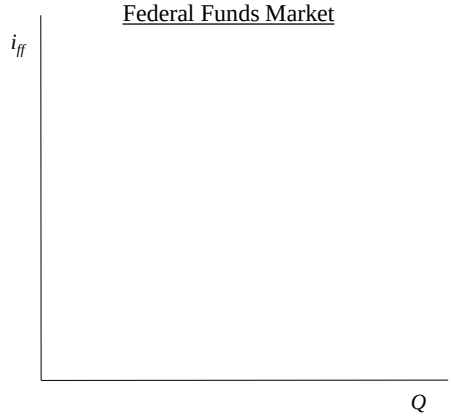
- The **horizontal part** of the reserves supply curve is the discount rate (i_d)
  - If the federal funds rate is less than the discount rate ($i_{ff} < i_d$), banks will not borrow from the Fed because
    - "Insurance" purchased from the Fed
  - If the federal funds rate is more than the discount rate ($i_{ff} > i_d$), banks will want to borrow from the Fed instead
    - "Insurance" purchased from other banks is

Supply for Reserves

- **Example:** Suppose $R_B = 0$ (billion \$), $R_N = 28$ (billion \$) and $i_d = 3$ (percent). Graph the supply of reserves in the figure below.

Vertical part:

Horizontal part:



Federal funds market equilibrium

- If demand for reserves intersects the vertical section of the supply of reserves, then
  - The federal funds interest rate is less than the discount interest rate ($i_{ff} < i_d$)
  - A bank would rather borrow from other banks
  - The quantity of reserves equals $R_N + R_B$

- If demand for reserves intersects the horizontal section of the supply of reserves, the federal funds interest rate equals the discount interest rate ($i_{ff} = i_d$)
  - A bank is indifferent between borrowing from other banks or the Fed
  - However, the bank borrows from the Fed because something (a crisis) has dried up all of the excess reserves held by banks.
  - The equilibrium quantity of reserves exceeds $R_N + R_B$
  - The difference between equilibrium quantity of reserves and $R_N + R_B$ is the quantity of discount loans made by the Fed

Federal funds market equilibrium

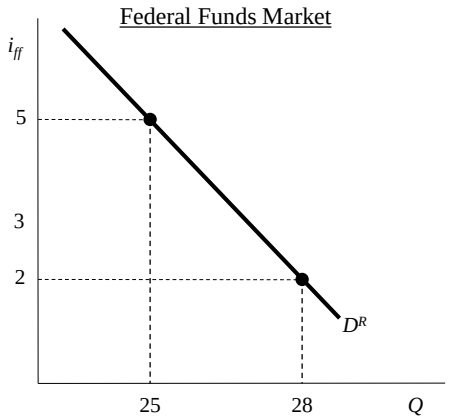
- **Example:** Assume the following values for the demand for reserves: $\rho = 0.1$, $D = 50$, $S = 25$, and $\beta = 1$. Assume the following values for the supply of reserves: $R_B = 0$, $R_N = 28$, and $i_d = 3$. Graph the reserves supply and demand in the figure below.

$$i_{ff} = 30 - Q_R^D$$

i_{ff} (percent)	Q_R^D (Billions $)
2	
5	

Vertical part:

Horizontal part:



Discount Rate

Discount Policy and the Lender of Last Resort

- Discount window
- Primary credit: standing lending facility
  - Lombard facility
- Secondary credit
- Seasonal credit
- Lender of last resort to prevent financial panics
  - Creates moral hazard problem

Advantages and Disadvantages of Discount Policy

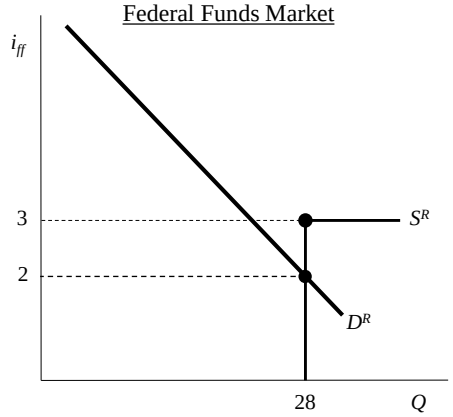
- Used to perform role of lender of last resort
  - Important during the subprime financial crisis of 2007-2008.
- Cannot be controlled by the Fed; the decision maker is the bank
- Discount facility is used as a backup facility to prevent the federal funds rate from rising too far above the target

Discount Rate

- **Example (*continued*):** Suppose the Fed increases the discount rate to 4 (percent). Show the affect of this policy change in the figure below.

The horizontal section

The vertical section

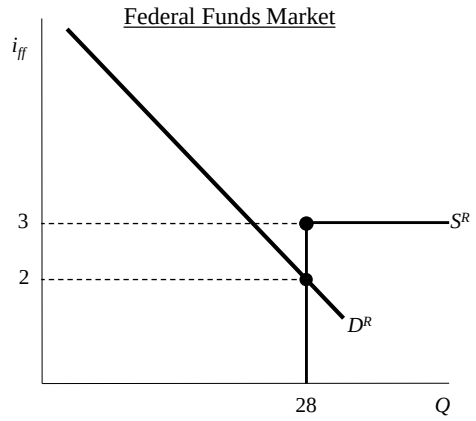


Required Reserves Ratio

- **Example (*continued*):** Instead, suppose the Fed increases the required reserve ratio to 14%. Show the affect of this policy change in the figure below.

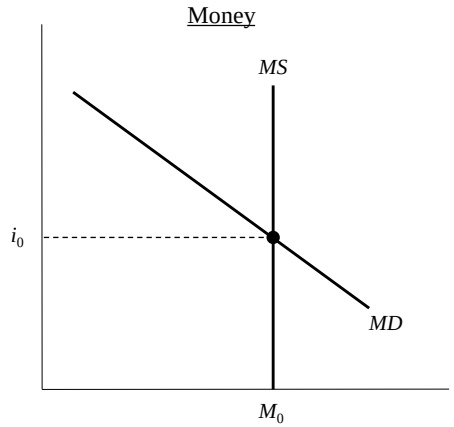
$$i_{ff} = [0.1 \cdot 50 + 25] - Q_R^D$$

The new equilibrium:



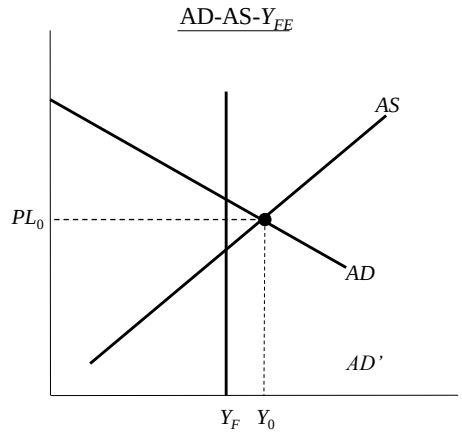
Required Reserves Ratio

- **Example (*continued*):** Instead, suppose the Fed increases the required reserve ratio to 14%. Show the affect of this policy change in the figure below.



Required Reserves Ratio

- **Example (*continued*):** Instead, suppose the Fed increases the required reserve ratio to 14 (percent). Show the affect of this policy change in the figure below.



Open Market Operations

- The Fed conducts an Open Market Purchase (OMP) by buying Treasuries from banks
  - Cash flows from the Fed to
  - The quantity of reserves in the federal funds market
  - The federal funds interest rate
  - This is
- The Fed conducts an Open Market Sale (OMS) by selling Treasury bonds to banks
  - The Fed has bonds to sell because it purchased them directly from
    - Treasury in the primary market (this is called monetizing the debt)
    - Banks in the secondary market in a previous OMP
  - Banks give to the
  - The quantity of reserves in the federal funds market
  - The federal funds interest rate
  - This is

Open Market Purchase

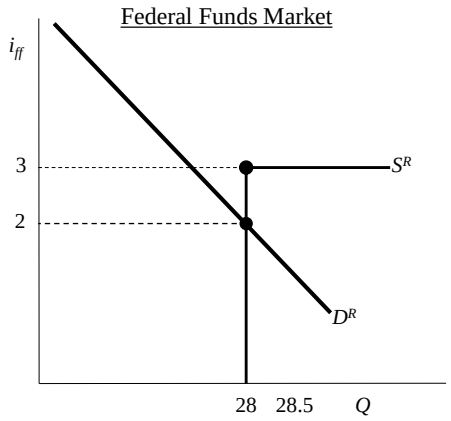
- **Example (*continued*):** Instead, suppose of changing i_d or ρ the Fed performs an OMP by buying a half of a billion dollars worth of bonds from banks (R_N = 28 + **.5** = **28.5**). Show the affect of this policy change in the figure below.

The horizontal section

The vertical section

$R_N + R_B = (28 + \quad) + 0$

New equilibrium



Open Market Purchase

- **Example (*continued*):** Instead, suppose of changing i_d or ρ the Fed performs an OMP by buying a half (billion $) worth of bonds from banks. Show the affect of this policy change in the figure below.

Increased R_N means banks have more cash to lend to consumers and business.

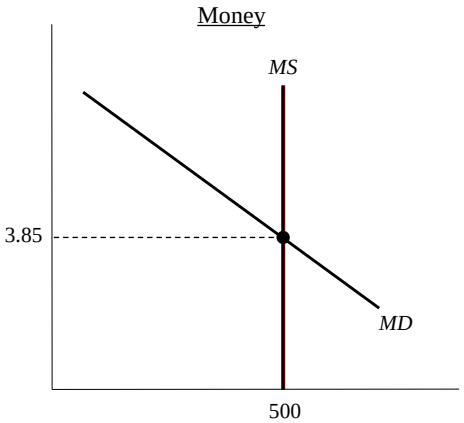
The money supply via lending

If m = 4, then

$\Delta MS =$

$\Delta MS =$

If inflation remains unchanged, r will



Open Market Purchase

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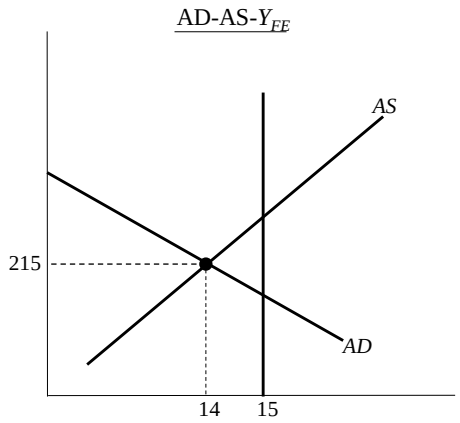


Open Market Sale

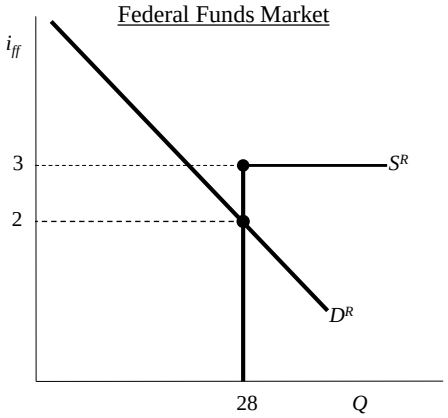
- **Example (*continued*):** Suppose the Fed performs an OMS by selling a half of a billion dollars worth of bonds to banks (R_N = 28 – **.5** = **27.5**). Show the affect of this policy change in the figure below.

The horizontal section

The vertical section

$R_N + R_B = (28 - \quad) + 0$

New equilibrium



Open Market Sale

- **Example (*continued*):** Suppose the Fed performs an OMS by selling a <u>half of a billion</u> dollars worth of bonds to banks (R_N = 28 – **.5** = **27.5**). Show the affect of this policy change in the figure below.

Lower R_N means banks have less cash to lend to consumers and business.

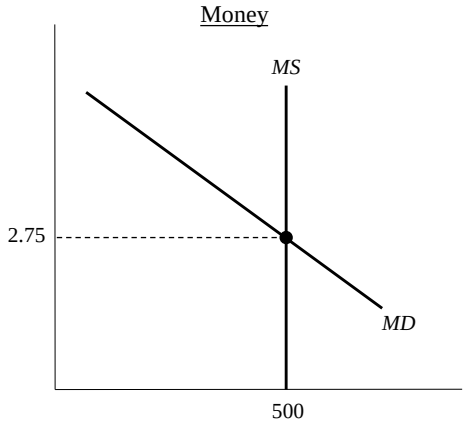
The money supply via lending

If m = 4, then

$\Delta MS =$

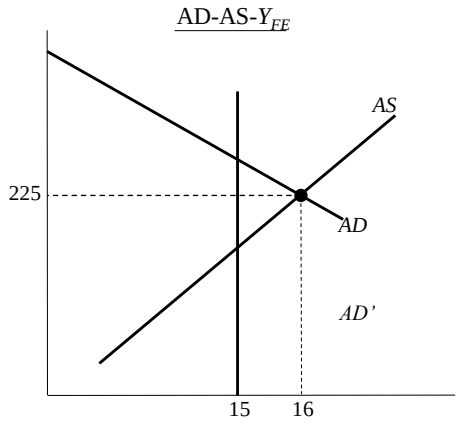
$\Delta MS =$

If inflation remains unchanged, r rises



Open Market Sale

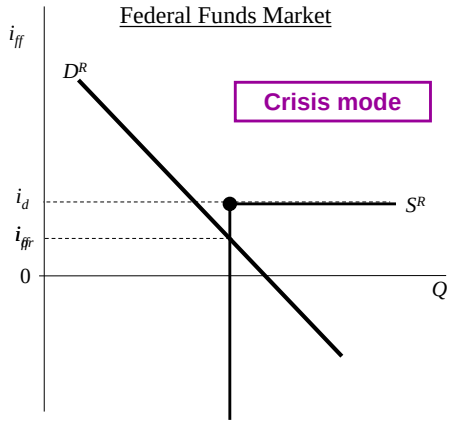
- **Example (*continued*):** Suppose the Fed performs an OMS by selling a <u>half of a billion</u> dollars worth of bonds to banks (R_N = 28 – **.5** = **27.5**). Show the affect of this policy change in the figure below.



Interest on Reserves

- The Fed's rescue of the financial system in 2008-2009 included purchasing enough securities to increase the supply of reserves so much that it would drive the federal funds rate negative.

To prevent this in October of 2008, the Fed began paying interest on reserves (i_{or}), which is currently



Interest on Reserves

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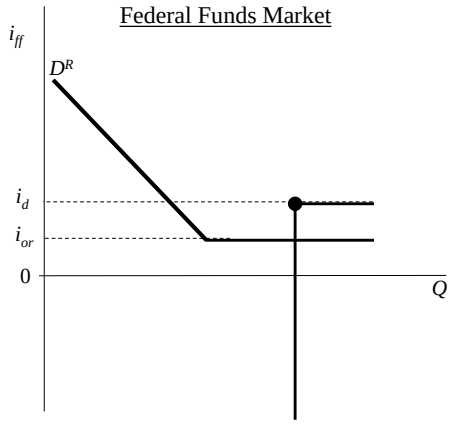


Hyperinflation & Discretionary MP

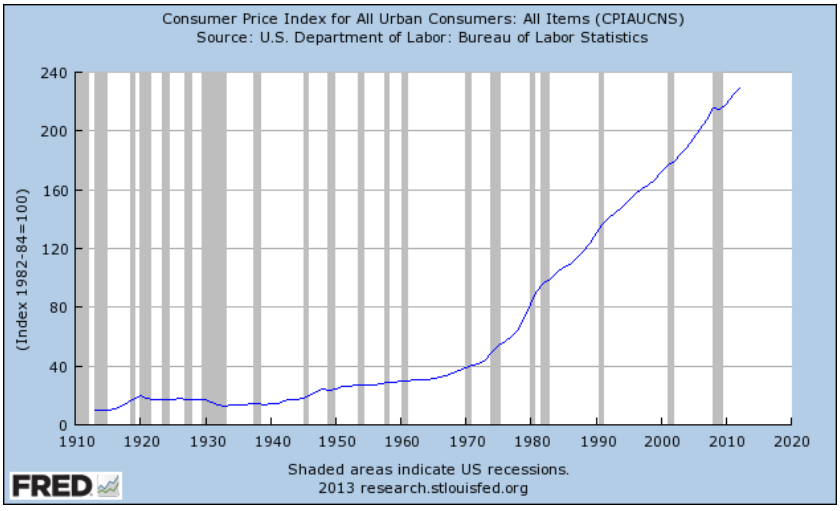
Government expenditures is paid for by

- Raising tax revenue
- Treasuries can print money
  - In the U.S., the Fed buys bonds directly from Treasury
- Treasuries can sell more bonds
  - If the deficit is financed by selling bonds to the public, there is no effect on the MB = $R + C$, and on the MS
  - If the deficit is financed by the Fed buying bonds from banks, the MB and MS increase
    - $1 could buy 11% more goods in 1912 than in 1776
    - $1 could buy 95% fewer goods in 2008 than in 1913

$1m held from 1913 to 2008 is worth $50k

www.lewrockwell.com/2009/07/erik-voorhees/the-record-of-the-federal-reserve/

Hyperinflation & Discretionary MP



Example – CPI data from the FRED

Hyperinflation & Discretionary MP

Hyperinflation is a period of high inflation (> 50% per month)

Larry Allen's *The Encyclopedia of Money*:

- Bolshevik Revolution
  - Prior to the 1917, prices rose 2 to 3 times faster than wages.
  - After 1917, prices rose by
    - 92,300% from 2013 to 1919
    - 64,823,000,000% from 2013 to 1923
- Post WWI Germany
  - In 1914, there were 6,323 million marks in circulation
  - By 1923 there were 17,393,000 million.
  - A newspaper costing one mark in May 1922 cost 1,000 marks 16 months later, and 70 million marks a year and a half later.
  - At its worst,
    - Customers rolled wheelbarrows full of money to the grocery store
    - Customers and restaurants negotiated the cost of meals in advance
    - Printed money was bailed like hay to heat one's home.
    - It took about 4 days for prices to double

Hyperinflation & Discretionary MP

Hyperinflation is a period of high inflation (> 50% per month)

- Erich Maria Remarque's *The Black Obelisk*:

> *Workmen are given their pay twice a day now--in the morning and in the afternoon, with a recess of a half-hour each time so that they can rush out and buy things--for if they waited a few hours the value of their money would drop*

- Steve Hanke's *R.I.P. Zimbabwe Dollar*:

- The time it took for prices to double in
  - 1994 Yugoslavia, 33.6 hours
  - 2008 Zimbabwe, 24.7 hours
  - 1946 Hungary, 15.6 hours

Hyperinflation & Discretionary MP

Hyperinflation in the Weimar Republic (Germany, post WWI)

Hyperinflation & Discretionary MP

Hyperinflation in the Weimar Republic (Germany, post WWI)

- Why did this happen?
  - In Nov. of 1918, there were **29,200,000,000** paper marks in circulation
  - A year later, **497,000,000,000,000,000,000** paper marks in circulation
  - That was a massive increase in the money supply, an increase of

1,702,054,794,421%

Hyperinflation & Discretionary MP

Yugoslavia had inflation problems in the 1980's, but in 1993 things really got bad.

$1 = 900 Dinar (1/1/93)
$1 = 2,000,000 Dinar (11/12/93)
$1 = 13,000,000 Dinar (11/23/93)
$1 = 64,000,000 Dinar (11/31/93)
$1 = 6,400,000,000 Dinar (12/15/93)

PRICES WERE DOUBLING EVERY DAY

$1 = 12,000,000,000,000,000,000,000 Dinar (1/24/94)

Keynes vs. Hayek

Keynes: advocate of proactive government intervention

- Budget deficits in recessions
- Surpluses in economic expansions
- Both can be used to manage AD, ensuring full employment

Hayek: advocate of economic freedom

- Government intervention results in
- Economic efficiency
- *"The problem was that under central planning, there was no economic calculation--no way to make a rational decision to put this resource here or buy that good there, because there was no price system to weigh the alternatives."*
- *"Socialism told us that we had been looking for improvement in the wrong direction."*
- The thesis in *The Road to Serfdom* is
  - Government intervention leads to
  - Each intervention has
  - Unintended consequences of well-intentioned policy
  - It is this dynamic that leads society

Keynes vs. Hayek

Keynesians intervene in the short-run to steer the economy back to full-employment. They pursue policies that close short-run recessionary and inflationary gaps.

Hayekians are not concerned with short-run fluctuations, advocating instead for pro-growth, free-market (not pro-business) polices.