Monetary Policy

Part I: Money and Inflation in the Long-Run

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Agenda

- Two classes on money, inflation, and monetary policy

    – introduction: basic concepts and hyperinflation (today)
    – monetary policy: goals, instruments, central banking, and monetary transmission mechanism (next week)

Today

- Basic concepts and theories

    – quantity theory of money

        * money and inflation in the long run

    – Fisher effect

        * interest rates and expected inflation in the long run

- Hyperinflation

    – examples
    – connection to fiscal policy

Money concepts

- What is money? Traditional answers

    – medium of exchange
    – store of value

- Consider assets safe in nominal terms

    – more liquid, zero or low interest-bearing assets 'money'
    – less liquid, higher interest-bearing assets 'bonds'
    – spectrum, no hard boundaries (so M0, M1, M2, etc)

- Some monetary assets created by government

- Some monetary assets created by private sector

Money and exchange

- Why is money accepted in exchange?

    - alternative is a barter economy
    - money overcomes 'double coincidence of wants' problem
    - facilitates specialization

- What monetary assets solve this problem?

    - cash?
    - credit?

Prices and inflation

Price level and inflation

- Given some money, how much real stuff can I consume?

    - answer depends on prices as summarized by price level
    - consumer price index (CPI) or GDP deflator

- High price level means consume less for given amount of money

- We will use the symbol P for the price level and π for inflation

- Inflation is the rate of growth in the price level

    $$\pi_t = \gamma_{P,t} = \log(P_t) - \log(P_{t-1})$$

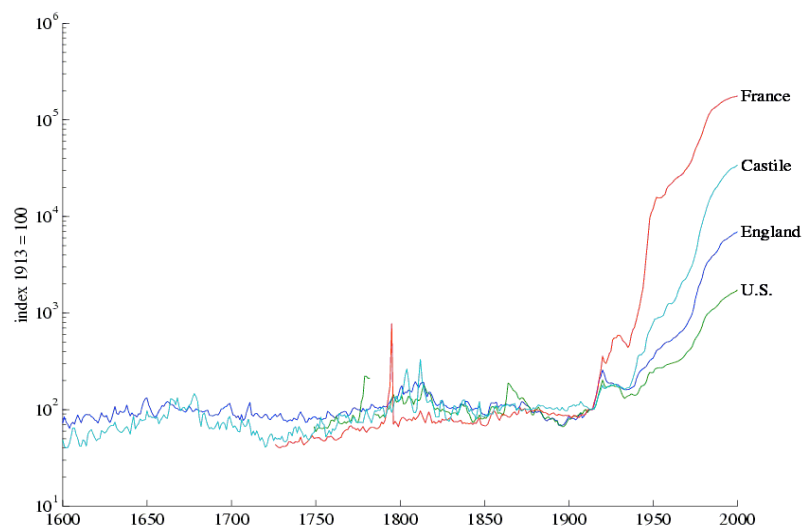# Monetary regimes

- Gold standard, etc

    - historical notion: actual use of commodity in exchange
    - modern notion: paper money backed by government

        'one US dollar worth $\dfrac{1}{35}$ of a troy ounce (889 mg) of gold'

    - if credible, pins down price level
    - problems?

- Fiat money

    - historical notion: paper money, legal status by government decree
    - modern notion: paper money unbacked by government
    - problems?

Monetary regimes

Costs of high inflation

- Time and energy devoted to avoiding holding money

  – costs of changing nominal prices
  – in extreme cases, money no longer useful for transactions
  – if so, revert to barter economy (or 'dollarize')

- With high and/or variable inflation, need to index contracts

  – wages, bond payments, mortgage payments
  – otherwise, inflation redistributes from lenders to borrowers

Monetary neutrality

- Classic thought experiment

  – government replaces each dollar with a 'strong dollar'

    $$\$^{str}1 = \$10$$

  – drop a zero to get prices in strong dollars, nothing real changes
  – money is neutral

- Real-world examples

  – currency reforms, introduction of euro

- Questions

  – is money neutral?
  – implications for monetary policy?
  – if money is neutral, why worry about inflation?

Monetarism

- Milton Friedman:

  *The fact is that **inflation is always and everywhere a monetary phenomenon**. There has never been an inflation in the course of history which has not been produced by an excessively rapid rate of increase in the quantity of money. The quantity of money has gone up faster than total output and the result inevitably has been a rise in prices.*

- What does this mean? Why does he say this?

  – he is articulating the 'quantity theory of money'
  – what's that?

Velocity of money

- One dollar used to execute several transactions per period of time

- Velocity, V is defined by

$$V \equiv \frac{PC}{M}$$

  where P is price level, C is real consumption, M is money supply

- Often written

$$MV = PC$$

- So far, this is just a definition

Long run evidence on the quantity theory

Quantity theory of money (first take)

- Velocity of money

$$MV = PC$$

- Assumptions

  1. level of velocity approximately constant
  2. growth rate of **real** consumption independent of money supply
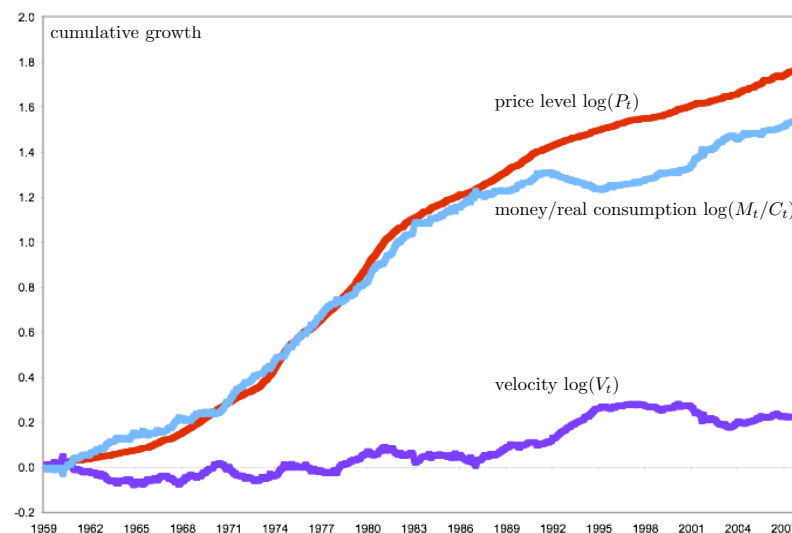 3. money supply controlled by the government

- Implication: inflation is a monetary phenomenon

$$\pi \equiv \gamma_P = \gamma_M + \gamma_V - \gamma_C = \gamma_M - \gamma_C$$

- Money growth in excess of consumption growth causes inflation

Inflation and interest rates

- **Nominal** interest rate. Example

  – bond pays $100 in one year
  – current price is $96.15
  – annualized interest rate i solves

$$96.15 = \frac{100}{1+i} \quad \Rightarrow \quad i = 0.04$$

- **Real** interest rate. Usual measure

$$r = i - E\{\pi\}$$

  where $E\{\pi\}$ is expected inflation (why 'expected'?)

Fisher expected inflation effect

- Real and nominal interest rates

  $$i = r + E\{\pi\}$$

- Irving Fisher's theory

 - real interest rates independent of monetary forces
  - instead determined by

    * time discounting
    * growth rate of real output, productivity
    * demographics, etc

- Implications

  - monetary policy can only influence expected inflation
  - nominal rates and expected inflation should move together

Fisher effect with high inflation

Greece – Inflation and Nominal Rates

Legend: Yield on 3–month T–Bill · Rate of inflation
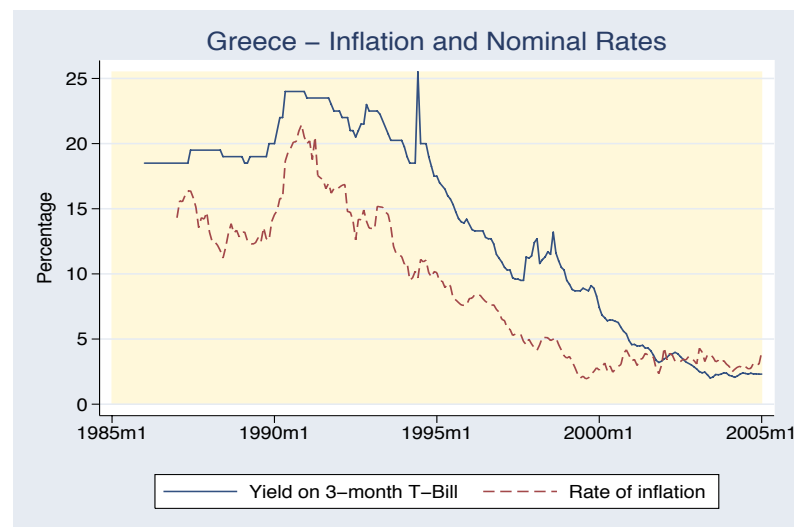
Evidence and implications
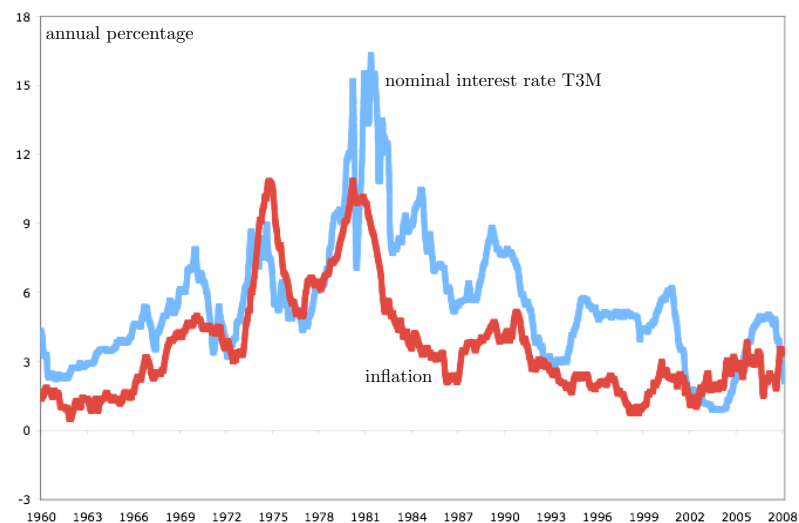
- Evidence for Fisher's theory?

  - works when high inflation or in long run
  - does not work when low inflation or in short run

- Implication

  - monetary policy influences real rate in short run
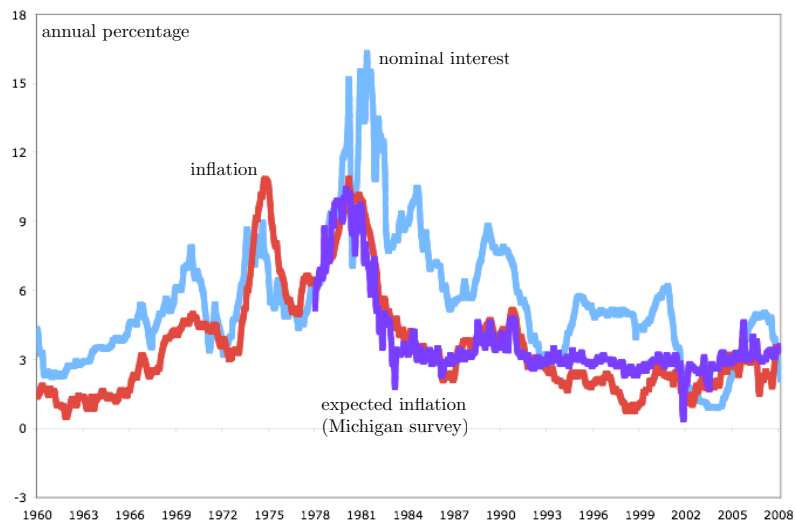 - monetary policy does not influence real rate in long run

US nominal interest rates and inflation

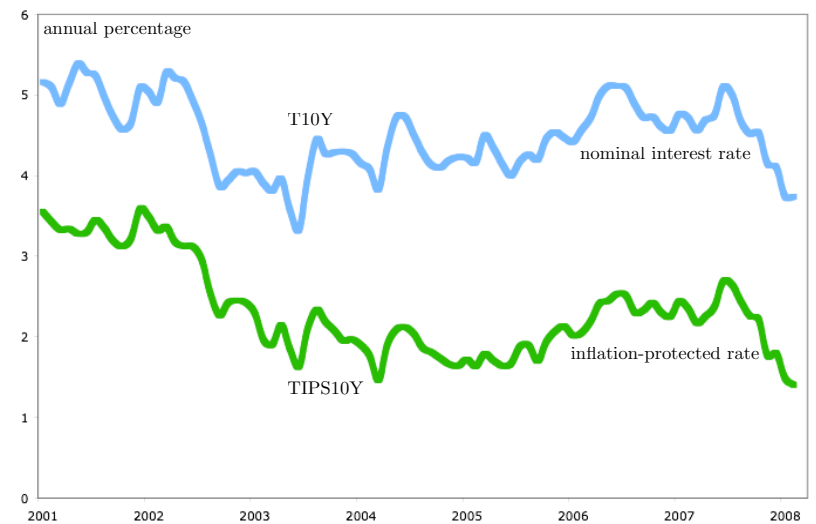annual percentage. nominal interest rate T3M. inflation.

Inflation and expected inflation
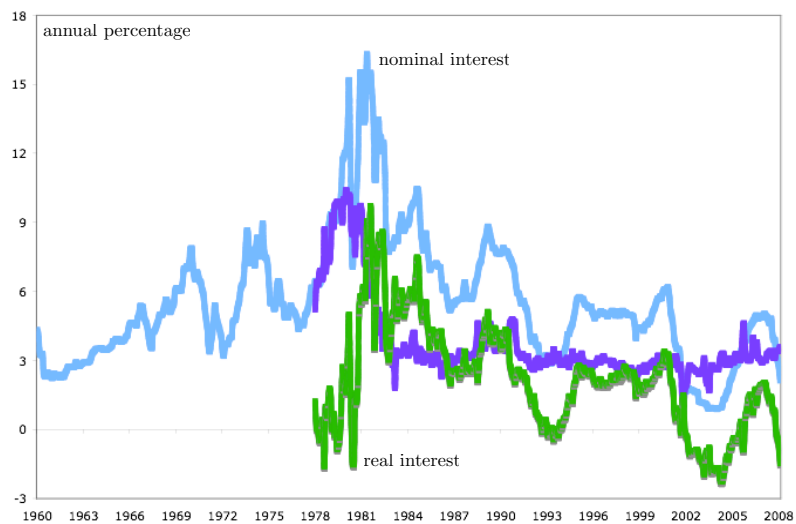

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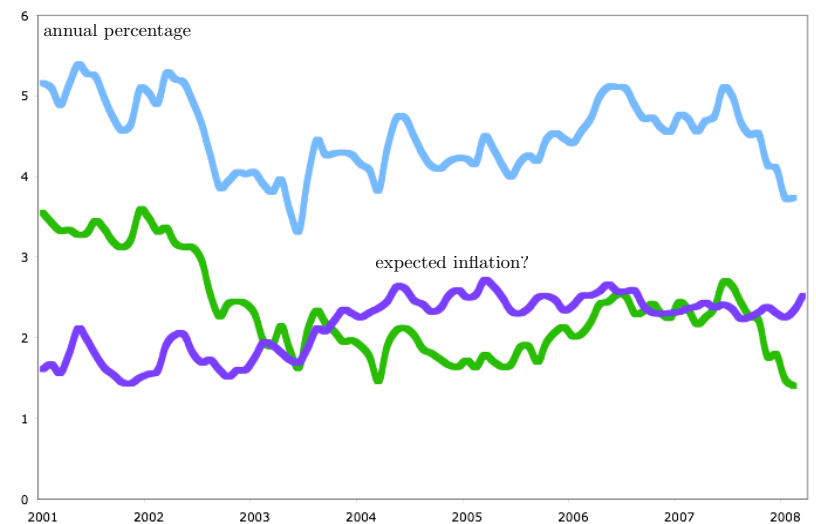## Treasury inflation-protected securities (TIPS)

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Nominal and real interest rates

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Naive measure of market expectations

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Naive measure of market expectations

- Recall usual formula

$$i = r + E\{\pi\}$$

- Main idea

  - if TIPS rate is market real rate r
  - then expected inflation is nominal rate less TIPS rate

- Problems

  - TIPS rate is not quite market real rate r
  - TIPS market less liquid than treasuries market – *liquidity premium*
  - usual formula only an approximation, does not account for *inflation risk premium*
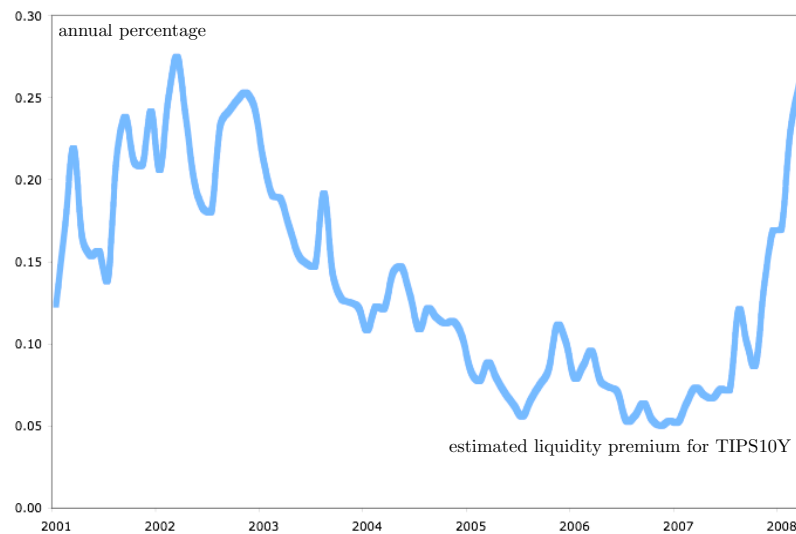
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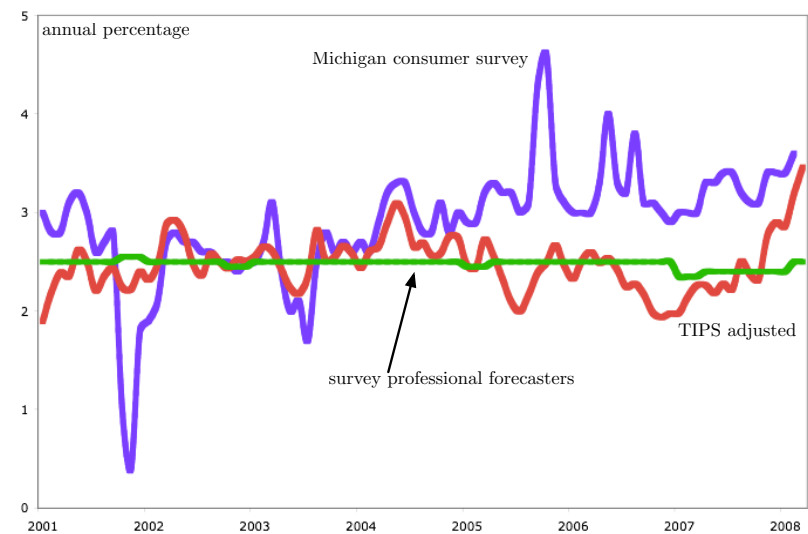## After adjusting for liquidity and inflation risk
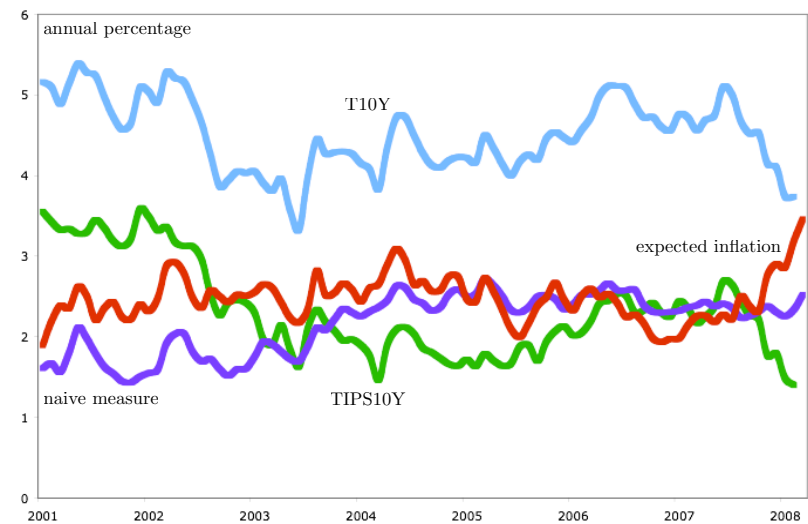
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Liquidity premia in TIPS market

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Various measures of expected inflation

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What have we learned so far?

- In the long run

    – money neutral
    – inflation caused by money growth in excess of consumption growth
    – nominal interest rates reflect expected inflation

- But in the short run, especially if inflation is low

    – money not neutral
    – real interest rates and nominal interest rates move together

Rest of this class

- Hyperinflation

    – examples
    – connection to fiscal policy
    – preventing them

Argentina

This note is from the 1980s. What's it worth today? Why?

Germany

October 1923: 20 dollars = 100,000,000,000 marks

Germany

Progression of stamps in Weimar Germany

German hyperinflation

End result of a hyperinflation?

Open market operations

- Monetary base controlled by central banks

- Introduce money via open market operations

    - open market **sale**: sell government debt, receive money
    - open market **purchase**: buy government debt, pay money

- Implies

    - fiscal deficit financed with mix of bond issues and printing money

- Seignorage

    - revenue obtained by monetizing fiscal deficits

Fiscal origins of hyperinflation

- Financing government deficits

$$\text{deficit} = (M_{t+1} - M_t) + (B_{t+1} - B_t)$$

where

$$M_t = \text{ money supply at date } t$$

$$B_t = \text{ bonds outstanding at date } t$$

- Why would government finance deficit by printing money?

    - intractable deficit
    - no buyers for government debt

German experience

- 1914 suspended convertibility of currency for gold

- 1914-1918 borrowed to finance WWI

- 1919-1923 big deficits continue, war reparations, deficits monetized

- 1922 inflation peaks at 3.35 million percent per month

- 1923 fiscal-monetary reform: 1 '**gold**' mark $= 10^{12}$ paper marks

Latin American hyperinflations

	Argentina	Bolivia	Brazil	Nicaragua	Peru
1984	627	1,281	192	35	110
1985	672	11,750	226	219	163
1986	90	276	147	681	78
1987	131	14	228	911	86
1988	343	16	629	10,205	667
1989	3,080	15	1,430	47,770	3,399
1990	2,314	17	2,947	7,485	7,482
1991	172	21	432	2,945	410
1992	25	12	951	23	74
1993	10.6	9	1,977	20	49
1994	0.16	12	16	11.6	12

European hyperinflations

Country	dates	average inflation (per month)
Austria	1921-1922	47%
Germany	1922-1923	322%
Greece	1943-1944	365%
Hungary	1923-1924	46%
Hungary	1945-1946	19,800%
Poland	1923-1924	81%
Russia	1921-1924	57%

Brazilian example
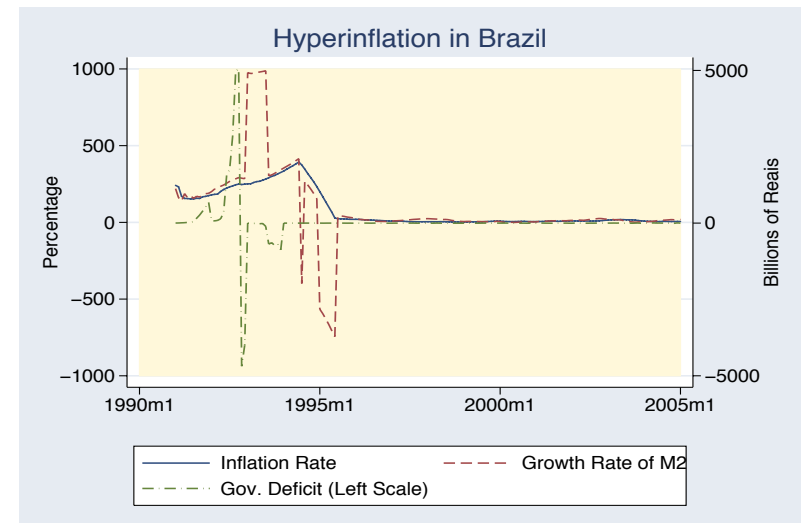
Zimbabwe

date	average annual inflation (official)
1980	7%
1985	10%
1990	17%
1995	28%
2000	55%
2001	112%
2002	199%
2003	599%
2004	133%
2005	586%
2006	1,281%
2007	66,212%

Paying for lunch

Zimbabwe

- 1980 independence, de facto one party state

- 1980-1990s steady decline in living standards, political dissent

- 2000 begins policy of redistributing white-owned farms

- 2000s export collapse, difficulties paying foreign loans, inflation

- Feb 2006 government prints 20.5 trillion ZWD to pay foreign loans

- Aug 2006 redenomination 1 new ZWD = 1000 old ZWD

- Feb 2007 inflation declared 'illegal,' price controls

- Nov 2007 'impossible to calculate inflation any further'

Preventing hyperinflation

- Inflation caused by excessive money growth

- Money growth because of monetized fiscal deficits

- Orthodox solution

  - independent central bank
  - goal of central bank: price stability
  - fiscal discipline

- Even mild inflation can get out of hand because of momentum

  - need to 'anchor' inflation expectations