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## Money Growth and Inflation

PowerPoint Slides prepared by:  
Andreea CHIRITESCU  
Eastern Illinois University





# Inflation, Part 1

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- Inflation
  - Increase in the overall level of prices
- Deflation
  - Decrease in the overall level of prices
- Hyperinflation
  - Extraordinarily high rate of inflation



# Inflation, Part 2

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- 2002 to 2012
  - Prices rose at an average rate of 2.5% per year
- The 1970s
  - Prices rose by 7.8% per year
  - The price level more than doubled over the decade



# Inflation, Part 3

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- International data, 2012, inflation rate
  - 2.1% in the U.S
  - Negative 0.1% in Japan
  - 5.1% in Russia
  - 9.3% in India
  - 21.1% in Venezuela
- February 2008, Zimbabwe
  - 24,000 percent



# The Classical Theory of Inflation, Part 1

- Classical theory of money
  - Quantity theory of money
  - Explain the long-run determinants of the price level
  - Explain the inflation rate

*“So what’s it going to be?  
The same size as last year  
or the same price as last  
year?”*



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# Level of Prices; Value of Money

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- Inflation
  - Economy-wide phenomenon
  - Concerns the value of economy's medium of exchange
- Inflation: rise in the price level
  - Lower value of money
  - Each dollar buys a smaller quantity of goods and services



# The Classical Theory of Inflation, Part 2

- Money demand

- Reflects how much wealth people want to hold in liquid form
- Depends on
  - Credit cards
  - Availability of ATM machines
  - Interest rate
  - Average level of prices in economy
- Demand curve – downward sloping



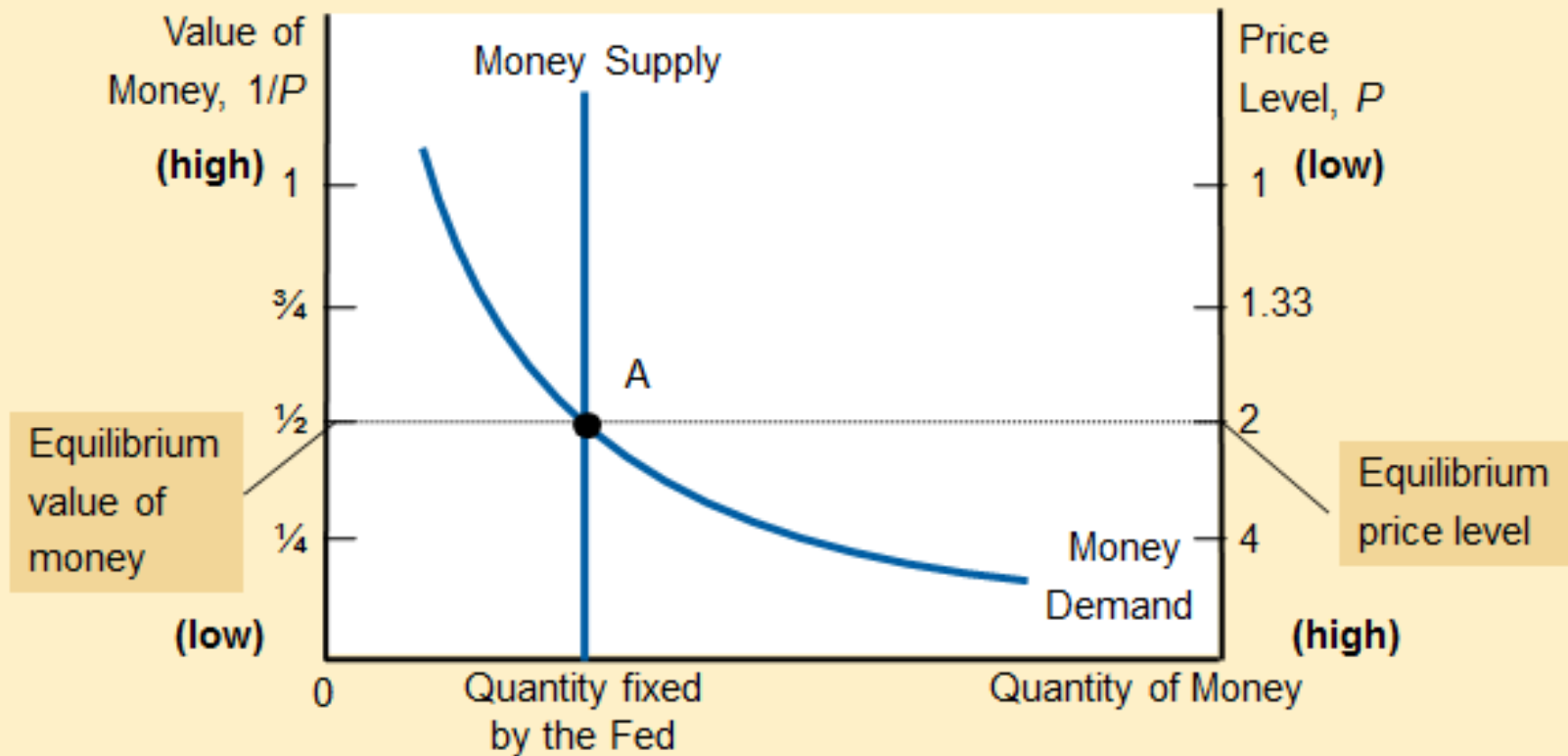
# The Classical Theory of Inflation, Part 3

- Money supply
  - Determined by the Fed and the banking system
  - Supply curve is vertical
- In the long run
  - Overall level of prices adjust
    - To the level at which the demand for money equals the supply



# Figure 1

## How the Supply and Demand for Money Determine the Equilibrium Price Level



The horizontal axis shows the quantity of money. The left vertical axis shows the value of money, and the right vertical axis shows the price level. The supply curve for money is vertical because the quantity of money supplied is fixed by the Fed. The demand curve for money is downward sloping because people want to hold a larger quantity of money when each dollar buys less. At the equilibrium, point A, the value of money (on the left axis) and the price level (on the right axis) have adjusted to bring the quantity of money supplied and the quantity of money demanded into balance.

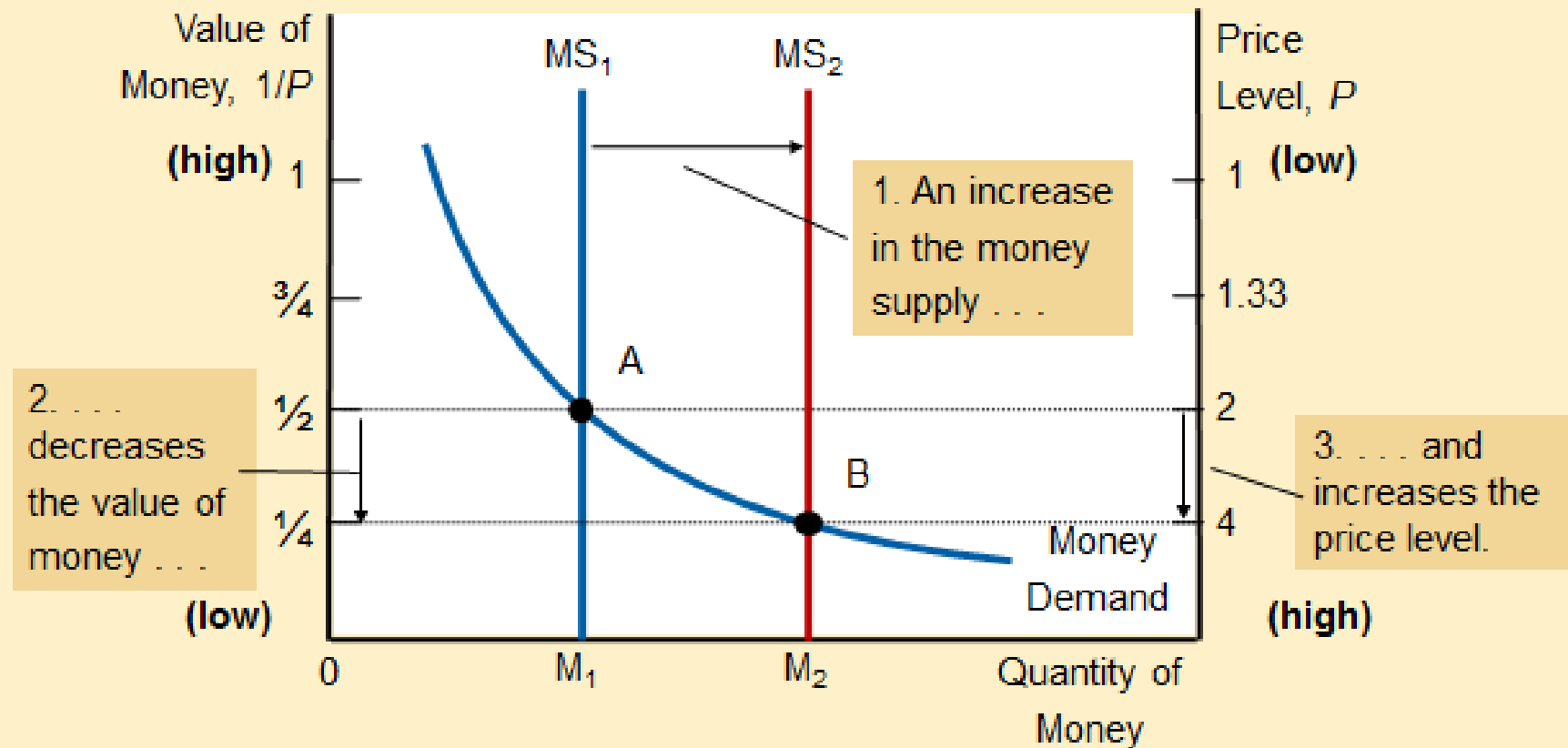


# Effects of a Monetary Injection, Part 1

- Economy is in equilibrium
  - If the Fed doubles the supply of money
    - Prints bills
    - Drops them on market
  - Or the Fed: open-market purchase
  - New equilibrium
    - Supply curve shifts right
    - Value of money decreases
    - Price level increases

# Figure 2

## An Increase in the Money Supply



When the Fed increases the supply of money, the money supply curve shifts from  $MS_1$  to  $MS_2$ . The value of money (on the left axis) and the price level (on the right axis) adjust to bring supply and demand back into balance. The equilibrium moves from point A to point B. Thus, when an increase in the money supply makes dollars more plentiful, the price level increases, making each dollar less valuable.



# Effects of a Monetary Injection, Part 2

- Quantity theory of money
  - The quantity of money available in the economy determines (the value of money) the price level
  - Growth rate in quantity of money available determines the inflation rate



# Effects of a Monetary Injection, Part 3

- Adjustment process
  - Excess supply of money
  - Increase in demand of goods and services
  - Price of goods and services increases
  - Increase in price level
  - Increase in quantity of money demanded
  - New equilibrium



# Classical Dichotomy, Part 1

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- **Nominal variables**
  - Variables measured in monetary units
    - Dollar prices
- **Real variables**
  - Variables measured in physical units
    - Relative prices, real wages, real interest rate
- **Classical dichotomy**
  - Theoretical separation of nominal and real variables



# Classical Dichotomy, Part 2

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- Developments in the monetary system
  - Influence nominal variables
  - Irrelevant for explaining real variables
- Monetary neutrality
  - Changes in money supply don't affect real variables
  - Not completely realistic in short-run
  - Correct in the long run



# Velocity and the Quantity Equation, Part 1

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- Velocity of money ( $V$ )
  - Rate at which money changes hands
- $V = (P \times Y) / M$ 
  - $P$  = price level (GDP deflator)
  - $Y$  = real GDP
  - $M$  = quantity of money



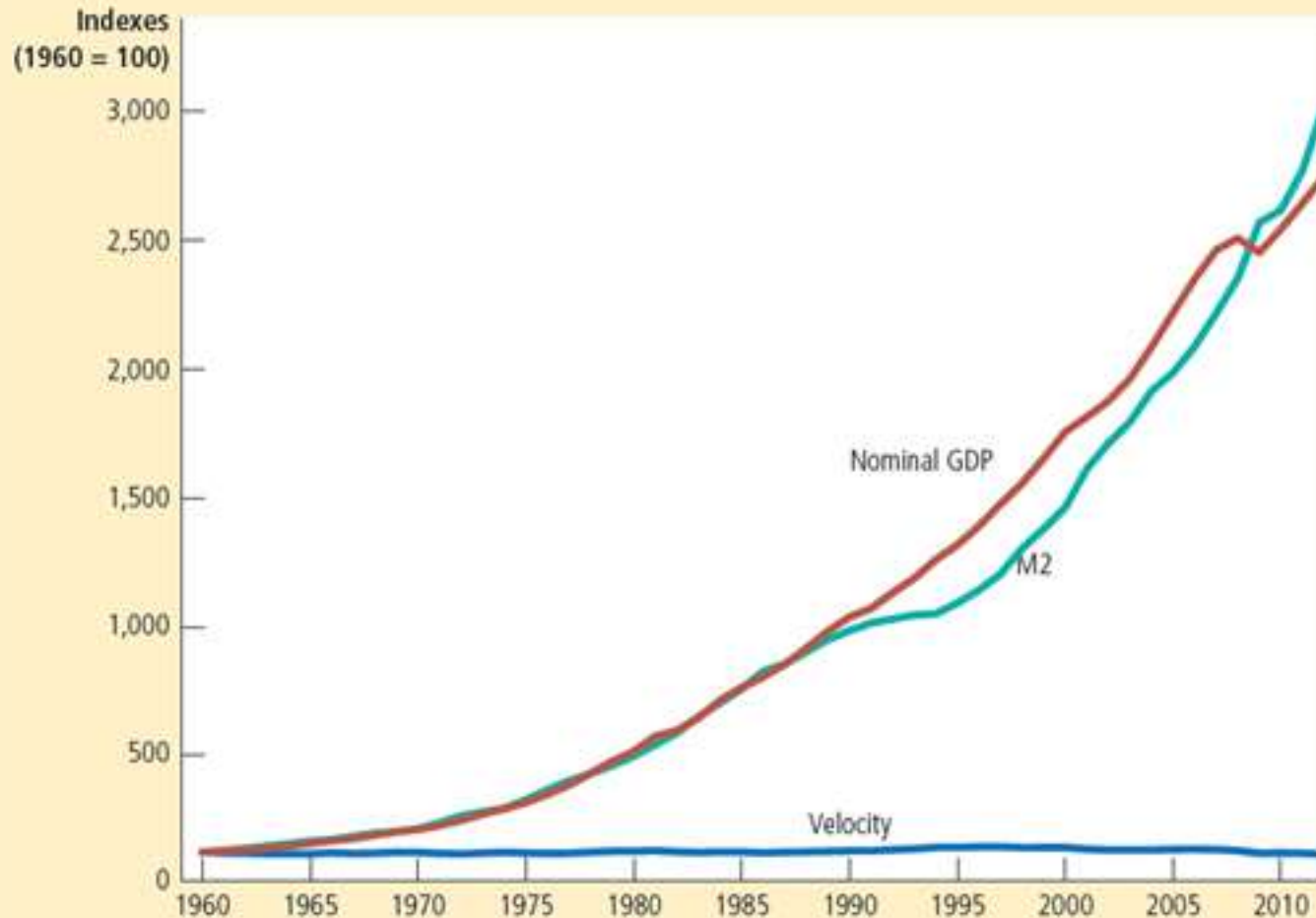


# Velocity and the Quantity Equation, Part 2

- Quantity equation:  $M \times V = P \times Y$ 
  - Quantity of money (M)
  - Velocity of money (V)
  - Dollar value of the economy's output of goods and services ( $P \times Y$ )
- Shows: an increase in quantity of money
  - Must be reflected in:
    - Price level must rise
    - Quantity of output must rise
    - Velocity of money must fall

# Figure 3

## Nominal GDP, the Quantity of Money, and the Velocity of Money



This figure shows the nominal value of output as measured by nominal GDP, the quantity of money as measured by M2, and the velocity of money as measured by their ratio. For comparability, all three series have been scaled to equal 100 in 1960. Notice that nominal GDP and the quantity of money have grown dramatically over this period, while velocity has been relatively stable.

Source: U.S. Department of Commerce; Federal Reserve Board.



# Quantity Theory of Money, Part 1

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## 1. Velocity of money

- Relatively stable over time

## 2. Changes in quantity of money, $M$

- Proportionate changes in nominal value of output ( $P \times Y$ )

## 3. Economy's output of goods & services, $Y$

- Primarily determined by factor supplies
- And available production technology
- Money does not affect output



# Quantity Theory of Money, Part 2

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## 4. Change in money supply, $M$

- Induces proportional changes in the nominal value of output ( $P \times Y$ )
  - Reflected in changes in the price level ( $P$ )

## 5. When the central bank increases the money supply rapidly

- High rate of inflation

# Money and prices during four hyperinflations, Part 1

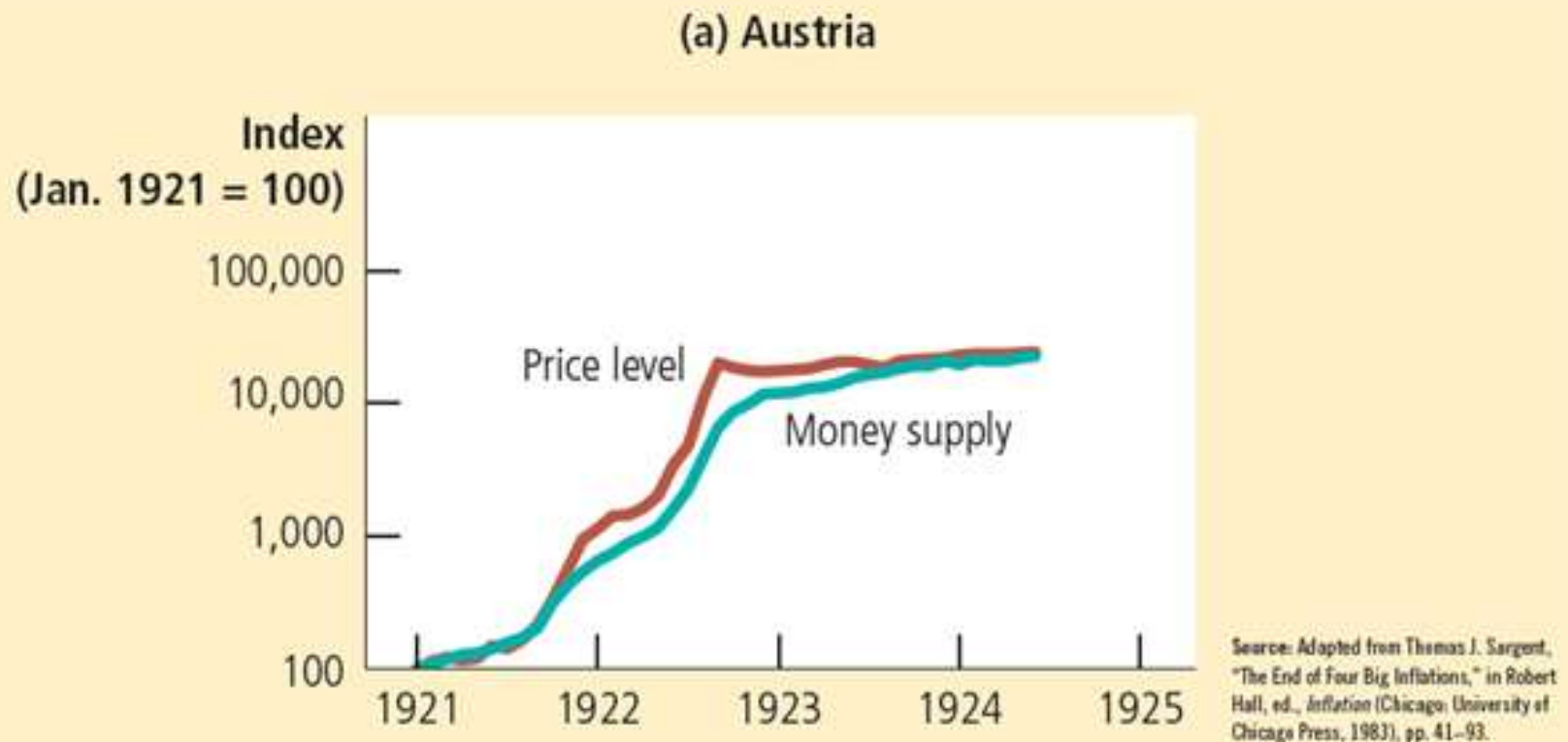
- **Hyperinflation**
  - Inflation that exceeds 50% per month
  - The price level increases more than a hundredfold over the course of a year
- **Data on hyperinflation**
  - Clear link between quantity of money and the price level

# Money and prices during four hyperinflations, Part 2

- Four classic hyperinflation, 1920s
  - Austria, Hungary, Germany, and Poland
  - Slope of the money line
    - Rate at which the quantity of money was growing
  - Slope of the price line: inflation rate
  - The steeper the lines: the higher the rates of money growth or inflation
- Prices rise when the government prints too much money

# Figure 4, Part 1

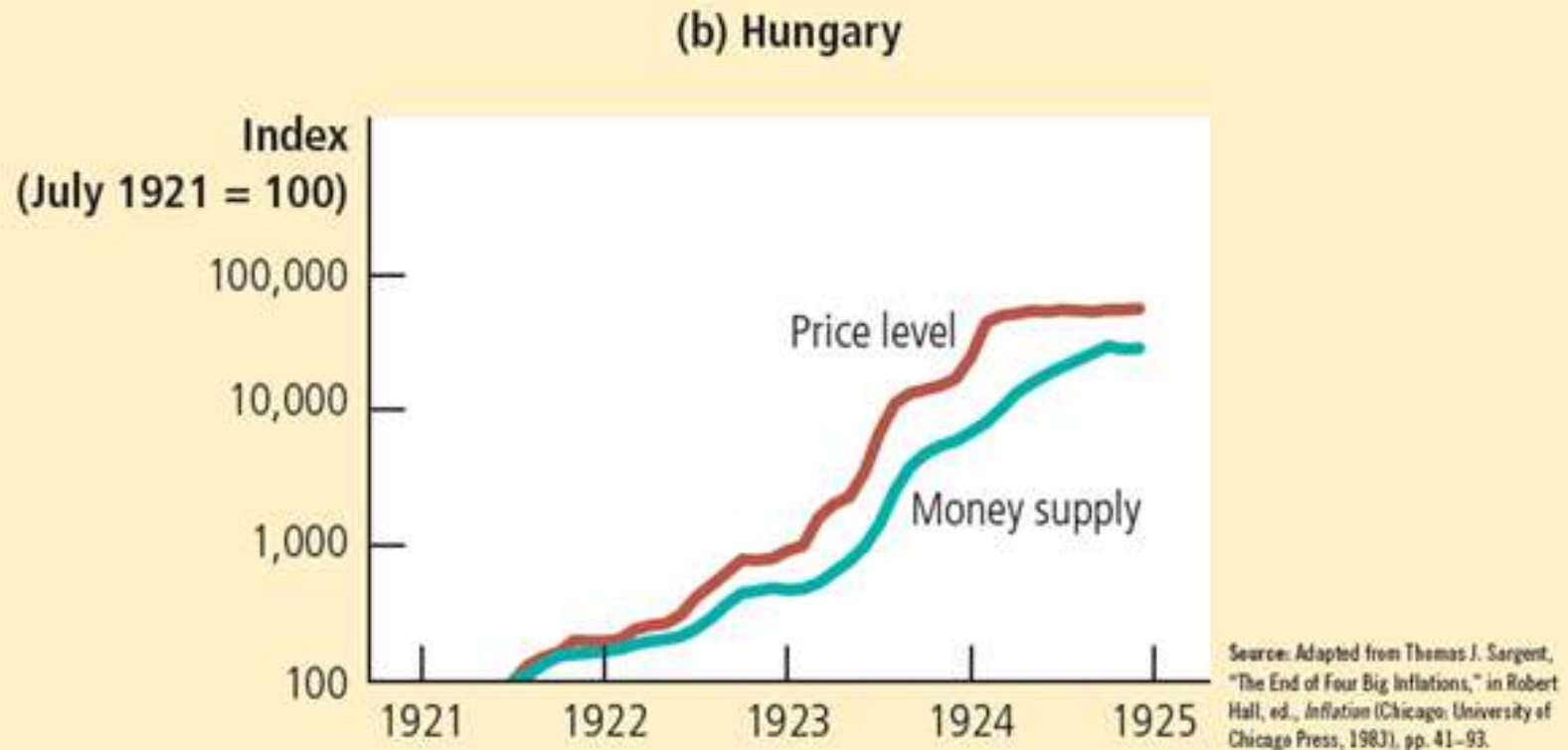
## Money and Prices during Four Hyperinflations



This figure shows the quantity of money and the price level during four hyperinflations. (Note that these variables are graphed on logarithmic scales. This means that equal vertical distances on the graph represent equal percentage changes in the variable.) In each case, the quantity of money and the price level move closely together. The strong association between these two variables is consistent with the quantity theory of money, which states that growth in the money supply is the primary cause of inflation.

# Figure 4, Part 2

## Money and Prices during Four Hyperinflations



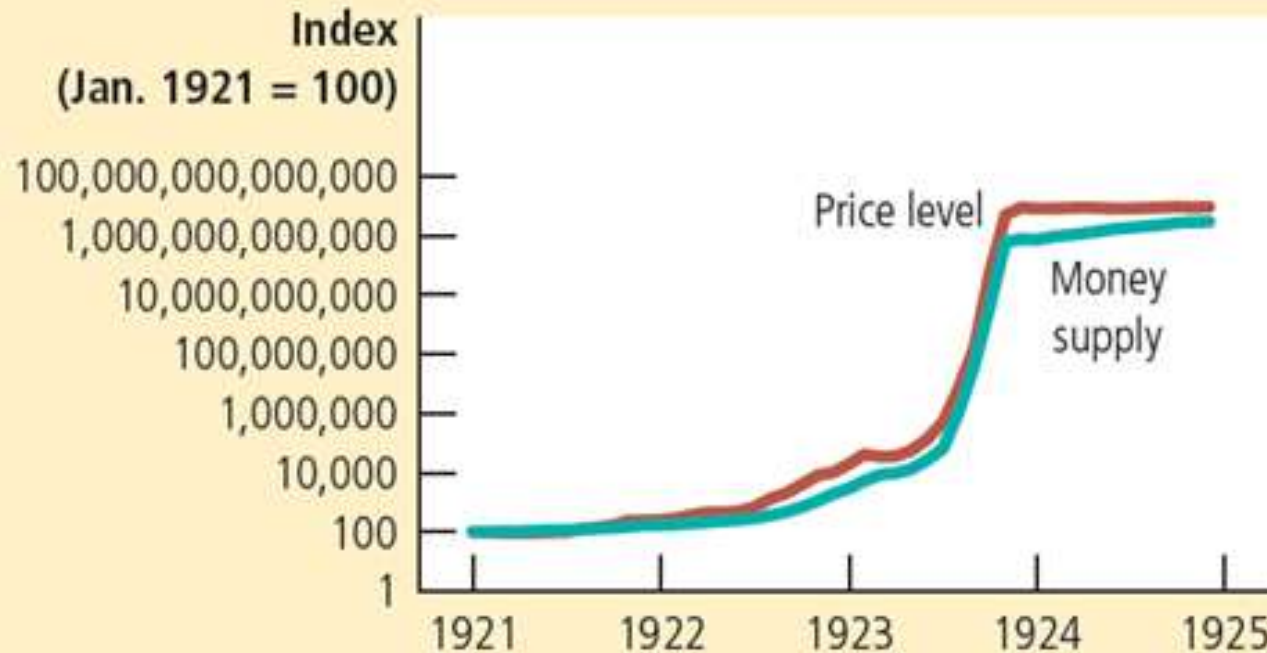
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# Figure 4, Part 3

## Money and Prices during Four Hyperinflations

(c) Germany



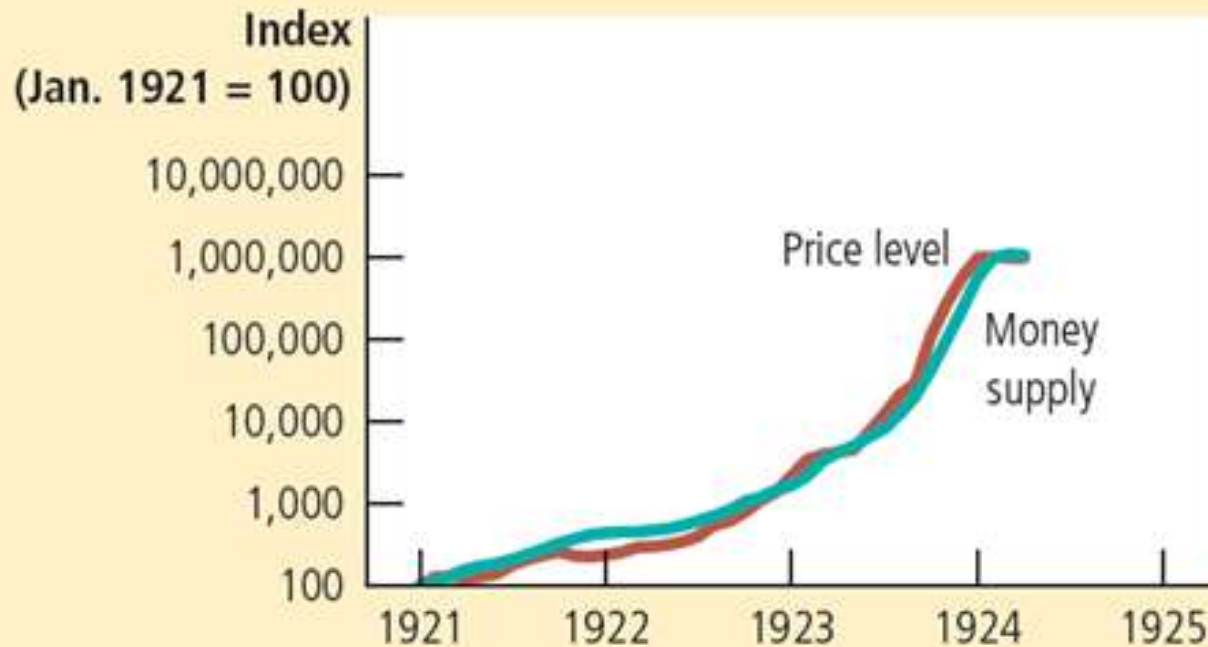
Source: Adapted from Thomas J. Sargent, "The End of Four Big Inflation," in Robert Hall, ed., *Inflation* (Chicago: University of Chicago Press, 1983), pp. 41-93.

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# Figure 4, Part 4

## Money and Prices during Four Hyperinflations

(d) Poland



Source: Adapted from Thomas J. Sargent, "The End of Four Big Inflation," in Robert Hall, ed., *Inflation* (Chicago: University of Chicago Press, 1983), pp. 41–93.

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# The Inflation Tax

- The inflation tax
  - Revenue the government raises by creating (printing) money
  - Tax on everyone who holds money
    - When the government prints money
    - The price level rises
    - And the dollars in your wallet are less valuable



# The Fisher Effect, Part 1

- Principle of monetary neutrality
  - An increase in the rate of money growth
  - Raises the rate of inflation
  - But does not affect any real variable
- $\text{Real interest rate} = \text{Nominal interest rate} - \text{Inflation rate}$
- $\text{Nominal interest rate} = \text{Real interest rate} + \text{Inflation rate}$

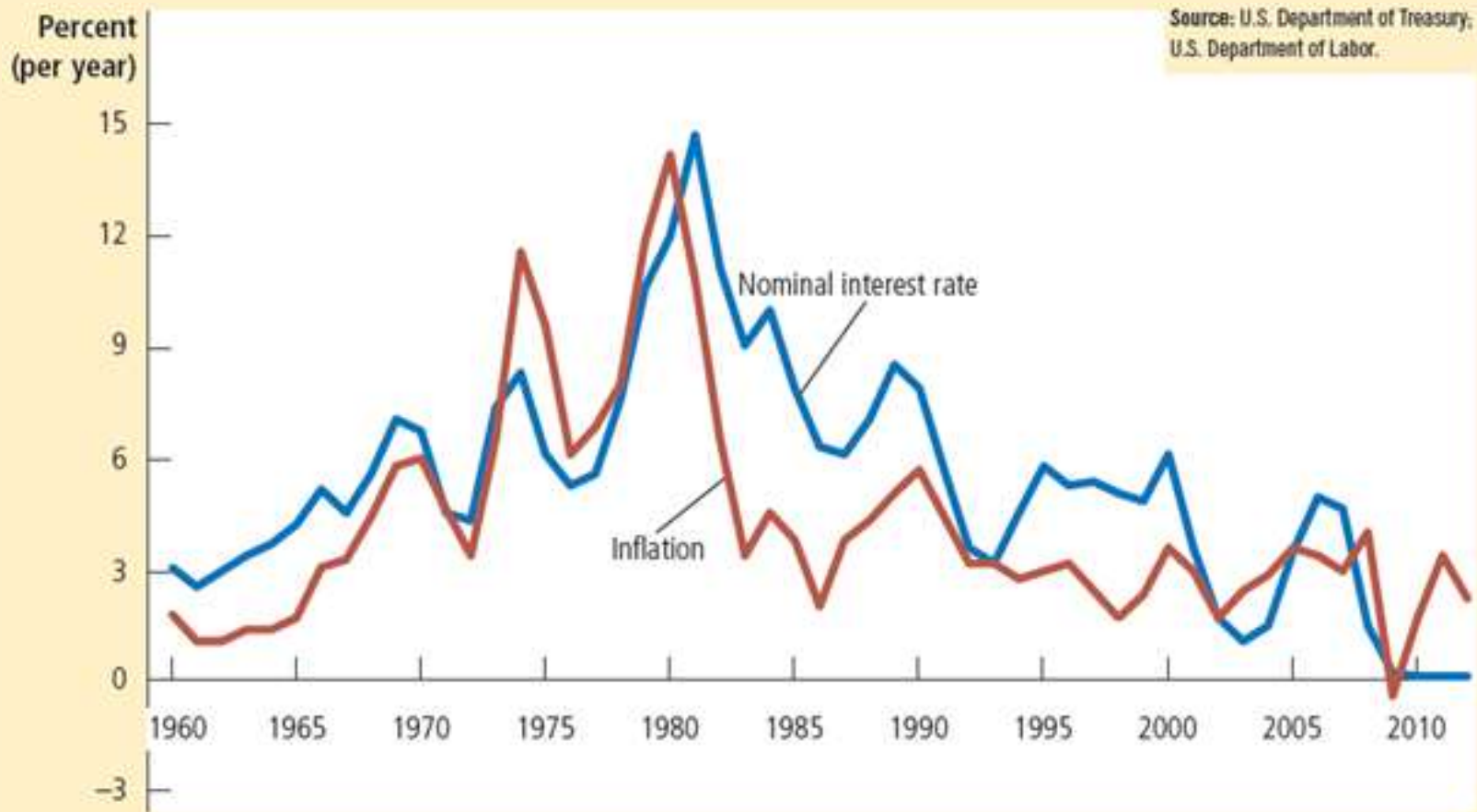


# The Fisher Effect, Part 2

- Fisher effect
  - One-for-one adjustment of nominal interest rate to inflation rate
  - When the Fed increases the rate of money growth
  - Long-run result
    - Higher inflation rate
    - Higher nominal interest rate

# Figure 5

## The Nominal Interest Rate and the Inflation Rate



This figure uses annual data since 1960 to show the nominal interest rate on three-month Treasury bills and the inflation rate as measured by the consumer price index. The close association between these two variables is evidence for the Fisher effect: When the inflation rate rises, so does the nominal interest rate.



# The Costs of Inflation, Part 1

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- Inflation fallacy
  - “Inflation robs people of the purchasing power of his hard-earned dollars”
- When prices rise
  - Buyers pay more
  - Sellers get more
- Inflation does not in itself reduce people’s real purchasing power



# The Costs of Inflation, Part 2

- Shoeleather costs
  - Resources wasted when inflation encourages people to reduce their money holdings
  - Can be substantial
- Menu costs
  - Costs of changing prices
  - Inflation – increases menu costs that firms must bear





# Relative-Price Variability

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- Market economies
  - Relative prices allocate scarce resources
  - Consumers compare quality and prices of various goods and services
    - Determine allocation of scarce factors of production
  - Inflation distorts relative prices
    - Consumer decisions are distorted
    - Markets are less able to allocate resources to their best use



# Inflation-Induced Tax Distortions, Part 1

- Taxes distort incentives
  - Many taxes: more problematic in the presence of inflation
- Tax treatment of capital gains
  - Capital gains are profits
    - Sell an asset for more than its purchase price
  - Inflation discourages saving
    - Exaggerates the size of capital gains
    - Increases the tax burden



# Inflation-Induced Tax Distortions, Part 2

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- Tax treatment of interest income
  - Nominal interest earned on savings
    - Treated as income
    - Even though part of the nominal interest rate compensates for inflation
- Higher inflation
  - Tends to discourage people from saving

# Table 1

## How Inflation Raises the Tax Burden on Saving

	<b>Economy A (price stability)</b>	<b>Economy B (inflation)</b>
Real interest rate	4%	4%
Inflation rate	0	8
Nominal interest rate (real interest rate + inflation rate)	4	12
Reduced interest due to 25 percent tax ( $0.25 \times$ nominal interest rate)	1	3
After-tax nominal interest rate ( $0.75 \times$ nominal interest rate)	3	9
After-tax real interest rate (after-tax nominal interest rate minus inflation rate)	3	1

In the presence of zero inflation, a 25 percent tax on interest income reduces the real interest rate from 4 percent to 3 percent. In the presence of 8 percent inflation, the same tax reduces the real interest rate from 4 percent to 1 percent.



# Confusion and Inconvenience

- Money
  - Yardstick with which we measure economic transactions
- The Fed's job
  - Ensure the reliability of money
- When the Fed increases money supply
  - Creates inflation
  - Erodes the real value of the unit of account



# Arbitrary Redistributions of Wealth

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- Unexpected inflation
  - Redistributes wealth among the population
    - Not by merit
    - Not by need
  - Redistribute wealth among debtors and creditors
- Inflation: volatile and uncertain
  - When the average rate of inflation is high



# Deflation May Be Worse, Part 1

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- Small and predictable amount of deflation
  - May be desirable
- The Friedman rule: moderate deflation will
  - Lower the nominal interest rate
  - Reduce the cost of holding money
  - Shoeleather costs of holding money - minimized by a nominal interest rate close to zero
    - Deflation equal to the real interest rate



# Deflation May Be Worse, Part 2

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- Costs of deflation
  - Menu costs
  - Relative-price variability
  - If not steady and predictable
    - Redistribution of wealth toward creditors and away from debtors
  - Arises because of broader macroeconomic difficulties
    - Symptom of deeper economic problems



# The wizard of oz and the free-silver debate, Part 1

- Movie *The Wizard of Oz*
  - Based on a children's book, 1900
  - Allegory about U.S. monetary policy in the late 19th century
- 1880-1896, price level fell by 23%
  - Major redistribution of wealth
  - Farmers in west were debtors
  - Bankers in east were creditors
  - Real value of debts increased

# The wizard of oz and the free-silver debate, Part 2

- Possible solution to the farmers' problem
  - Free coinage of silver
  - During the gold standard
- Quantity of gold determined
  - Money supply
  - Price level

# The wizard of oz and the free-silver debate, Part 3

- **Free-silver advocates**
  - Silver and gold - to be used as money
  - Increase money supply
  - Pushed up the price level
  - Reduced real burden of the farmers' debts

# The wizard of oz and the free-silver debate, Part 4

- L. Frank Baum
  - Author of the book *The Wonderful Wizard of Oz*
  - *Midwestern* journalist
- Characters
  - Protagonists in the major political battle of his time

*An early debate over  
monetary policy*



# The wizard of oz and the free-silver debate, Part 5

- **Characters**

- Dorothy: Traditional American values
- Toto: Prohibitionist party, also called the Teetotalers
- Scarecrow: Farmers
- Tin Woodsman: Industrial workers
- Cowardly Lion: William Jennings Bryan - prominent advocate of free silver
- Munchkins: Citizens of the East (creditors)
- Wicked Witch of the East: Grover Cleveland

# The wizard of oz and the free-silver debate, Part 6

- Characters

- Wicked Witch of the West: William McKinley (1896 president; gold standard)
- Wizard: Marcus Alonzo Hanna, chairman of the Republican Party
- Oz: Abbreviation for ounce of gold
- Yellow Brick Road: Gold standard

- Dorothy finds her way home

- Not by just following the yellow brick road
- Magical power of her *silver* slippers

# The wizard of oz and the free-silver debate, Part 7

- **Populists**

- Lost the debate over the free coinage of silver
- Get the monetary expansion and inflation that they wanted
  - Increased supply of gold
    - New discoveries - Klondike River in the Canadian Yukon
    - Mines of South Africa
- Money supply and price level started to rise