

# Session 9:

## A Dismal Science — Inflation in the Long Run

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## 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)

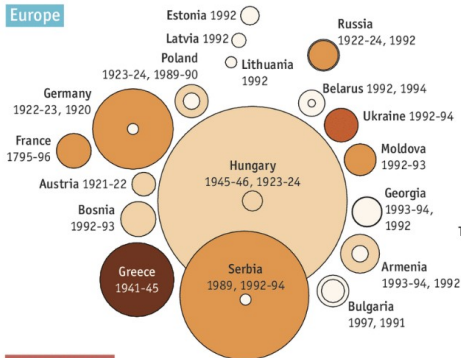
	When?	Peak monthly inflation rate	Time for prices to double
Hungary	July 1946	$4 \cdot 10^{16}\%$	15 hours
Zimbabwe	Nov 2008	$8 \cdot 10^{10}\%$	25 hours
Germany	Oct 1923	30,000%	3.7 days
Taiwan	May 1949	2,200%	6.7 days

## Currency in Zimbabwe in 2008

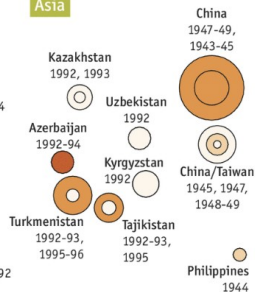


# A World of Hyperinflation

## Europe



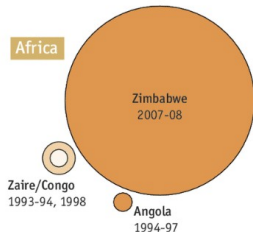
## Asia



## Latin America



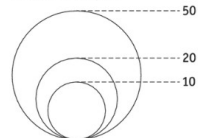
## Africa



Duration, months

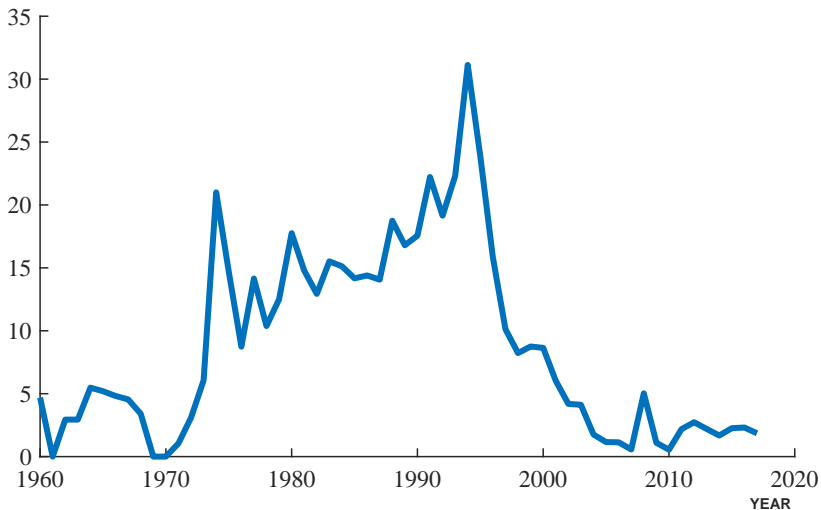


Maximum daily inflation rate, %

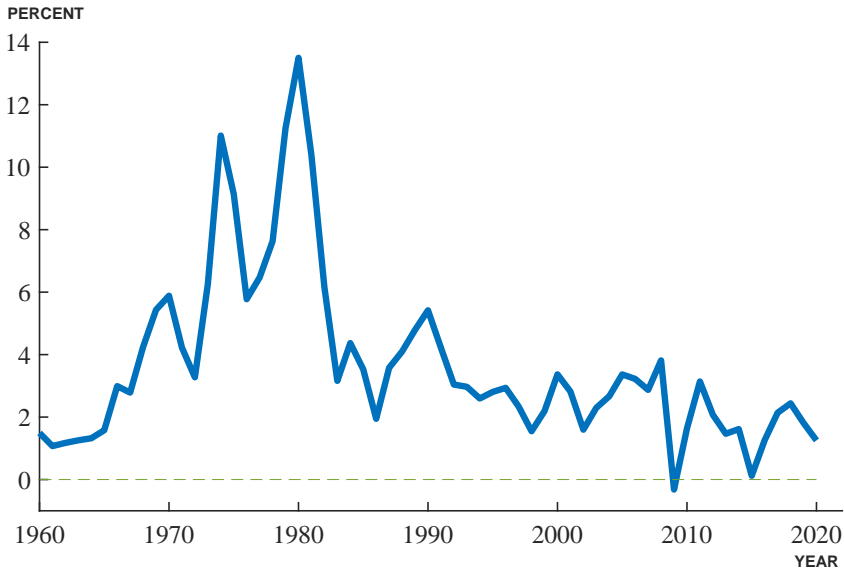


## Fraction of Countries with Inflation $> 25\%$

PERCENT OF COUNTRIES



## Inflation in the United States





## Real and Nominal Interest Rates

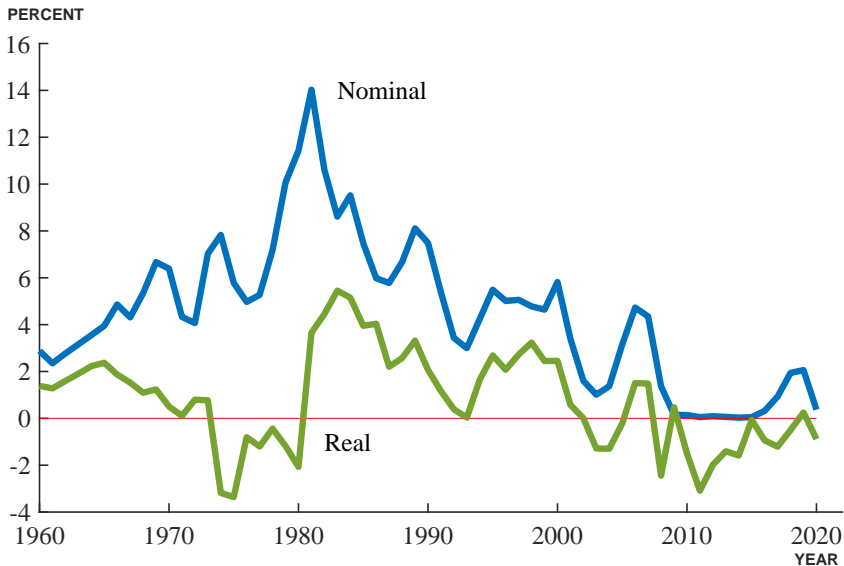
- Recall: what determines the real interest rate?
- What is a nominal interest rate?
- The Fisher equation:

$$i = r + \pi$$

- 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 April 26, 2021

Maturity	T-Bond Nominal Yield	TIPS Real Yield	Implied expected inflation
5 year	0.85	-1.62	2.47
10 year	1.58	-0.78	2.36
30 year	2.24	-0.02	2.26

<http://www.federalreserve.gov/releases/h15/Update/>



# The Quantity Theory of Money

## What is money?

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

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- 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

$$M_t V_t = P_t Y_t$$

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$$M_t V_t = P_t Y_t$$

$M_t$  = 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?

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

“Too much money chasing too few goods.”

## Reading: Cryptoasset Valuations

- How is cryptocurrency like money? How is it not like money?
- Why does money have value? Why does cryptocurrency have value?
- How does the quantity theory of money help to value cryptoassets?

## The Quantity Theory and Inflation

- How can we use this result to explain **inflation**?

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- 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

$$g_M + g_V = g_P + g_Y$$

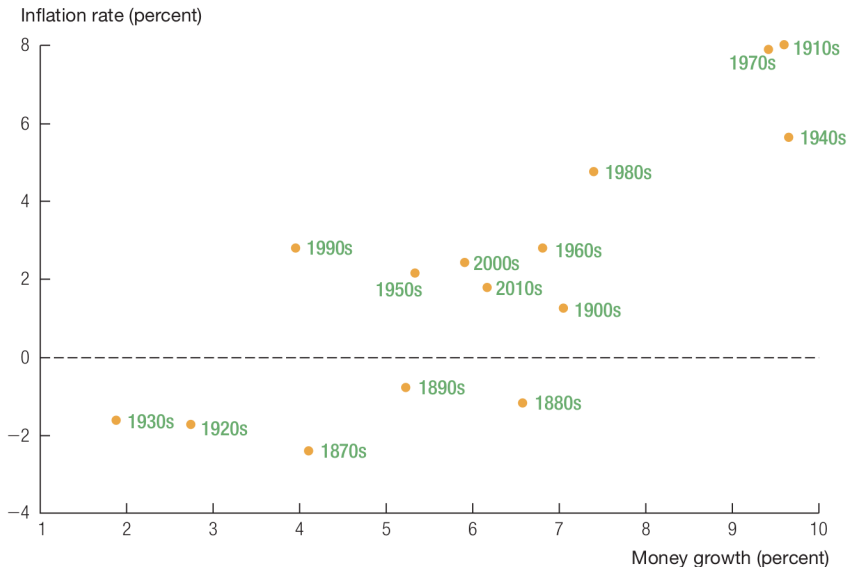
- Let  $\pi \equiv g_P$  and recall  $g_V = 0$

$$\pi = g_M - g_Y$$

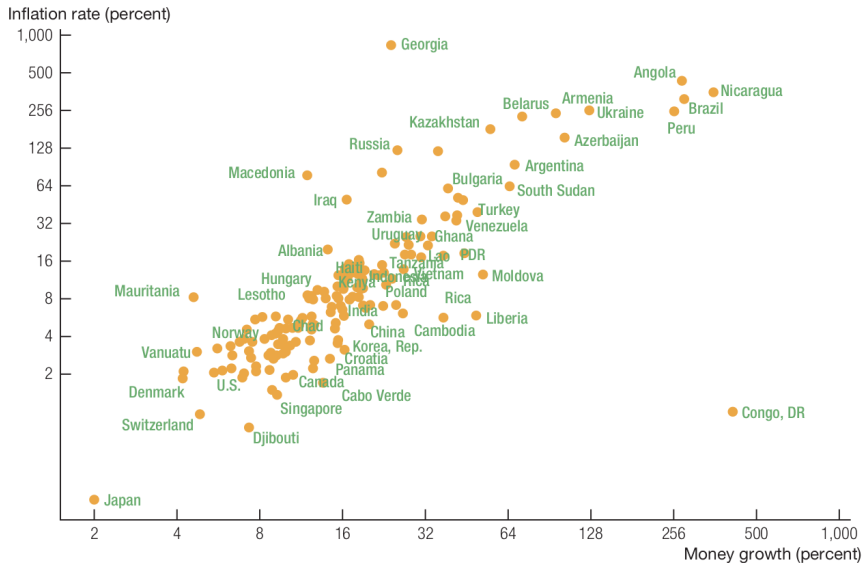
“Inflation is always and everywhere a monetary phenomenon.”

— 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?

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

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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?
  - 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 recent sovereign debt problems in Europe?

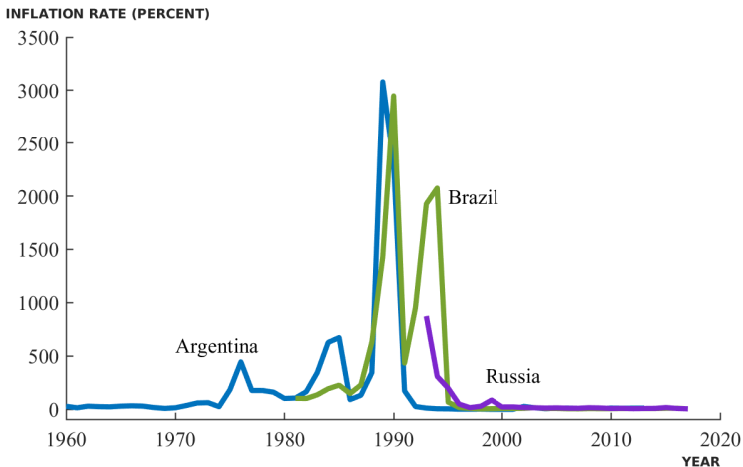
## Greece / Ireland / Portugal / Spain / Italy?

- 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 drop out?)



# Hyperinflations

## Hyperinflation in Argentina, Brazil, and Russia

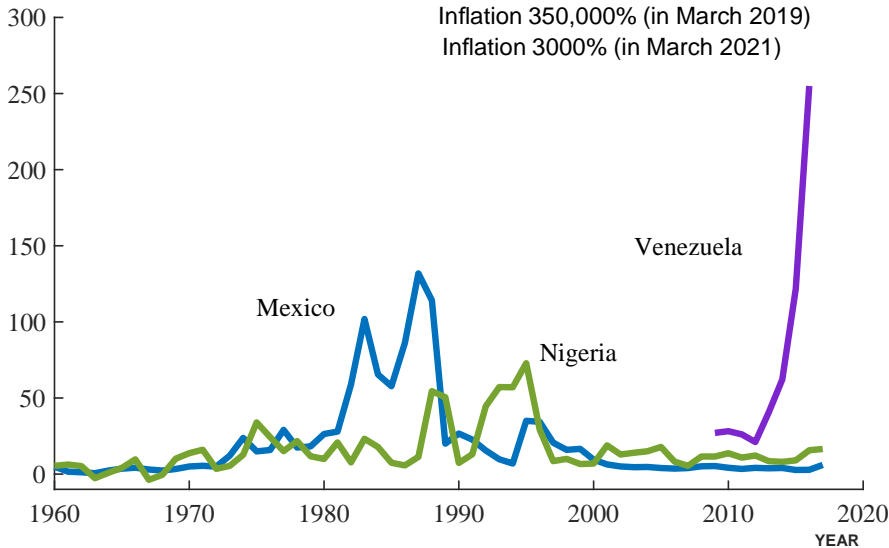


- Rapid starts and ends (recall, surprises are most costly)
- Recurrences (need to fix fiscal root cause)

## High Inflation in Mexico, Nigeria, and Venezuela

INFLATION RATE (PERCENT)

Reading: The Tragedy of Venezuela  
Inflation 350,000% (in March 2019)  
Inflation 3000% (in March 2021)





## The End of Hyperinflations?

- How do episodes of high inflation or hyperinflation end?

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- 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

## 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?