

Session 9:

A Dismal Science — Inflation in the Long Run

Chad Jones
Stanford GSB

Outline

- The Quantity Theory of Money
- Real and nominal interest rates
- The costs of inflation
- The fiscal causes of high inflation

Inflation

- Inflation: The percentage change (growth rate) in the price level
- What are the highest rates of inflation you've ever experienced?

Worst Hyperinflations in History (select)

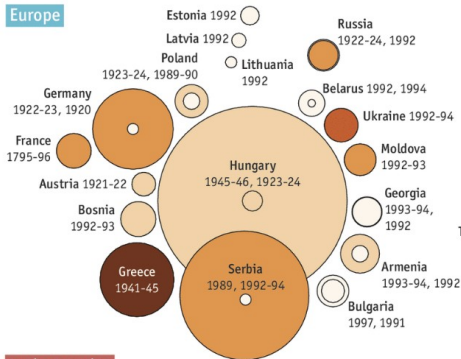
| | When? | Peak monthly inflation rate | Time for prices to double |
|----------|-----------|-----------------------------|---------------------------|
| Hungary | July 1946 | $4 \cdot 10^{16}\%$ | 15 hours |
| Zimbabwe | Nov 2008 | $8 \cdot 10^{10}\%$ | 25 hours |
| Germany | Oct 1923 | 30,000% | 3.7 days |
| Taiwan | May 1949 | 2,200% | 6.7 days |

Currency in Zimbabwe in 2008

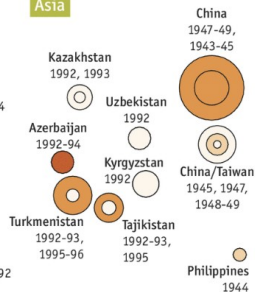


A World of Hyperinflation

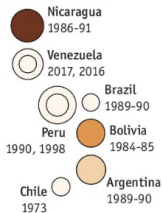
Europe



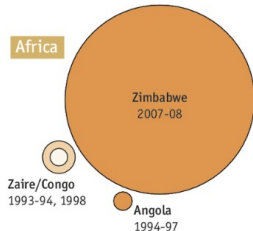
Asia



Latin America



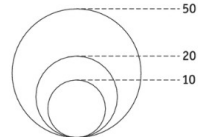
Africa



Duration, months

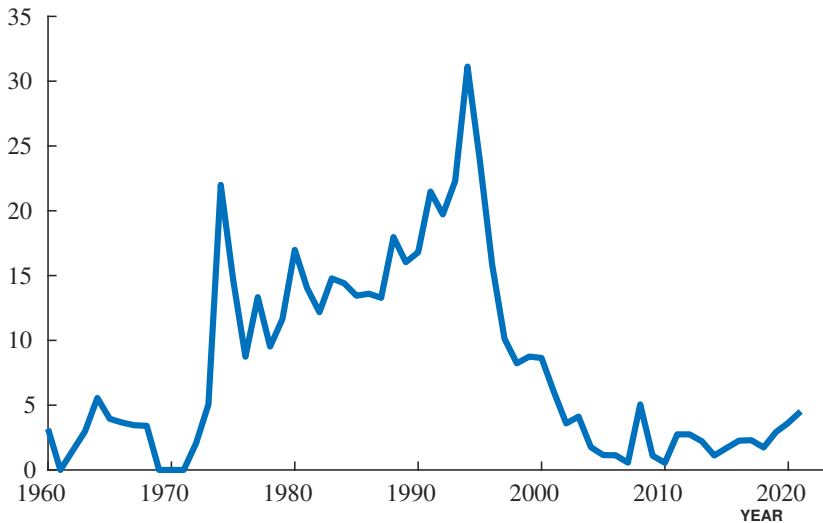


Maximum daily inflation rate, %

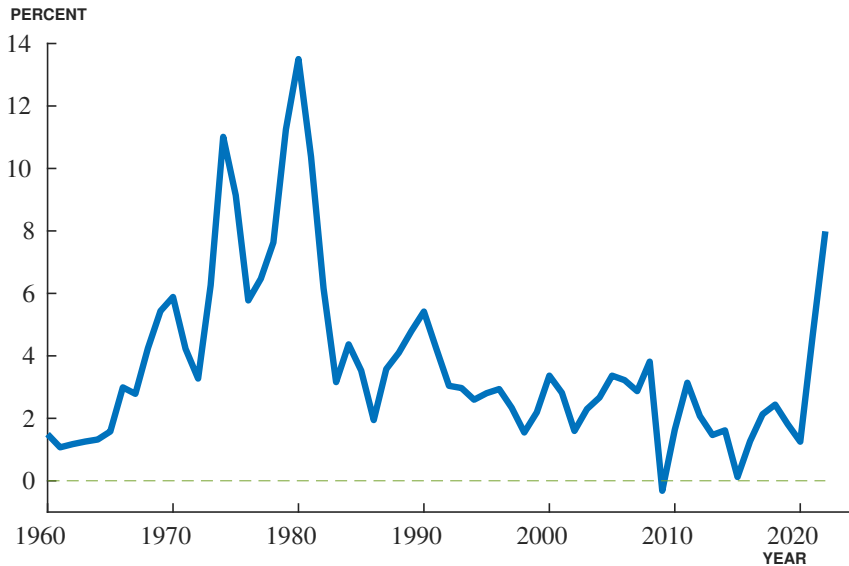


Fraction of Countries with Inflation > 25%

PERCENT OF COUNTRIES



Inflation in the United States



Real and Nominal Interest Rates

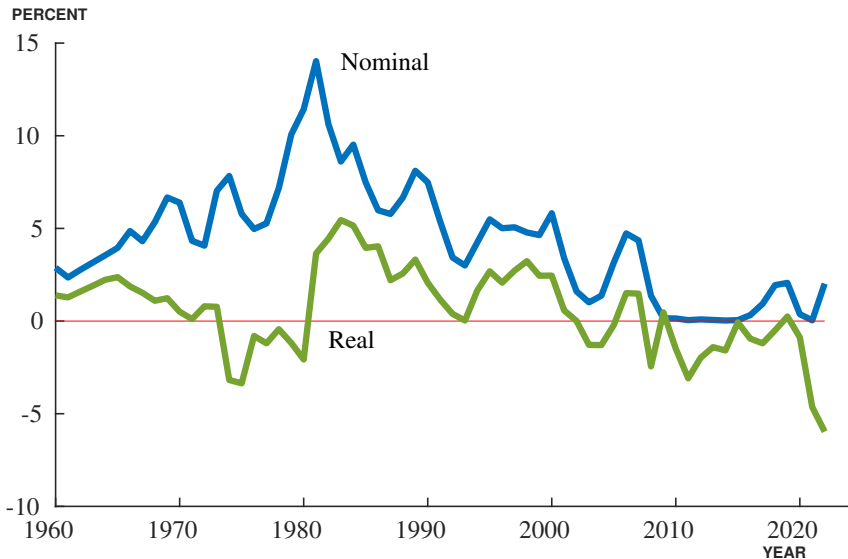
- Recall: what determines the real interest rate?
- What is a nominal interest rate?
- The Fisher equation:

$$i = r + \pi$$

- What is the economic intuition behind this relationship?

Suppose $r = 5\%$ and $\pi = 3\%$...

Real and Nominal Rates on 3-month U.S. T-bills



Inflation Indexed Treasury Bonds

- TIPS (Treasury Inflation Protected Securities)
 - The principal is indexed to the CPI, so there is no inflation risk and the rate of return is the **real** interest rate.
- Rates as of May 1, 2023

| Maturity | T-Bond Nominal Yield | TIPS Real Yield | Implied expected inflation |
|----------|----------------------------|-----------------------|----------------------------------|
| 5 year | 3.64 | 1.40 | 2.24 |
| 10 year | 3.59 | 1.36 | 2.23 |
| 30 year | 3.84 | 1.61 | 2.23 |

<http://www.federalreserve.gov/releases/h15/Update/>
Note 5 year inflation expectation was 3.5% a year ago!



The Quantity Theory of Money

What is money?

- What is money?
- Why do pieces of paper with weird colors and funny pictures have value?

What is money?

- What is money?
- Why do pieces of paper with weird colors and funny pictures have value?
- **Money is a social convention.** Rocks, sea shells, metal, paper. . .
- Money is useful as a
 - Medium of exchange (double coincidence of wants/barter system)
 - Store of value
 - Unit of account

The Quantity Equation

$$M_t V_t = P_t Y_t$$

The Quantity Equation

$$M_t V_t = P_t Y_t$$

M_t = Amount of money in the economy

P_t = Price level

Y_t = Real GDP

V_t = Velocity of money

Toward the Quantity Theory

- To make this equation pin down the price level, we need to explain how the other three variables (Y_t , V_t , and M_t) are determined
 - Y_t : The Classical Dichotomy (more later)
 - $V_t = \bar{V}$: Constant velocity (simplifying assumption, see M2 data)
 - M_t : Determined by the central bank
- Then, we can rearrange the quantity equation as

$$P_t = \frac{M_t \bar{V}}{Y_t}$$

- Interpretation?

Toward the Quantity Theory

- To make this equation pin down the price level, we need to explain how the other three variables (Y_t , V_t , and M_t) are determined
 - Y_t : The Classical Dichotomy (more later)
 - $V_t = \bar{V}$: Constant velocity (simplifying assumption, see M2 data)
 - M_t : Determined by the central bank
- Then, we can rearrange the quantity equation as

$$P_t = \frac{M_t \bar{V}}{Y_t}$$

- Interpretation?
 - Prices equal amount of spending divided by the amount of goods.

“Too much money chasing too few goods.”

The Quantity Theory and Inflation

- How can we use this result to explain [inflation](#)?

The Quantity Theory and Inflation

- How can we use this result to explain inflation?
- Recall the Quantity Equation:

$$M_t V_t = P_t Y_t$$

- Apply our growth rules to this equation

$$g_M + g_V = g_P + g_Y$$

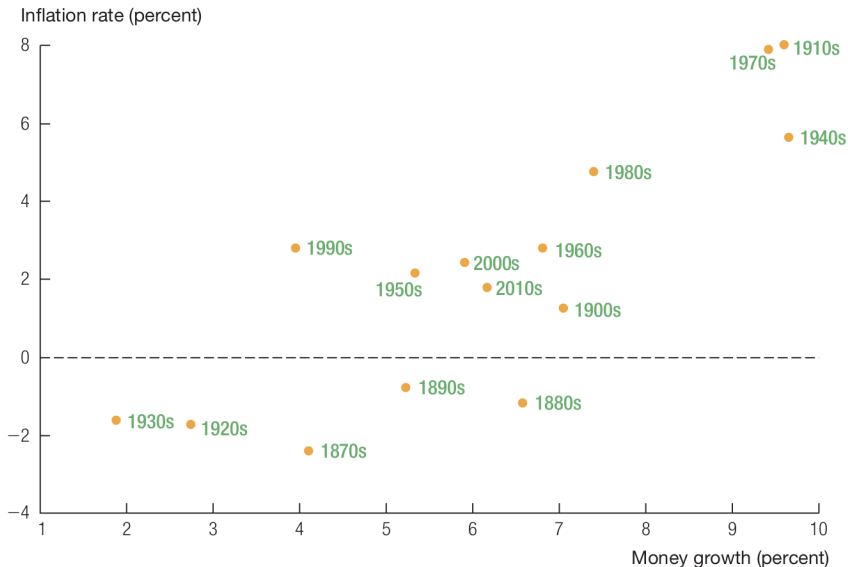
- Let $\pi \equiv g_P$ and recall $g_V = 0$

$$\pi = g_M - g_Y$$

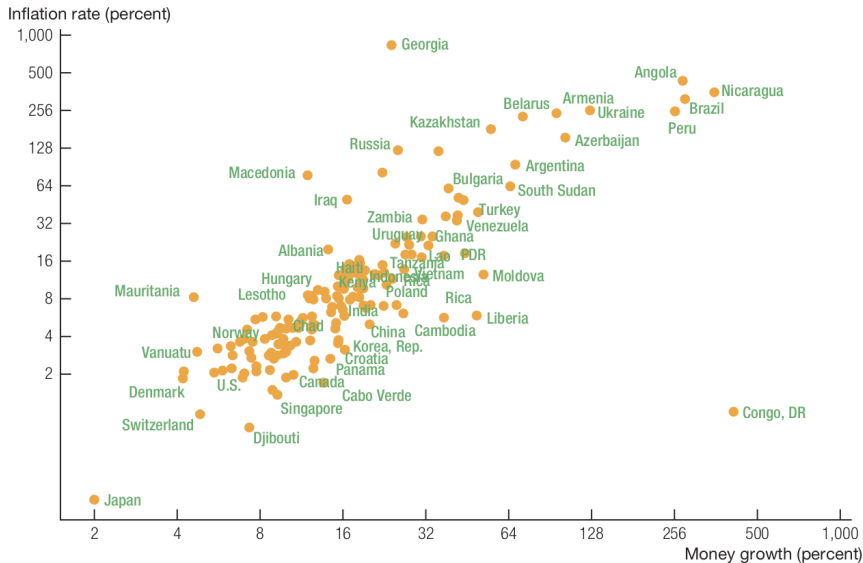
“Inflation is always and everywhere a monetary phenomenon.”

— Milton Friedman

Money Growth and Inflation in the U.S.



Money Growth and Inflation, World since 1990



The Color of Money...

- Revisiting the classical dichotomy: Why do we say that “money is neutral in the long run”?

We've actually seen this!





The Costs of Inflation

What are the costs of inflation?

What are the costs of inflation?

- Surprise inflation redistributes from creditors to debtors
 - Loss of wealth for people on fixed incomes/annuities (retirees)
 - Banks, financial institutions
- U.S. tax system in the 1970s taxed **nominal** not real income
 - Bracket creep in the income tax system
 - Taxation of nominal returns to businesses can distort. How?
- Relative prices can be distorted if some prices change quickly while others are “sticky” → misallocate effort/goods

Proper indexation can eliminate the costs of inflation, but when it occurs in unexpected ways, the costs can be high



The Fiscal Causes of High Inflation

Why is there high inflation?

- The Quantity Theory tells us that inflation is caused by “too much money chasing too few goods”
- But why would a central bank print too much money if it knows that costly high inflation will result?

What is this equation?

$$G = T + \Delta B + \Delta M$$

What is this equation?

$$G = T + \Delta B + \Delta M$$

The government budget constraint

Seignorage (aka the Inflation Tax)

- Suppose the government spends \$1 trillion on infrastructure investment — how can it be financed?
 - One possibility is to print new currency
 - No borrowing, and no taxes — what a deal!
 - The revenue is called **seignorage**
- Who pays for this program?

Seignorage (aka the Inflation Tax)

- Suppose the government spends \$1 trillion on infrastructure investment — how can it be financed?
 - One possibility is to print new currency
 - No borrowing, and no taxes — what a deal!
 - The revenue is called **seignorage**
- Who pays for this program?
 - Long-run effect → raise prices (Quantity Theory) = the **inflation tax**
 - Tax on holders of currency and other nominal instruments (bonds)
 - Holders of stocks, gold, labor, and real estate do not pay the inflation tax. Why?

When does the inflation tax get used?

When does the inflation tax get used?

- In normal times and in well-functioning economies, taxes today and taxes in the future (borrowing) are the main source of finance
- Imagine a government with a large growing budget deficit, financed by borrowing, and suddenly lenders become worried that the government will not repay
 - It may be difficult to raise taxes to cover the shortfall — many countries find it hard to collect income taxes
 - Inflation tax may be only alternative
 - Especially during and after wars
 - Validates the concern that lenders had about repayment

“Persistent high inflation is always and everywhere a fiscal phenomenon.”

— Tom Sargent

Greece / Ireland / Portugal / Spain / Italy?

- How is this story related to Europe in the 2010s?

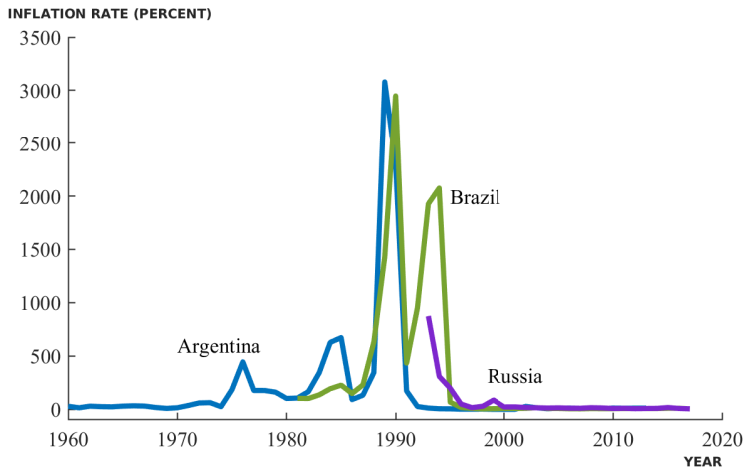
Greece / Ireland / Portugal / Spain / Italy?

- How did these countries get into trouble?
 - Greece: Shady accounting – government borrowed more than it reported
 - Ireland: Insuring financial institution debt at par
- Euro area: These countries **cannot** use inflation (even at modest levels) to help solve their problems
 - US after WWII: a combination of gradual inflation and growth reduced the debt-GDP ratio
 - Will not benefit significantly from inflation and cannot devalue their currencies to make their economies competitive in the short run
 - Makes explicit default more likely (restructuring)
 - Puts the euro arrangement itself under pressure (might Greece have dropped out?)



Hyperinflations

Hyperinflation in Argentina, Brazil, and Russia

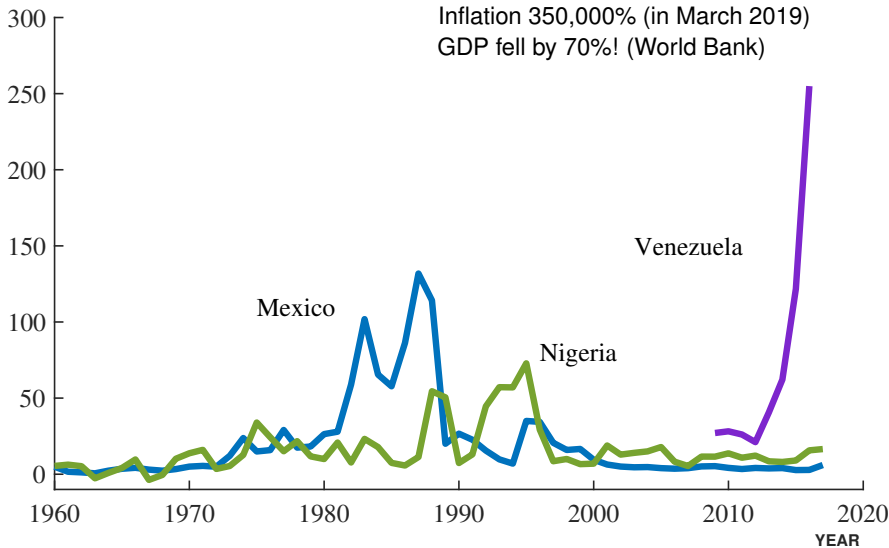


- Rapid starts and ends (recall, surprises are most costly)
- Recurrences (need to fix fiscal root cause)

High Inflation in Mexico, Nigeria, and Venezuela

INFLATION RATE (PERCENT)

Reading: The Tragedy of Venezuela
Inflation 350,000% (in March 2019)
GDP fell by 70%! (World Bank)



The End of Hyperinflations?

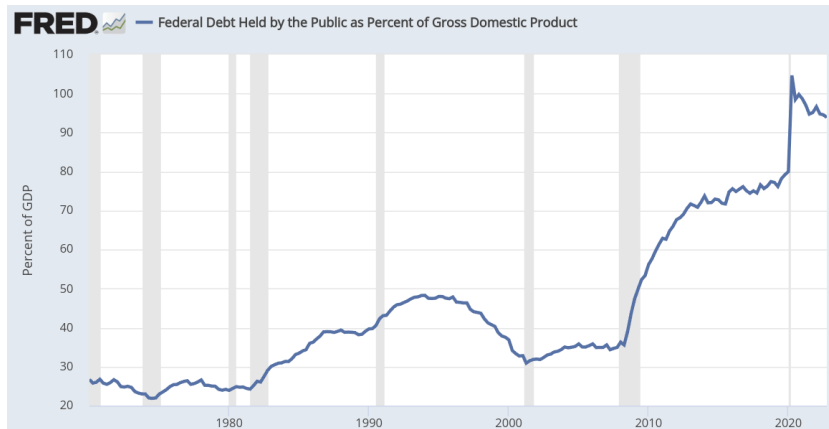
- How do episodes of high inflation or hyperinflation end?

The End of Hyperinflations?

- How do episodes of high inflation or hyperinflation end?
- Fundamentally difficult: much harder than just putting away the printing press
 - Must fix the source of the problem: the government budget constraint
 - **Fiscal reforms:** find ways to cut spending and raise taxes and restore borrowing
 - These difficulties explain why hyperinflations tend to recur
- Coordination problem: convincing everyone in a frenzy of rising prices that they should stop raising their own prices

Is recent U.S. inflation due to fiscal problems?

Reading: Greg Ip, “To Solve Inflation, First Solve Deficits, This Theory Advises”



<https://fred.stlouisfed.org/series/FYGFQDQ188S>

Questions for Review

- What is the Quantity Theory of Money, and what does it say determines the rate of inflation in the long run?
- How and why are real and nominal interest rates related?
- Explain how Nobel Prize winners Milton Friedman and Tom Sargent are both correct in their seemingly contradictory “always and everywhere” quotations about inflation
- Why and when is inflation costly?
- What is the fiscal theory of inflation?
- Why is it hard to end hyperinflations?