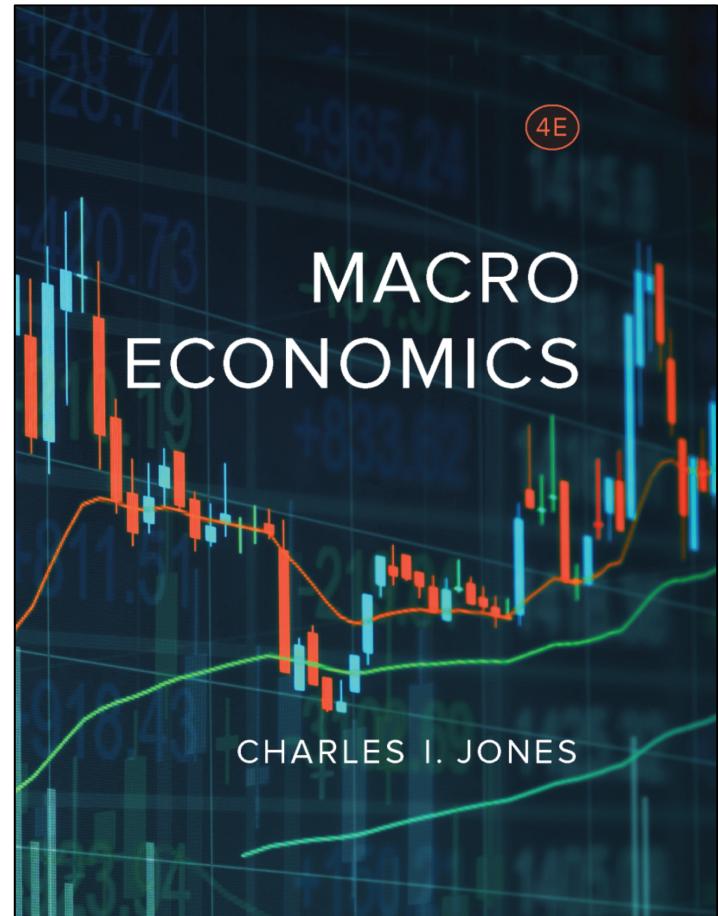


Chapter 8

Inflation



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8.1 Introduction

- In this chapter, we learn:
 - How the **quantity theory of money** and the **classical dichotomy** help us understand inflation
 - The relationship of interest rates and inflation through the **Fisher equation**
 - The important link between fiscal policy and high inflation

Inflation—1

- Inflation

- percentage change in the overall price level

- Hyperinflation

- Episode of extremely high inflation
 - Typically defined as greater than 500 percent per year.

Inflation Today

- USA: 1.6% { February
- Switzerland: 0.4%
- Turkey: 138% (Nov 2018)
- Venezuela: 130% c.?? not sure

Inflation—2

- Inflation rate: annual percentage change in the price level

$$\text{inflation rate} = \frac{P_{t+1} - P_t}{P_t} \times 100$$

where P_t is the price level in year t

- The Consumer Price Index (CPI)
 - price index for a bundle of consumer goods
 - based on basket for "typical" urban household
 - not representative for U.S.

Inflation Rate in the United States, 1960–2015

The Inflation Rate in the United States, 1960–2015

Percent

14

12

10

8

6

4

2

0

1960

1965

1970

1975

1980

1985

1990

1995

2000

2005

2010

2015

Year



1960

1965

1970

1975

1980

1985

1990

1995

2000

2005

2010

2015

Year

Case Study: How Much Is That?—1

- We can use the CPI to evaluate the value of a good in 1950 in today's dollars.

TABLE 8.1

The Consumer Price Index, 1900–2015 (2015 = 100)

Year	CPI	Year	CPI
1900	3.43	1980	34.76
1930	7.05	1990	55.14
1950	10.16	2000	72.65
1960	12.50	2010	92.00
1970	16.39	2015	100.00

Source: Lawrence H. Officer and Samuel H. Williamson, "The Annual Consumer Price Index for the United States, 1774–2015," MeasuringWorth, www.measuringworth.com.

Case Study: How Much Is That? – 2

- Start in 1900, then use the CPI table...

$$0.06 \text{ in 1900 dollars} \times \frac{106 \text{ in 2015 dollars}}{3.43 \text{ in 1900 dollars}} \approx 1.75 \text{ in 2015 dollars.}$$

- Other price indexes

- the CPI excluding food and energy prices
- GDP Deflators. (Final goods / Services - except households)

Case Study: How Much Is That?—3

- ... and compare the price to actual price in 2015, which is 79 cents.
- In our example, the item is 1 quart of milk.
 - Nominal increase = $\frac{0.19}{0.79}$
 - Real increase = negative. $1.75 \rightarrow 0.79$.
$$\frac{0.79 - 1.75}{1.75}$$

is milk in 1900 the same as 2015?

benefit: older than average ~~household rely on~~ ~~severity benefit~~ ~~problem~~

8.2 The Quantity Theory of Money

- We often think of money as paper currency
 - Historically:
 - Money was backed by gold }
 - { silver - seashells -->
 - Sometimes by other “precious” commodities
 - Today:
 - Currency is “flat money”
 - In private transactions, money has value because of social convention.

Measures of the Money Supply—1

- The monetary base includes currency and accounts (reserves)
- What are reserves?
 - Bank hold accounts with the economy's central bank.
 - Banks ensure that they have cash on hand in case of withdrawals.

Measures of the Money Supply—2

TABLE 8.2

Different Measures of the Money Supply in January 2016
(billions of dollars)

C	Currency	1,420
MB	Monetary base = currency plus reserves	3,790
M1	Currency plus demand deposits (e.g., checking accounts)	3,090
M2	M1 plus savings deposits and individual money market accounts	12,440

Source: Federal Reserve Board of Governors, H.3 and H.6.

Measures of the Money Supply—3

Case Study: Digital Cash

- Electronic forms of currency
 - Debit cards, PayPal, travelers' checks
 - Makes up most money in advanced economies
- Cryptocurrency (links on Canvas site)
 - <https://www.khanacademy.org/economics-finance-domain/core-finance/money-and-banking/bitcoin/v/bitcoin-overview>
 - Forbes magazine article “How Bitcoin works”

The Quantity Equation

- Connects money and inflation
- Velocity of money: the average number of times per year that each piece of paper currency is used in a transaction
- The amount of money used in purchases is equal to nominal GDP

The Classical Dichotomy and Constant Velocity—1

- The classical dichotomy:
 - In the long run, the real and nominal sides of the economy are completely separate
- In the quantity theory of money:
 - Real GDP is assumed as exogenously given
 - Determined by real forces
- In other words:

The Classical Dichotomy and Constant Velocity—2

- The velocity of money:
 - Assumed to be constant over time (and hence exogenous constant)

$$V_t = \bar{V}$$

- Why is it roughly constant in the real world?
- The money supply:
 - Determined by the central bank
 - Monetary policy is exogenously given

$$M_t = \bar{M}_t$$

The Quantity Theory of Money

TABLE 8.3

The Quantity Theory of Money: 4 Equations and 4 Unknowns

Endogenous variables: M_t, V_t, P_t, Y_t

The quantity equation

$$M_t V_t = P_t Y_t$$

Real GDP from growth model (classical dichotomy)

$$Y_t = \bar{Y}_t$$

Exogenous and constant velocity

$$V_t = \bar{V}$$

Exogenous money supply

$$M_t = \bar{M}_t$$

Exogenous variables/parameters: $\bar{M}_t, \bar{V}, \bar{Y}_t$

The Quantity Theory for the Price Level

- To solve the model
 - Plug all the exogenous variables
 - Solve for the price level

$$P_t^* = \frac{\overline{M}_t \overline{V}}{\overline{Y}_t}$$

- Prices will rise as a result of

- -



The Quantity Theory for Inflation—1

- We can express the quantity equation in terms of growth rates

The Quantity Theory for Inflation—2

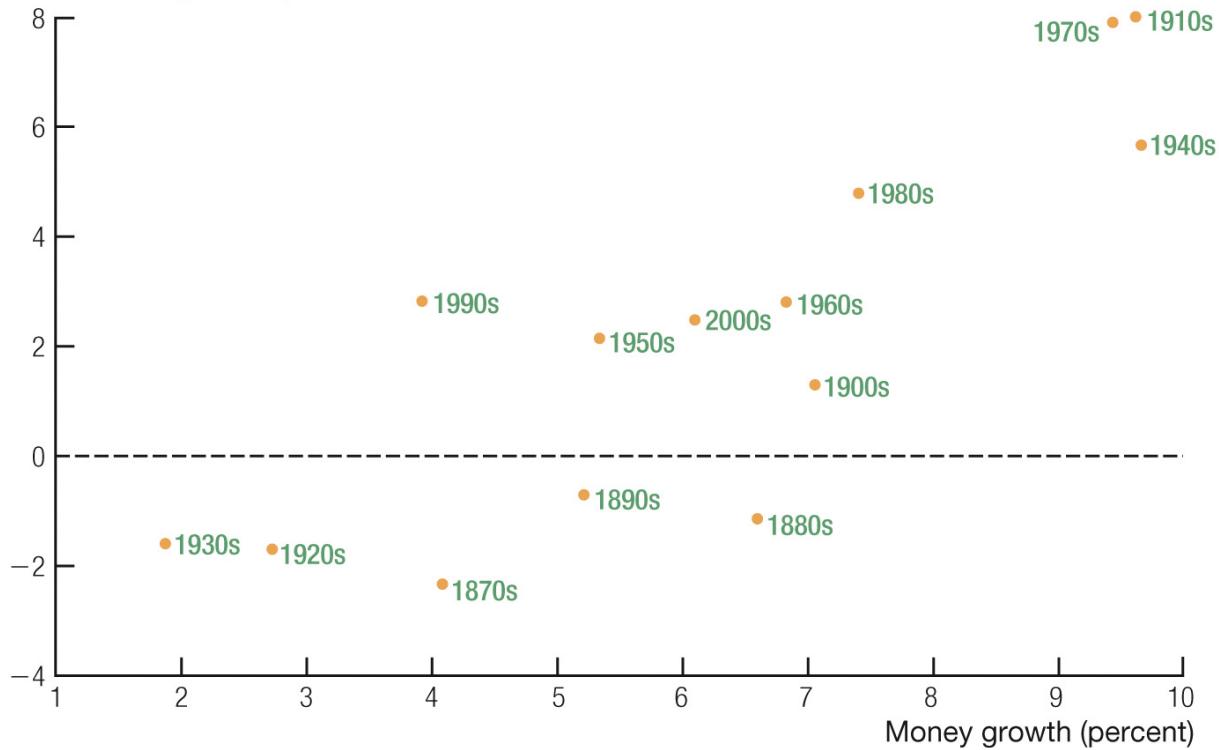
$$\pi^* = \bar{g}_M - \bar{g}_Y$$

- Quantity Theory of Money:
 - Changes in the growth rate of money lead one-for-one to changes in the inflation rate
 - Empirically, this holds up both in United States and worldwide data (plots on next two slides)
- Deflation:
 - Occurs when inflation rates are negative
 - or $\bar{g}_Y > \bar{g}_M$

Money Growth and Inflation in the United States, 1870–2012

Money Growth and Inflation in the United States, 1870–2012

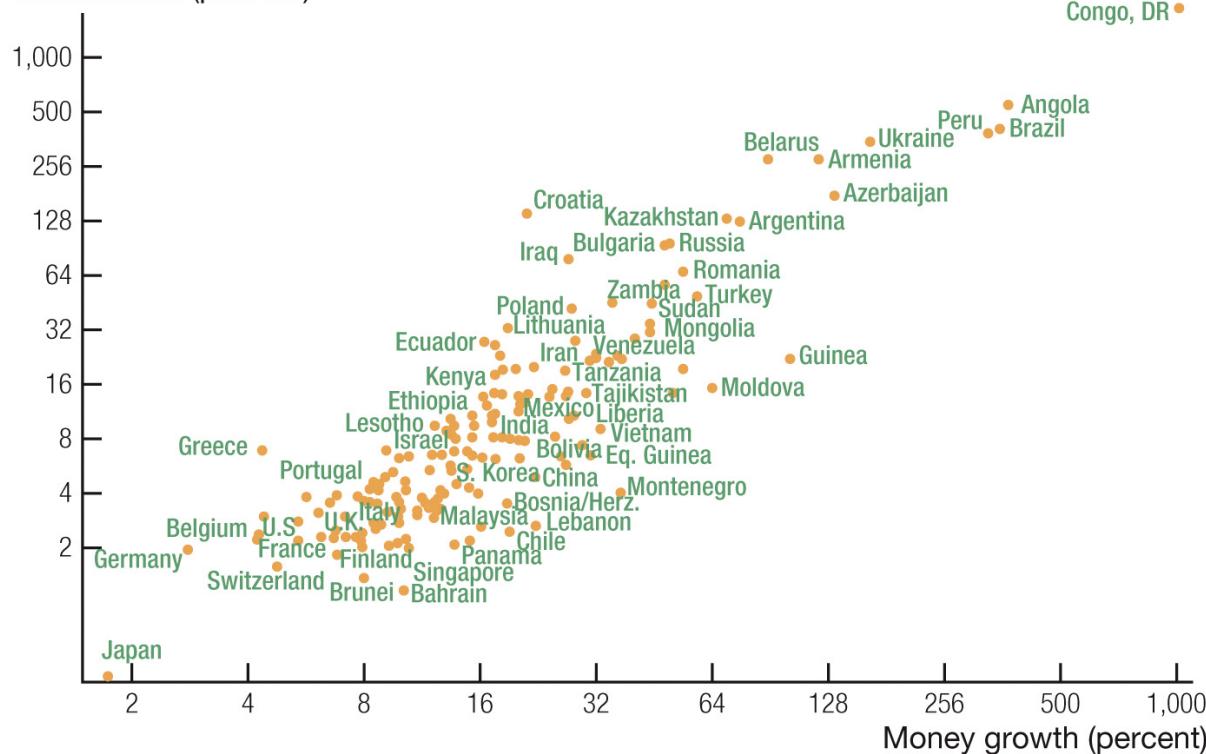
Inflation rate (percent)



Money Growth and Inflation around the World, 1990–2011

Money Growth and Inflation around the World, 1990–2011

Inflation rate (percent)



Revisiting the Classical Dichotomy—1

- When all prices in the economy double, relative prices are unchanged
- Do all prices respond to changes in money supply at the same rate?
 -
 -
- When the **relative** prices of goods are unchanged, nothing real is affected

Revisiting the Classical Dichotomy—2

- The neutrality of money says that changes in the money supply
 - Have no real effects on the economy
 - Only affect prices
- Empirically
 - Holds in the long run
 - Does **not** hold in the short run
 -
 -

8.3 Real and Nominal Interest Rates

- The real interest rate
 - Is equal to the marginal product of capital (in the long run)
 - Is paid in goods & services
- The nominal interest rate
 - Is the interest rate on a savings account
 - Is paid in dollars

The Fisher Equation—1

- The Fisher equation

$$i = R + \pi$$

where

- i : nominal interest rate
 - R : real interest rate
 - π : inflation rate
- The nominal interest rate is generally high when inflation is high

The Fisher Equation—2

- If $i = R + \pi$, then

$$R = i - \pi$$

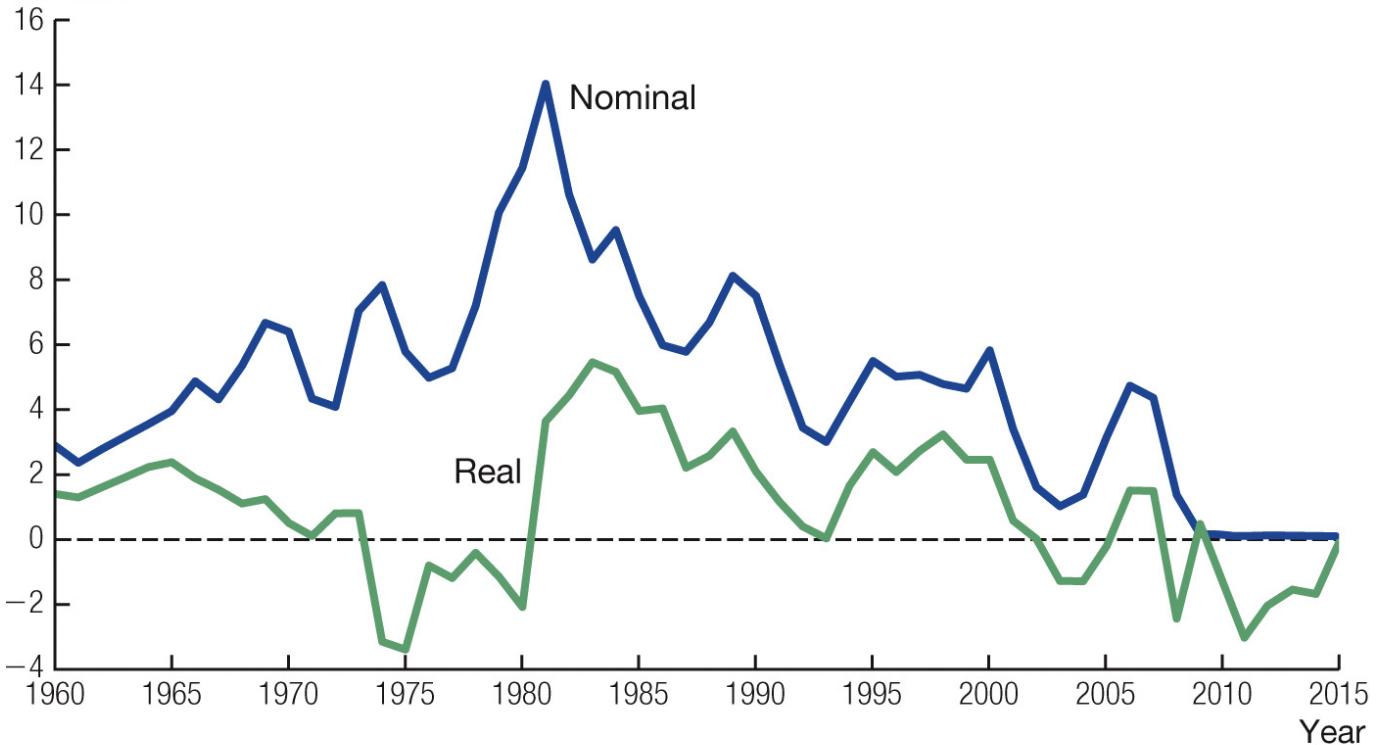
- Empirically, however:



Real and Nominal Interest Rates in the United States, 1960–2015

Real and Nominal Interest Rates in the United States, 1960–2015

Percent



8.4 Costs of Inflation—1

1.
2.
3.



8.4 Costs of Inflation—2

- Not all individuals / firms are affected by inflation in the same way
- Inflation can redistribute wealth



Costs of Inflation—3

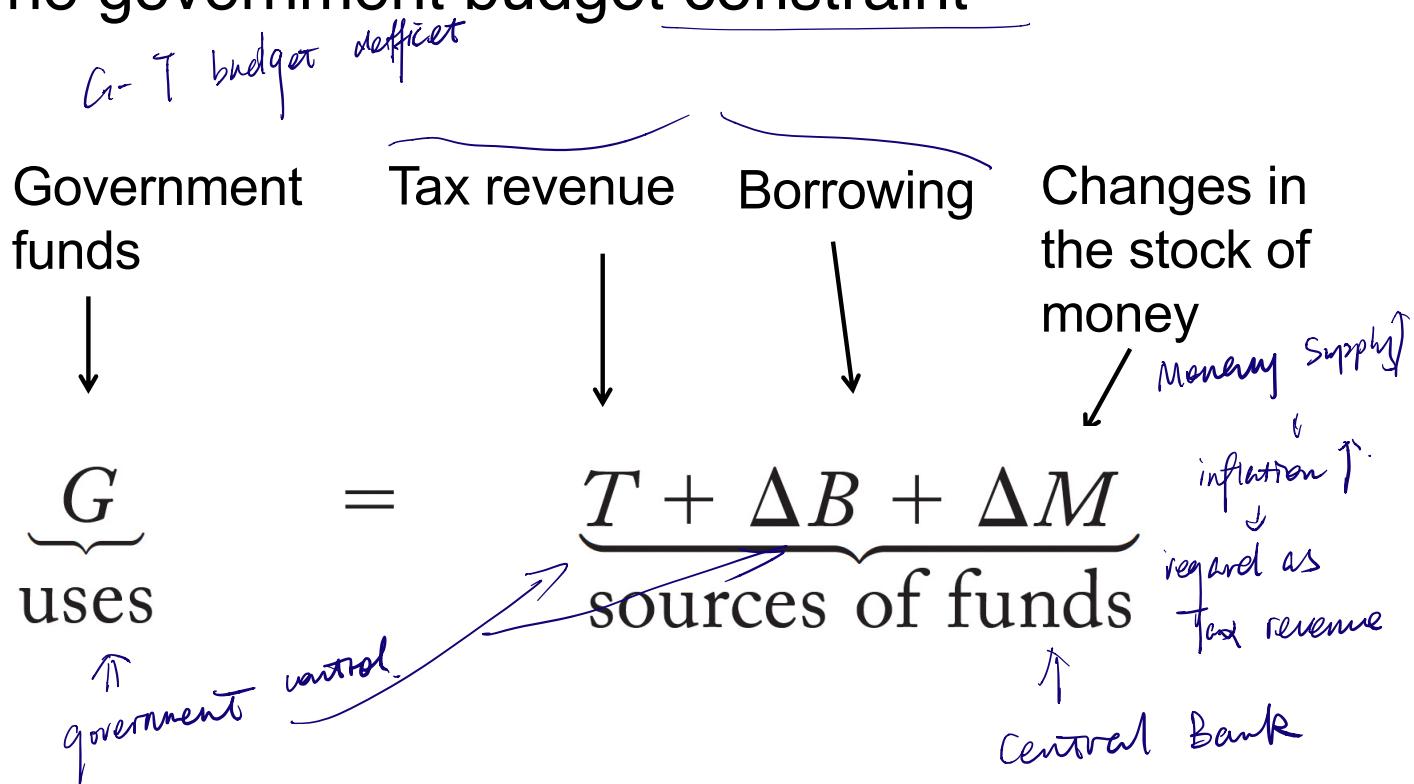
- Taxes
 - Based on nominal incomes
- Economic decisions
 - Based on real variables
 - The McMacro example of entrepreneurship
- Tax distortions are more severe when inflation is high
 - Why?
 - An example will illustrate the case

Costs of Inflation—4

- Inflation also distorts relative prices
 - Some prices are faster at adjusting to inflation than other prices.
 - Examples:
- Shoe leather costs of inflation
 - People want to hold less money when inflation is high.
- Menu costs
 -
 -

8.5 The Fiscal Causes of High Inflation

The government budget constraint



The Inflation Tax—1

power of issue money.

- Seignorage and the inflation tax
 - Names for the revenue that the government obtains from printing more money (ΔM)
- The inflation tax
 - Shows up as a rise in the price level
 - Is paid by people holding currency

The Inflation Tax—2

G-T.

- If a government runs large budget deficits, as debt rises
 - Lenders may worry the government will have trouble paying back loans
 - They may stop lending to the government altogether.
- Debt solution: Raising taxes?
 - May not be politically feasible *↑ policy, note not strong* *↑ tax, → may not ↑ tax revenue*
- The government may resort to printing currency to finance its budget.
 - Lenders to the government will be paid back in currency that is worth less than the dollars lent.

Central Bank Independence

- Monetary Policy
 - Conducted by Federal Reserve
- Fiscal Policy
 - President and Congress
- Central Bank Independence
 - An attempt to prevent fiscal considerations from leading to excessive inflation

✓ authority over hiring budget

German CB
hyperinflation.

"water-proof" independence is institutionally challenging

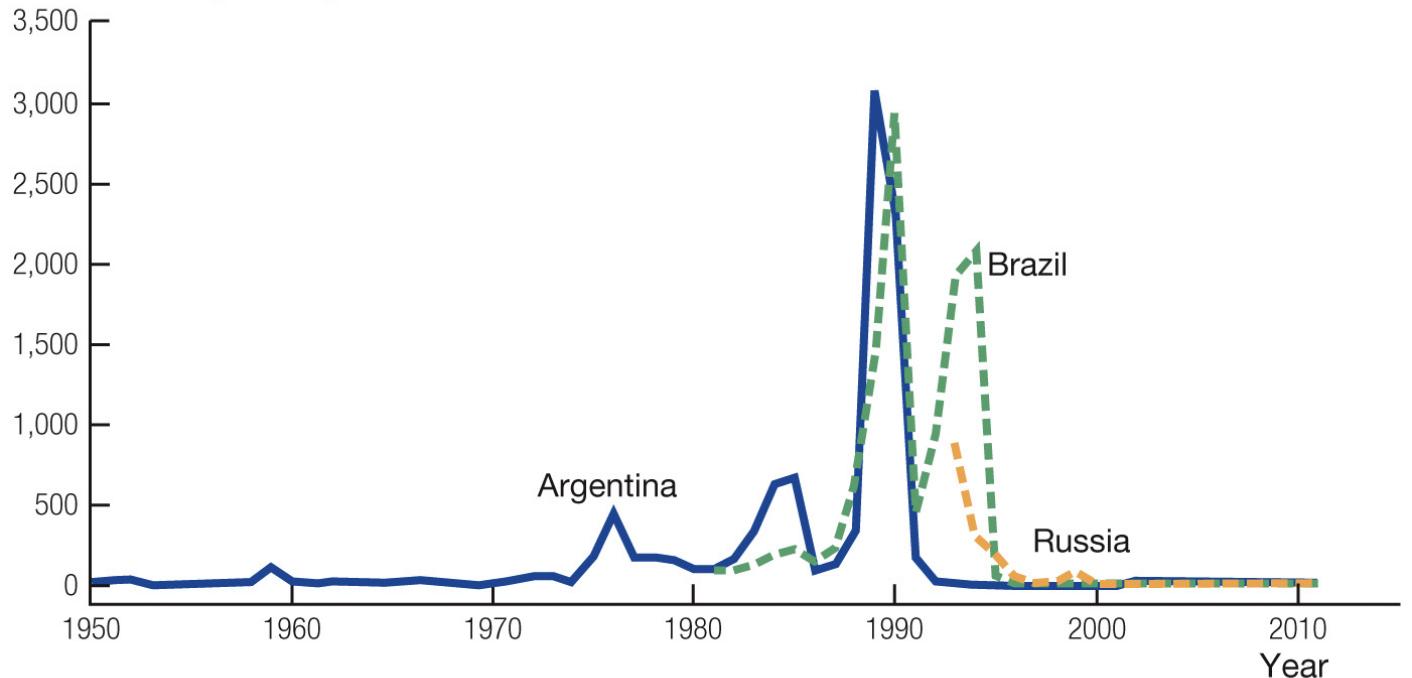
Case Study: Episodes of High Inflation—1

- Episodes of high inflation tend to recur since they have deep-rooted institutional causes
- Hyperinflation can stop just as quickly as it starts:
 - Introduction of "Rentenmark" in Weimar Republic of 1923
 - Fake money or "how four drinking soldiers saved Brazil" (1994).
- Countries experiencing hyperinflation typically raise about **5 percent of GDP** from the inflation tax

Hyperinflations in Argentina, Brazil, and Russia

Hyperinflations in Argentina, Brazil, and Russia

Inflation rate (percent)



8.6 The Great Inflation of the 1970s

- During the Great Inflation:
 - The rate peaked just below 15 percent
 - The inflation tax was a small fraction of government spending
 - If government can't raise significant resources, why would it allow inflation to rise?
- Inflation rose in the 1970s because:
 - 1.
 - 2.
 - 3.