Topics for Today

1.) Background on the "Subprime Crisis"

2.) Money and Inflation in the Long-Run
- Definitions of Money
- Money Supply
- Money Demand
- The "Quantity Theory"

3.) Inflation as a Tax

4.) Inflation and Interest Rates
- Real vs. Nominal
- The "Fisher Equation"

Background on Subprime Crisis

- Financial Institutions are intermediaries. They channel savings from households to firms who want to invest.

- Financial Institutions are leveraged (i.e., they invest with borrowed money).

A Bank's Balance Sheet

Assets	Liabilities
Business Loans	Deposits
Mortgages	
	Cash Reserves / Equity } Capital

- Banks take in deposits (they borrow from depositors), and lend out money to firms (and households, especially mortgages).
- They make money by paying a lower interest rate on deposits than they charge for their loans
- Why is this useful to society? (Maturity Mismatch)
  - Investment projects are long-lived and illiquid Mortgages/Houses are also illiquid
  - Depositors want ready access to their funds due to random expenditure needs

- So banks are in the business of "maturity transformation".
- What makes this work is the fact that not everyone needs their money at the same time.
- Suppose a bank has $100 of deposits, and that each person has a 10% chance of needing their money each period.
- With a large depositor base, it is very unlikely that more than $10 will be withdrawn each period.
- Therefore, the bank can (normally!) assume that it only needs to keep $10 on hand as reserves against withdrawals. It can lend out the remaining $90.
- Because of the interest spread between loans and deposits, it has an incentive to maximize its leverage

- Leverage exposes the bank to 2 kinds of risk

1.) **Bank Runs** - Since it has lent out $90 of the $100 (and these loans will be hard to liquidate at face value), the bank cannot pay off all its depositors at once, and depositors know this! A first-come, first served payout policy creates an incentive to not be the last in line!

Fortunately, govt. deposit insurance has largely prevented modern bank runs.

2.) **Loan Losses** - Since the bank's capital is only 10% of its loans, a modest 10% decline in asset values can wipe the bank out (i.e., leave it with no equity value. It becomes "insolvent").

This is what happened in the subprime crisis

Of course, (2) is related to (1), since fear of collapse can ignite a run among 'large' creditors.

Mortgage-Backed Securities

- The previous bank balance sheet was misleading in one important respect.
- During the past decade financial "innovators" came up with the idea of securitizing the mortgages that banks were holding
- This meant packaging them together in 'pools', and creating securities that would entitle the holder to the stream of future mortgage/rental payments.
- The logic behind this was based on a diversification argument. By pooling the default risk, the securities were supposed to be safer than individual mortgages.
- As a result, banks no longer held (risky) mortgages, they held (safe) securities. This led them to believe they could take on more leverage. (Oops!).

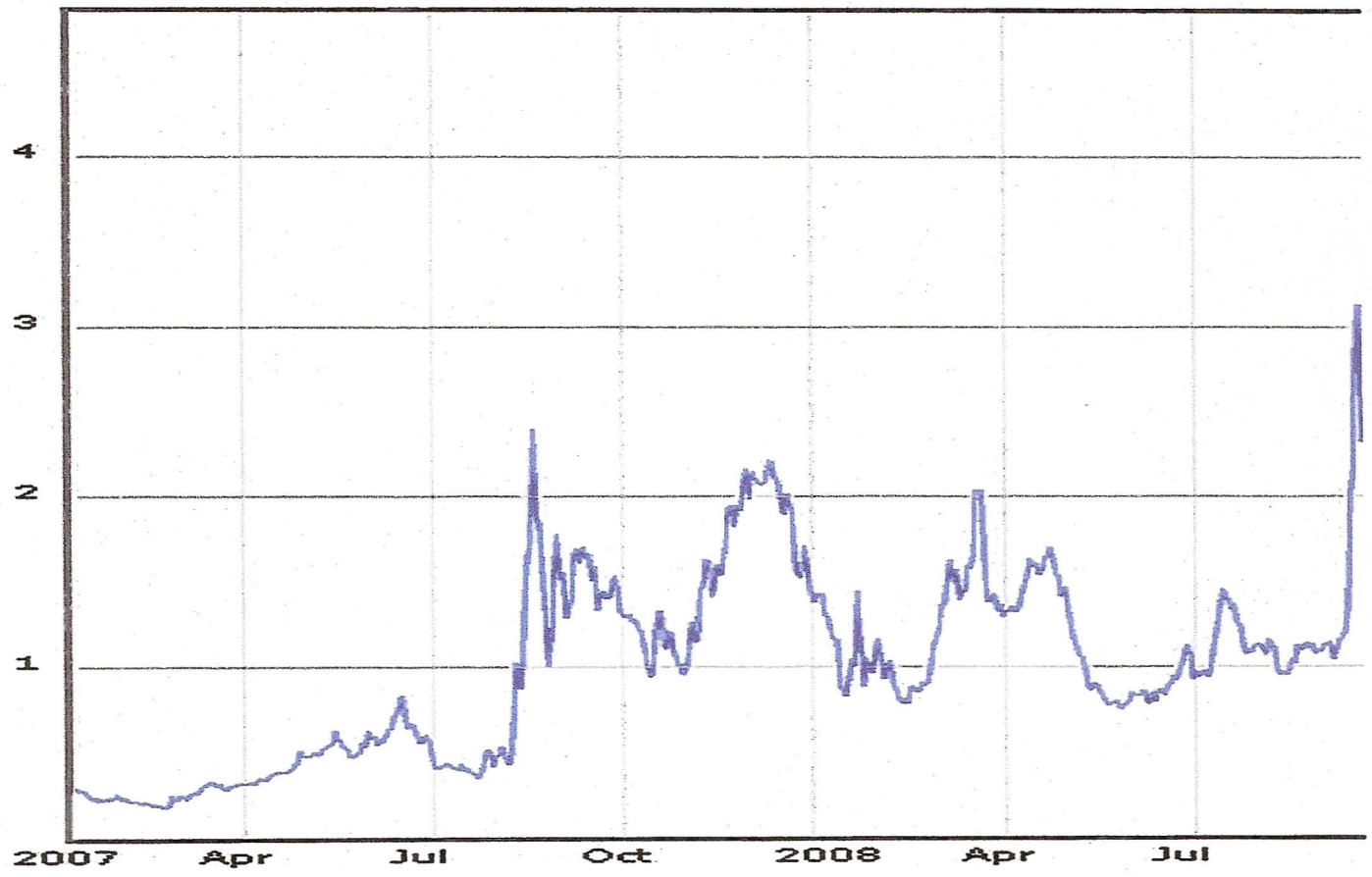
It turned out that mortgage-backed securities suffered from several problems that were not recognized at the time.

1.) Their risk was mispriced. Default risk has a major common component (e.g., interest rates, macroeconomic conditions) You can't diversify systematic risk!

2.) They make mortgages harder to renegotiate. (There's no one to talk to!)

3.) Counterparty Risk. Since these securities provided the basis for a pyramid of collateralized lending, it has become hard to evalnate risk within the financial system.

The "TED Spread" (A Measure of interbank credit risk).



Causes of the Crisis

1.) Speculation

2.) Securitization

3.) Mortgage Fraud/Deception ("teaser" rates)

4.) Inaccurate Credit Ratings (conflict of interests?)

5.) Relaxed Lending Standards / High Risk Loans

6.) Low Interest Rates in 2001-2004

7.) Moral Hazard (Previous Bailouts)

8.) Govt. Policy (the "Ownership Society")

Responses

1.) Bailout
   - Who Pays? How Much?
   - Details of "asset" acquisitions
   - insolvency vs. illiquidity?

2.) Relaxed Lending to Banks by the Fed
   - Accept risky assets as collateral

3.) (Re) Regulation

4.) Expanded Deposit Insurance

So far, all the prices we've been talking about have been relative prices.

Interest Rate: Price of current consumption relative to future consumption

Real Exchange Rate: Price of Domestic Goods relative to foreign goods

Real Wage Rate = Price of "leisure" (or non-market time) relative to consumption goods

This reflects our Long-Run focus, and the assumption that money has no effect on relative prices and other real variables in the Long Run.

Definitions of Money

Money is defined by its uses
- medium of exchange
- store of value
- unit of account

Medium of Exchange:

Money = The Stock of Assets Used to Carry Out Transactions

Commodity Money: Something that has other uses is also used as money.

Fiat Money: Something that is intrinsically useless is used as money

Evolution of Money

Commodity Money (e.g., gold & silver bullion)

Minting (Coins)

Convertible Paper Currency

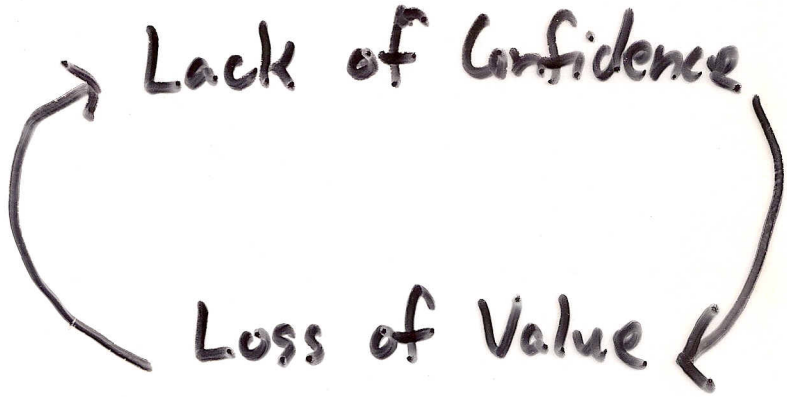
Fiat Money

Fragility of Fiat Money Systems

Fiat money only has value because other people think it has value.

Money is merely a social convention used to facilitate transactions.

Fragility:



Money Supply

How does money get into the economy?

"Open-Market Operations"

Open-Market Purchase of Bonds $\Rightarrow$ Money Supply Increases

Open-Market Sale of Bonds $\Rightarrow$ Money Supply Decreases

Measures of Money

Less Liquid

1.) Currency held by the public + Bank Reserves

"Monetary Base"

≈ $37 billion

2.) Currency + Reserves + Checking Accounts

"M1"

≈ $100 billion

3.) M1 + Personal Savings Accts.

"M2"

≈ $475 billion

4.) M2 + Non-Personal Fixed Term Deposits + Foreign Currency Deposits

"M3" ≈ $615 billion

The Money Multiplier

- The Central Bank can only directly control the Monetary Base. Broader definitions of money, like M1 or M2, are influenced by the portfolio decisions of households & the lending decisions of banks.

- Let $M = D + CU$ } Money Supply

  D: deposits, CU: currency

$$H = R + CU$$ } Monetary Base

  R: reserves

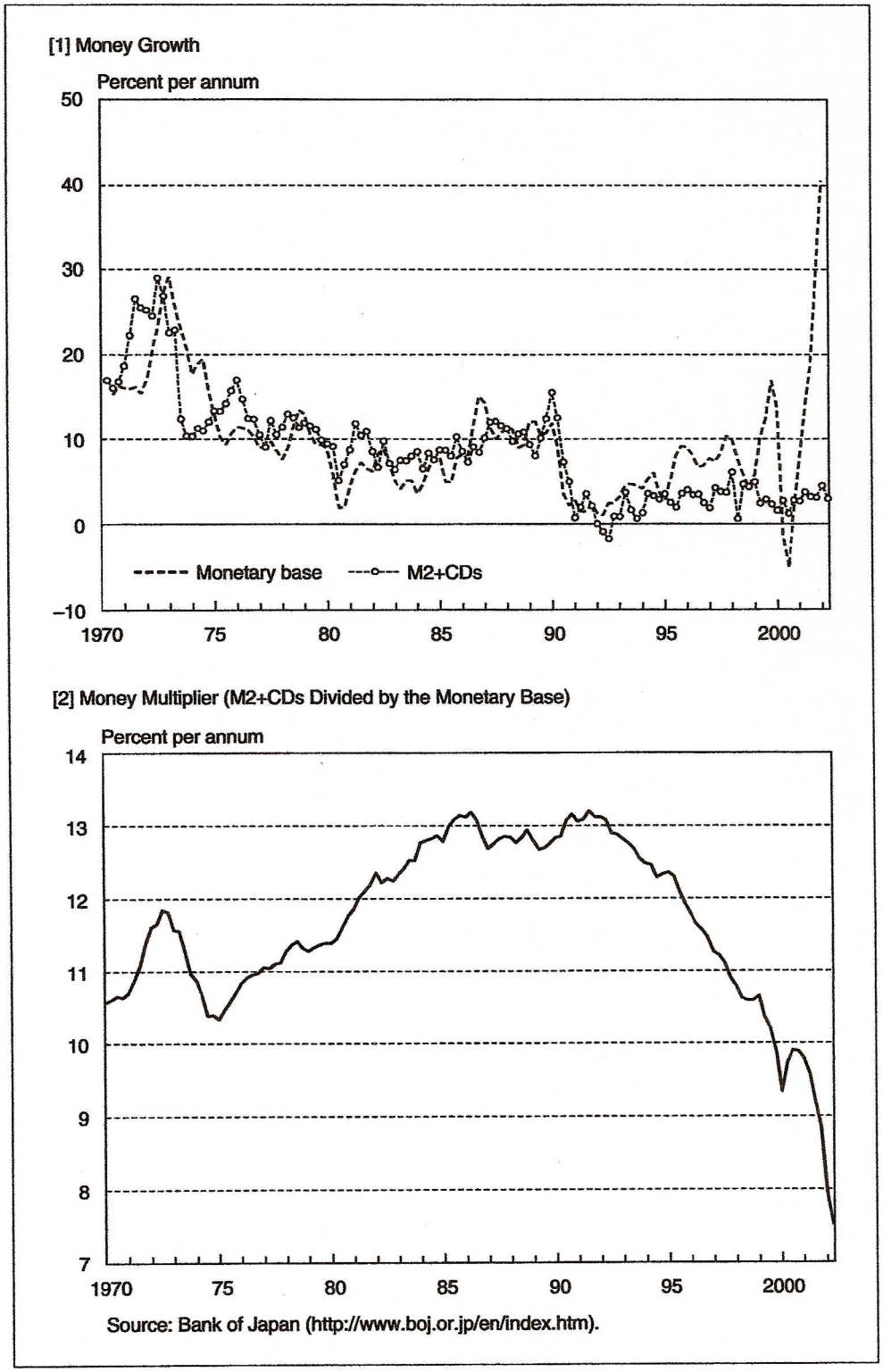
- Then $$\frac{M}{H} = \frac{D + CU}{R + CU} = \frac{1 + cu/D}{R/D + cu/D} = \frac{1+c}{r+c}$$

$$\Rightarrow \quad M = \left(\frac{1+c}{r+c}\right) H$$

Money Multiplier

- During financial crises, $r\uparrow$ $c\uparrow$, and the money multiplier falls.

Figure 3 Money Growth and the Money Multiplier in Japan



Source: Bank of Japan (http://www.boj.or.jp/en/index.htm).

Money Demand

Since people hold money in order to make transactions, money demand should be related to the number of transactions.

Suppose it's proportional

$$M^d = k\,P \cdot Y$$

k = fraction of their income that individuals hold as money

The "Quantity Theory"

Re-write $M^d = k\,P \cdot Y$ as follows:

(imposing the equilibrium condition $M^d = M^s = M$

$$M \cdot \frac{1}{k} = P \cdot Y$$

Quantity Equation

Define $\frac{1}{k} = V \Longrightarrow$ **$MV = PY$**

$$V = \frac{P \cdot Y}{M} = \text{"Velocity" of Money}$$

= Number of Times a dollar enters someone's income during a given time period

(Ignoring used goods + illegal activity) = Number of Times a dollar changes hands during a given time period

Define,

$g = \frac{\Delta Y}{Y}$ = The economy's growth rate

$\mu = \frac{\Delta M}{M}$ = Money growth rate

$\pi = \frac{\Delta P}{P}$ = Inflation Rate

Then, assuming $\Delta V = 0$,

$$\pi = \mu - g$$

What is the velocity of the Canadian Monetary Base?

$$V = \frac{1000}{37} \approx 27 \text{ times/year}$$

$$\approx 2^{+} \text{ times a month}$$

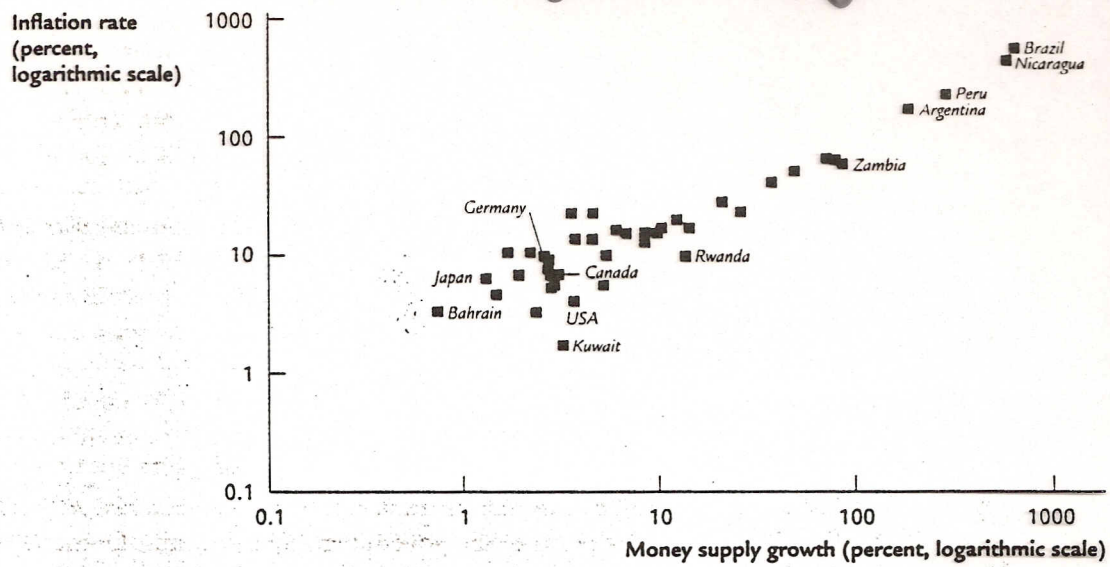
If we write the Quantity Equation in terms of % changes, we get a theory of inflation:

$$MV = PY$$

$$\frac{\Delta M}{M} + \frac{\Delta V}{V} = \frac{\Delta P}{P} + \frac{\Delta Y}{Y}$$

- $\frac{\Delta M}{M}$: Money Growth Rate
- $\frac{\Delta P}{P}$: Inflation Rate
- $\frac{\Delta Y}{Y}$: Real GDP growth rate

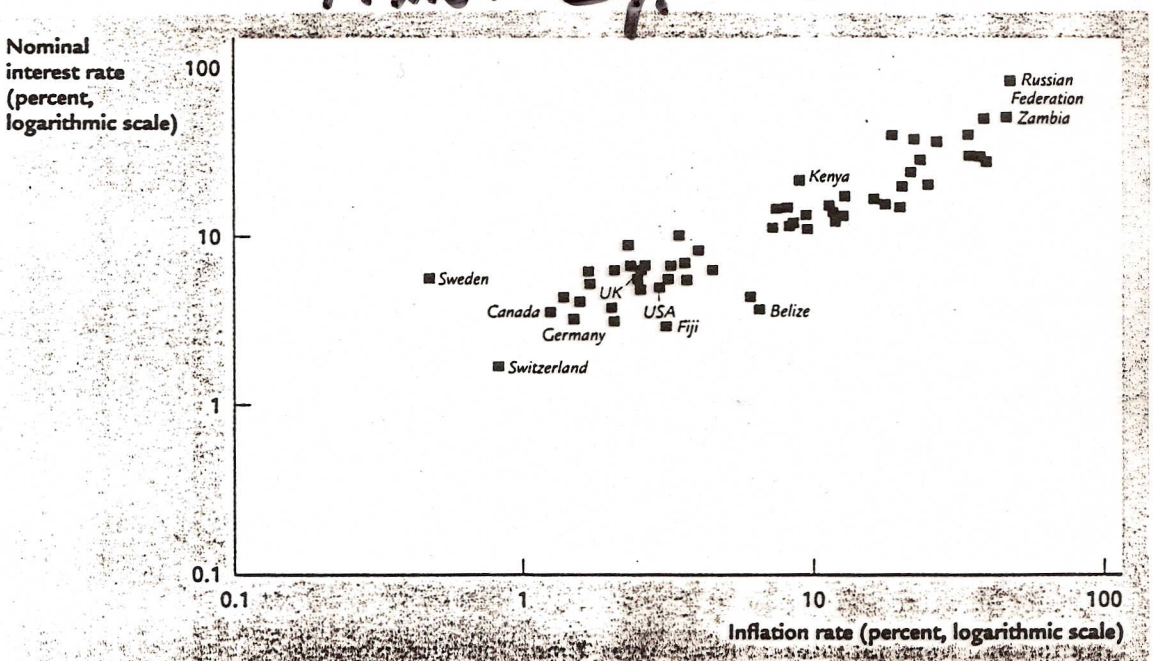
Quantity Theory



International Data on Inflation and Money Growth In this scatterplot, each point represents a country. The horizontal axis shows the average growth in the money supply (as measured by currency plus demand deposits) during the 1980s, and the vertical axis shows the average rate of inflation (as measured by the GDP deflator). Once again, the positive correlation is evidence for the quantity theory's prediction that high money growth leads to high inflation.

Source: International Financial Statistics.

Fisher Eq. : $i = \pi + r$



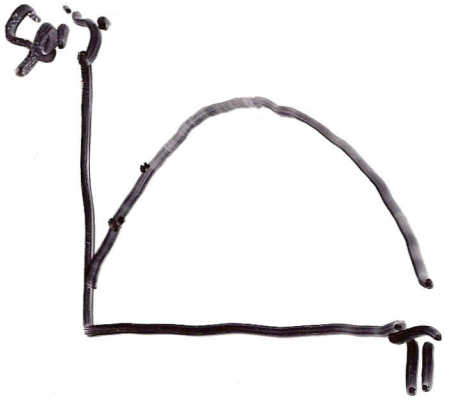
Inflation and Nominal Interest Rates Across Countries This scatterplot exhibits the three-month nominal interest rate and the inflation rate (during the previous year) in 58 countries in 1996. The positive correlation between the inflation rate and the nominal interest rate is evidence for the Fisher effect.

Source: International Financial Statistics.

Inflation as a Tax

If money growth causes inflation, why do countries adopt monetary policies that produce inflation?

Seignorage: The Revenue from printing money



$$= \frac{\Delta M}{P}$$

$$= \frac{\Delta M}{M} \cdot \frac{M}{P} = \mu \frac{M}{P}$$

$\pi \uparrow$ ($\frac{M}{P} \downarrow$)

$$\frac{\text{Seignorage}}{Y} = \mu \frac{M}{PY} = \mu \frac{1}{V}$$

$$= (\pi + g) \frac{1}{V}$$

$$\approx (.02 + .03)(.04)$$

$$\approx .2\%$$

Since $Y \approx 1000$

Seig. $\approx \frac{1}{2}$ billion

The Fisher Equation

i = Nominal Interest Rate

r = Real Interest Rate

π = Inflation

$$r^e = i - \pi^e$$

$$1+r = \frac{1+i}{1+\pi} \approx 1 + i - \pi$$

$$\Rightarrow \boxed{i = r + \pi}$$ > Fisher Eq.

- r: determined by MPK
- π: determined by money growth