Soochow University International Programs

2021 SCUIP Winter Session I

ECON202

Lecture 10: Money Growth and Inflation

ECON202: Macroeconomics
Soochow University

Prerequisites

- The theory of supply and demand (microeconomics)
- The measurement of the overall price level (CPI) and of inflation.
- Real interest rate = nominal interest rate – inflation rate
- The theory of long-run GDP
- The long-run theory (loanable funds theory) of the real interest rate
- Topic on “The Monetary System”, especially
  - ▷ The economists’ definition of money
  - ▷ The measurement of the quantity of money
  - ▷ The functions of money
  - ▷ The control of the quantity of money by a country’s central bank

Money Growth and Inflation

- In last topic, we saw how money is defined and measured.
- In topic 3, we saw how the price level and its rate of inflation are defined and measured.
- In this topic, we will see that the quantity of money determines the price level.
- The quantity theory of money explains the long-run determinants of the price level and the inflation rate.

Money Growth and Inflation (Cont'd)

- More specifically, in this topic, we will see that
  - ▹ The quantity of money in an economy determines its price level, and
  - ▹ The growth rate of the quantity of money determines the growth rate of the price level

    -> The growth rate of the price level is also called the rate of inflation.

Inflation in the U.S.

- Over the past 80 years, prices have risen on average about 3.6 percent per year in the U.S.
- Deflation, meaning decreasing average prices, occurred in the U.S. in the 19th Century.
  - ▹ The price level was 23% lower in 1896 than in 1880.
- In the 1970s prices rose by 7.8 percent per year.
- During 2005-2015, prices rose at an average rate of 1.2 percent per year.

Inflation in Germany

- Hyperinflation refers to very high rates of inflation, usually more than 50 percent per month.
  - ▹ At such rates, prices increase more than 100-fold in one year.

- Germany experienced hyperinflation in the 1920s.
  - ▹ The price of a newspaper rose from 0.30 mark in January 1921 to 70,000,000 marks in November 1923, less than three years latter.

Inflation in Germany (Cont'd)

- This does not mean that Germans suddenly felt that newspapers were incredibly wonderful things!
- Instead, what this means is that money became less valuable to Germans.
- We see from this example that price increases have more to do with the value of money than with the value of goods.
- Therefore, if we understand the value of money, we will understand the prices of goods.

The Level of Prices and the Value of Money

- When the overall price level rises, the price of money falls.
- Suppose the price of a gallon of ice-cream is $5.
- Then, the price of a dollar is 1/5 gallons of ice-cream.
- In general, let *P* denote the price level of goods and services.
  - ▻ So, *P* could be the Consumer Price Index or the GDP Deflator.
- Then, 1/*P* is the value of money measured in units of goods and services.
  - ▻ This is also the price of money and the purchasing power of money.
- So, when the overall price level rises, the value of money falls.

Money Supply, Money Demand and Monetary Equilibrium

- It is obvious that the quantity of money determined by the central bank must end up equal to the quantity of money held by the people as currency and checkable bank deposits.
- But in a free economy, people cannot be forced.
- Therefore, the quantity of money desired by the central bank must be equal to the quantity of money desired by the people as currency and checkable bank deposits.
- That is, the money supply must equal the money demand.
- What makes these two separate things equal?

Money Supply, Demand, and Monetary Equilibrium (Cont'd)

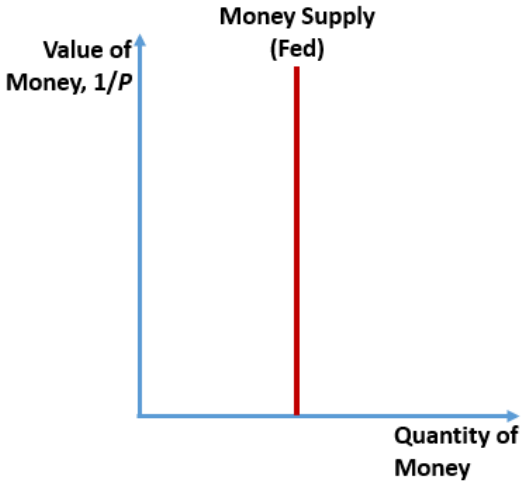
- The classical theory of inflation assumes that the price or value of money ($1/P$) automatically reaches the level at which money supply is equal to money demand.

Money Supply, Demand, and Monetary Equilibrium (Cont'd)

- Money supply is a policy variable that is controlled by the central bank.

  ▹ Through instruments such as open-market operations, the central bank controls the quantity of money supplies.

  -> In the US, the central bank is called the Fed.



Money Supply, Demand, and Monetary Equilibrium (Cont'd)

- Money demand is the quantity of money that people wish to hold as currency and checkable bank deposits.

- Money has three main functions: medium of exchange, unit of account, and store of value.

- The classical theory assumes that in the long run people wish to hold money because it is a medium of exchange and thereby makes shopping convenient.

  ▻ The unit of account function doesn't affect people much and there are better stores of value than money that pay higher interest rates.

Money Supply, Demand, and Monetary Equilibrium (Cont'd)

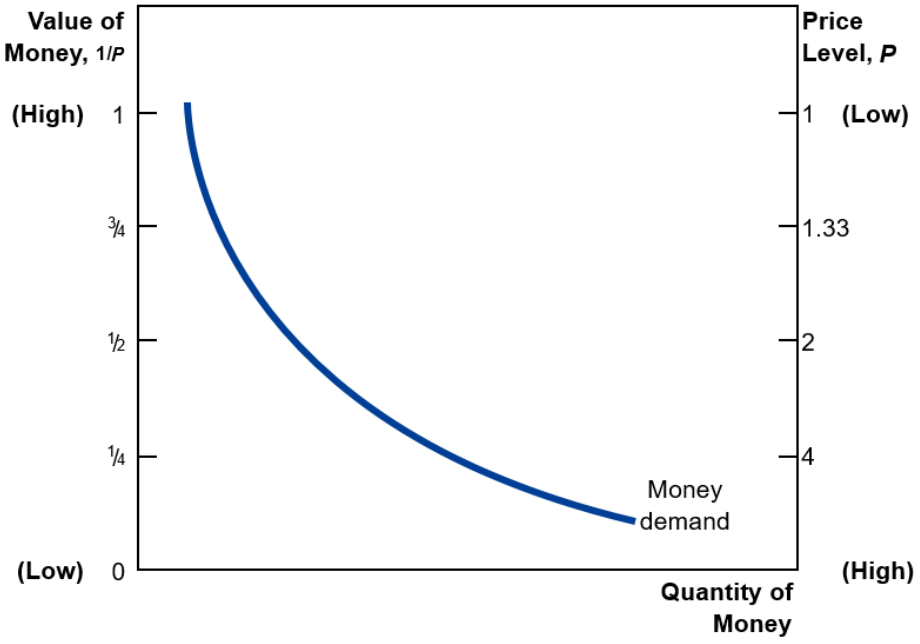
- Although money demand has several determinants, including interest rates paid by non-money assets, the most important factor in the long run is the average level of prices in the economy.

- People hold money because it is the medium of exchange.

▻ The amount of money people choose to hold for shopping depends on the prices of goods and services.

▻ The higher prices are, the more money the typical transaction requires, and the higher the amount of money people will choose to hold in their wallets and in their checking accounts.

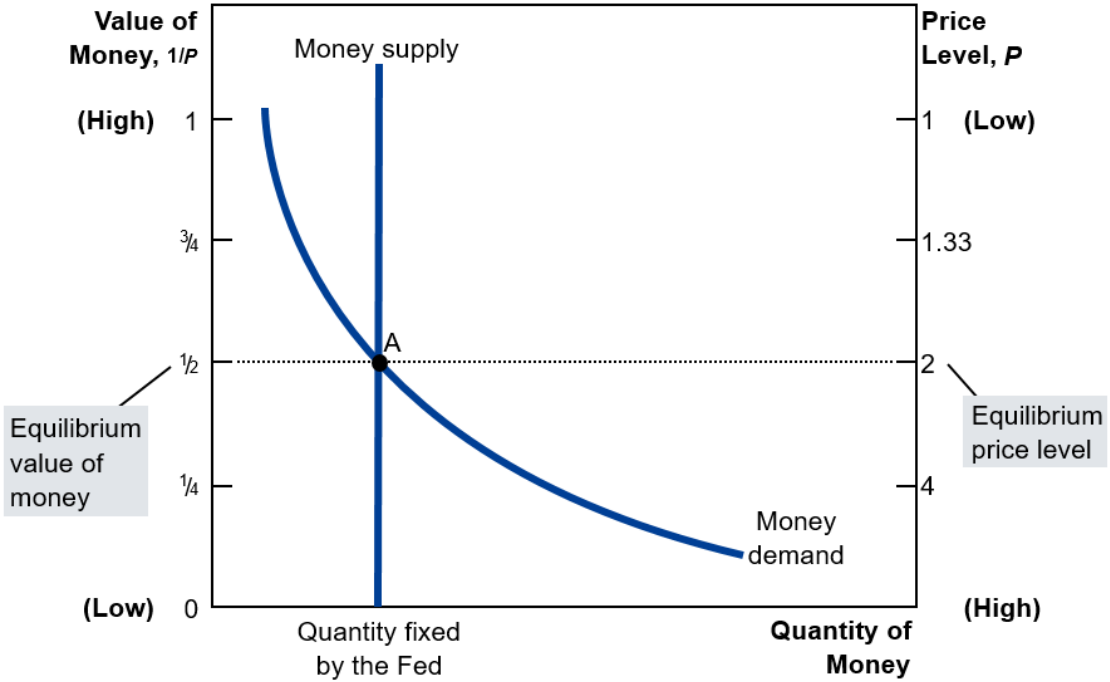
Money Demand



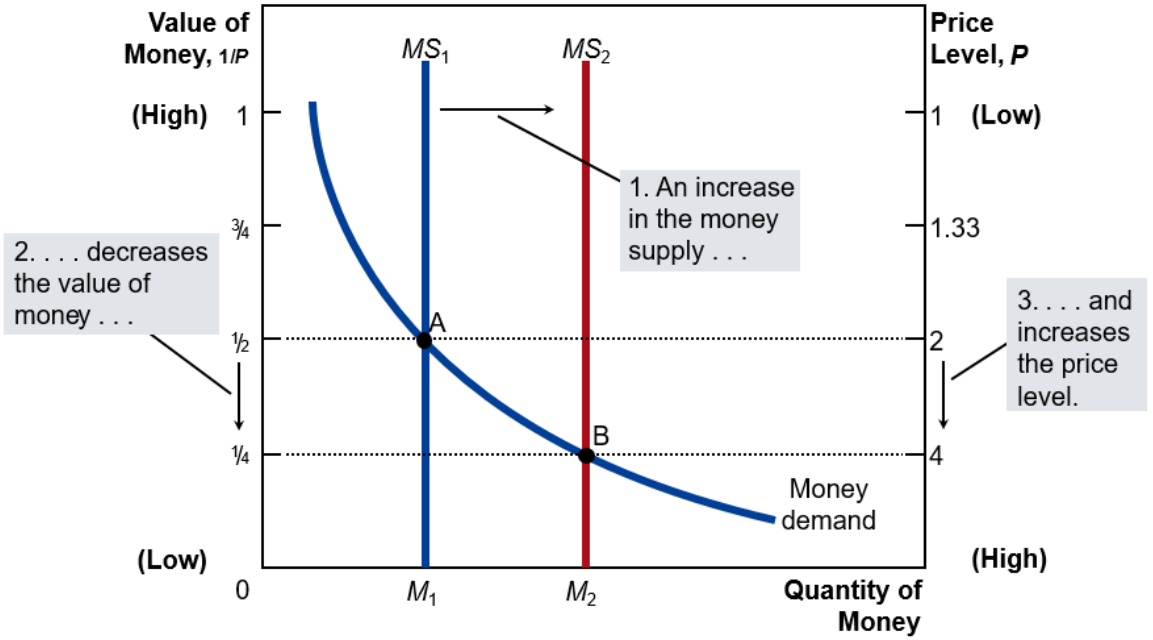
Money Supply, Demand, and Money Equilibrium (Cont'd)

- In the long run, the overall level of prices (*P*) adjusts to the level at which the demand for money equals the supply.
- This is monetary equilibrium.

Money Supply, Demand, and Equilibrium Price Level



The Effects of Monetary Injection



The Quantity Theory of Money

- The classical theory of inflation is also called the quantity theory of money.

- The quantity theory of money says that:
  - ▻ The quantity of money available in the economy determines the value of money.
    -> As the value of money is 1/*P*, when the value of money is determined, so is *P*.
  - ▻ The primary cause of inflation is the growth in the quantity of money.

The Adjustment Process

Imagine that a lot of cash is dropped from helicopters all across the country. What will be the consequences?

The Adjustment Process (Cont'd)

- If a lot of newly-printed cash is dropped from a helicopter …

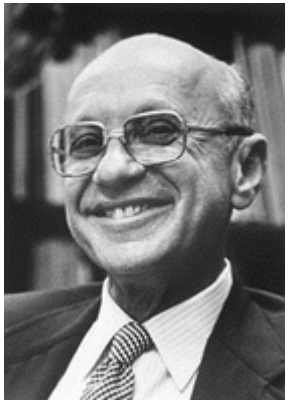
- People could try to spend the extra cash they pick up.
  ▻ They could put the cash in their bank accounts.
  ▻ But even in this case, the bank will lend the money to borrowers and stimulate even more spending.
  -> Recall the money multiplier!

- But there isn't any extra stuff to buy because productive capacity has not increased as a result of the money drop.

- Therefore, the only consequence is that prices will go up.

Quantity Theory of Money (Cont'd)

- "Inflation is always and everywhere a monetary phenomenon"
  - Milton Friedman (1921-2006)



The Classical Dichotomy

- Nominal variables are variables measured in monetary units.
- Real variables are variables measured in physical units.
- According to the classical dichotomy, different forces influence real and nominal variables.

Monetary Neutrality

- According to David Hume (1711-1776) and others, real economic variables are not affected by changes in the money supply.
- Changes in money supply affect nominal variables but not real variables.
- This feature of the classical theory of inflation is called monetary neutrality.

Monetary Neutrality (Cont'd)

- The irrelevance of monetary changes for real variables is called monetary neutrality.

- Monetary neutrality is thought to prevail in the long run.
  ▹ That is why we could study real variables, such as GDP, saving, investment, the real interest rate, the unemployment rate, etc.

Velocity and the Quantity Equation

- The classical theory of inflation or the quantity theory of money can also be expressed algebraically as the quantity equation.

Velocity and the Quantity Equation (Cont'd)

- The velocity of money is the speed at which the typical dollar bill travels around the economy from wallet to wallet in a year.
- Therefore, the velocity of money, *V*, is the number of times per year that a typical dollar bill is used to buy goods and services.
- Therefore, *V* is the dollar value of goods and services purchased with a dollar bill in a year.
- Therefore, if the economy's quantity of money is *M* dollar, then the dollar value of the goods and services purchased with *M* dollars in a year must be $M \times V$ dollars.
- Therefore, $M \times V$ must be equal to the country's nominal GDP.

Velocity and the Quantity Equation (Cont'd)

- Recall that the overall price level, P, can be interpreted as the GDP deflator.
- That is, P = GDP deflator = $\frac{\text{Nominal GDP}}{\text{Real GDP}}$
- Therefore, GDP deflator × Real GDP = Nominal GDP
- Therefore, $P \times Y$ = Nominal GDP.

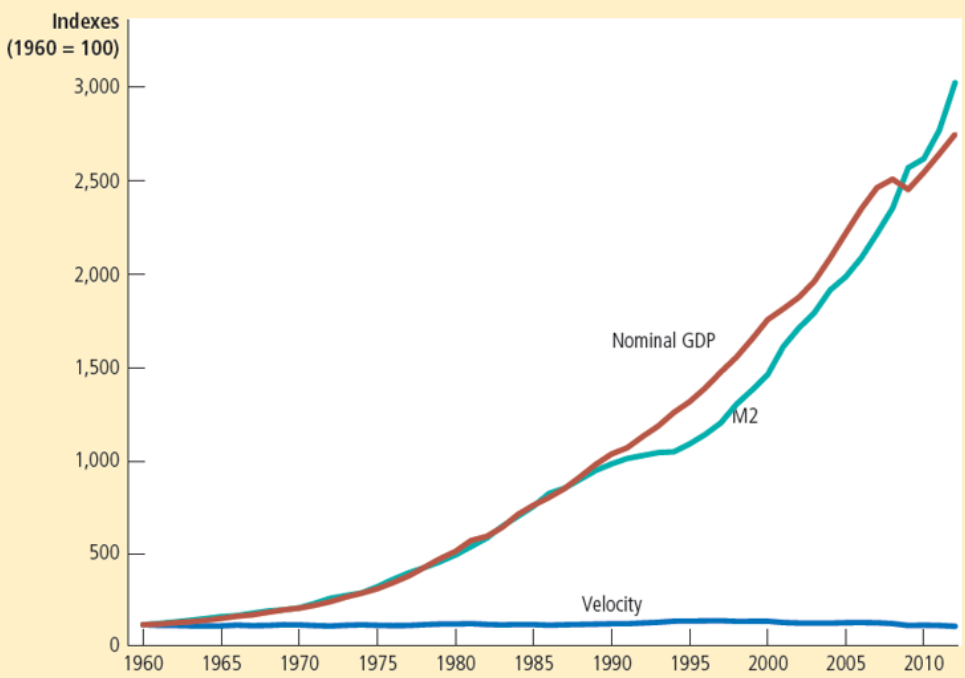
Velocity and the Quantity Equation (Cont'd)

- As both $M \times V$ and $P \times Y$ must be equal to the country's nominal GDP, we can write:
- $M \times V = P \times Y$
- This is the quantity equation.

Velocity and the Quantity Equation (Cont'd)

- The quantity equation ($M \times V = P \times Y$) implies:
- $V = (P \times Y) / M$ = Nominal GDP/Quantity of Money

Nominal GDP, Quantity of Money, and Velocity of Money



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

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.

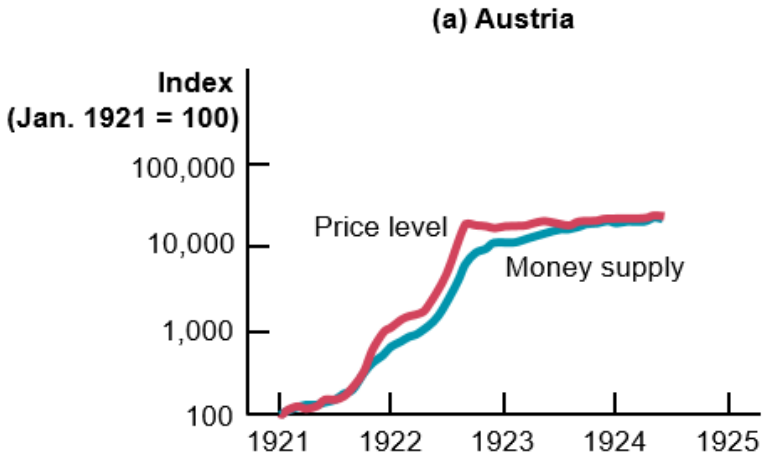
Velocity and the Quantity Equation (Cont'd)

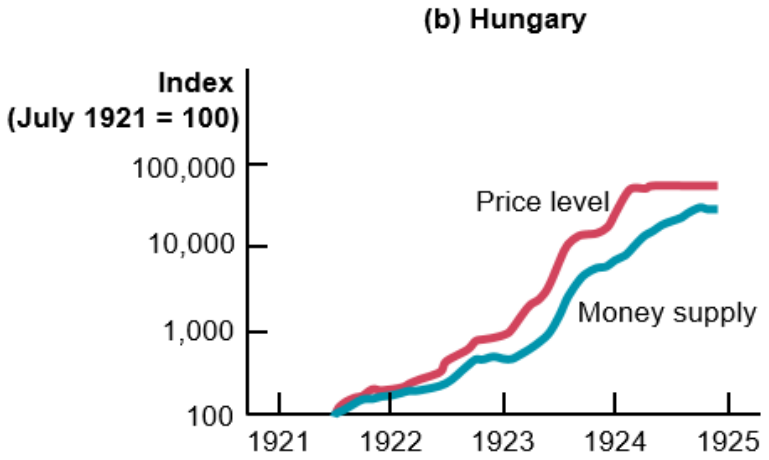
- The velocity of money is relatively stable over time.
- Also, as we saw in the topic "Production and Output", money does not affect output. Therefore,
- $M \times V = P \times Y$ implies that
- Any change in M causes an proportionate change in P. Therefore,
- Inflation is caused by rapid increases in the quantity of money.

Evidence on the Quantity Theory of Money

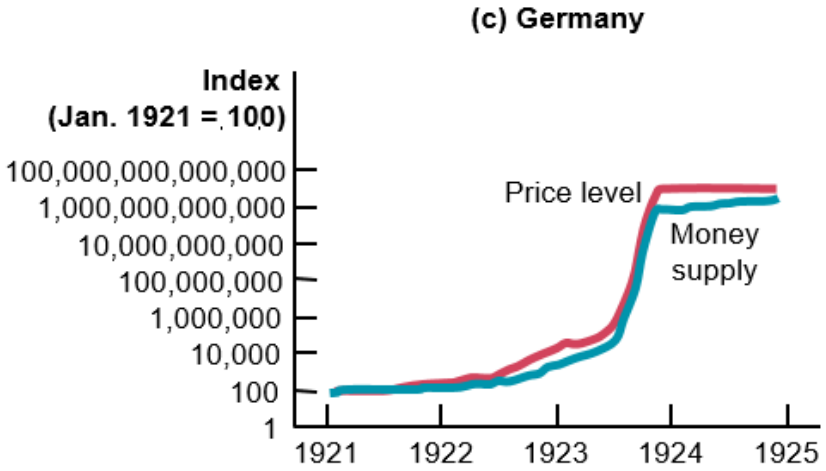
- Hyperinflation is inflation that exceeds 50 percent per month.
- Hyperinflation occurs in some countries because the government prints too much money to pay for its spending.

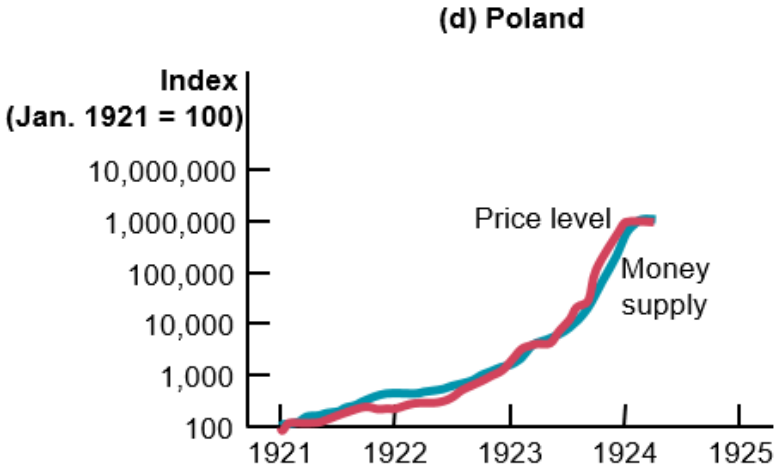
Money and Prices During Four Hyperinflations





Money and Prices During Four Hyperinflations (Cont'd)





The Inflation Tax

- Why do governments print so much money?
  - ▷ To pay for government spending when taxation is not an option.
- When the government raises revenue by printing money, it is said to impose an inflation tax.
- An inflation tax is like a tax on everyone who holds money.
- The inflation ends when the government institutes budgetary reforms – such as cuts in government spending – that ends the need to print money.

Hyperinflation in Zimbabwe

- During the 2000s, the Zimbabwe government was unable to cut spending enough or raise tax revenues enough to close its budget deficit.
- And it could not borrow, as nobody would lend it money.
- So, it printed money to cover its budget deficit.
- The result was rampant inflation.

Hyperinflation in Zimbabwe (Cont'd)

- Before the hyperinflation began, the Zimbabwe dollar was worth a bit more than the US dollar.
- In January 2008, however, the Reserve Bank of Zimbabwe, the central bank, issued a note worth 10 million Zimbabwe dollars, which was then equivalent to about four (4) US dollars.
- A year latter, a note worth 10 million Zimbabwe dollars, equivalent to three (3) US dollars, was issued.

Hyperinflation in Zimbabwe (Cont'd)

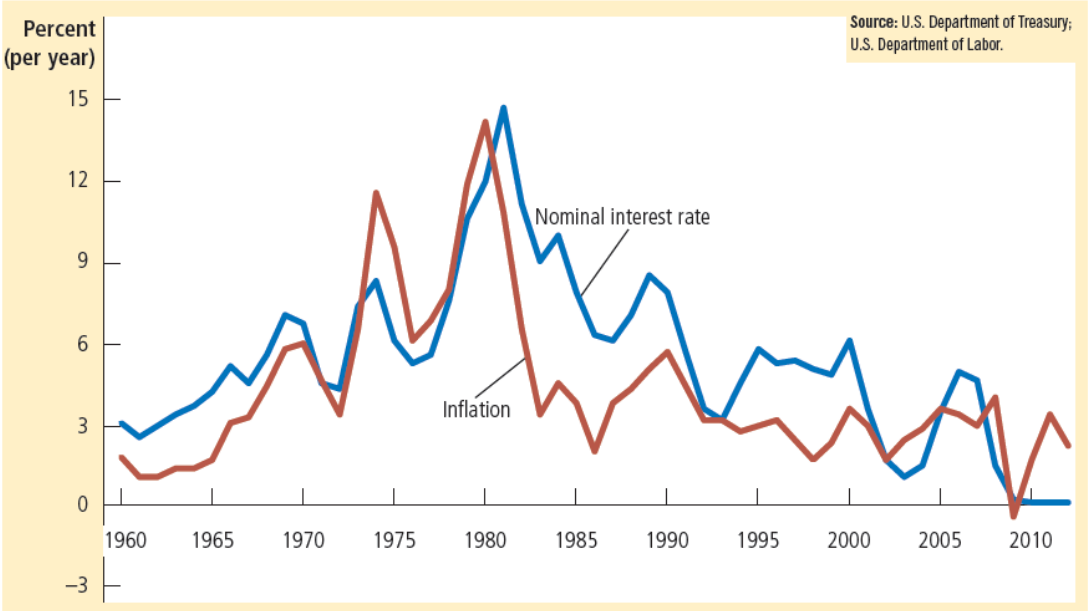
Hyperinflation in Zimbabwe (Cont'd)

- The Zimbabwe hyperinflation ended in 2009 when the Reserve Bank of Zimbabwe stopped printing Zimbabwe dollars and the nation began using foreign currencies such as the US dollar and the South African rand.

The Fisher Effect

- Real interest rate = nominal interest rate – inflation
- Real interest rate + inflation = nominal interest rate
- An increase in inflation is caused by an increase in money growth.
- An increase in money growth has no effect on the real interest rate, which is determined in the market for loanable funds.
- Therefore, any change in inflation must be accompanied by an equal change in the nominal interest rate.
  - ▻ This is called the Fisher effect, after economist Irving Fisher (1867-1947).

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: A Common Fallacy

- Inflation does not in itself reduce people's real purchasing power.

- Our standard of living depends on GDP, and inflation does not hurt our GDP.

  ▻ Recall from the topic "Production and Growth" that GDP is determined by other factors: technology, physical and human capital, natural resources, etc.

  ▻ The printing of money causes prices to rise but has no effect on the determinants of real GDP.

  -> Recall that monetary neutrality prevails in the long run.

- However, there are other, more subtle costs of inflation.

The Costs of Inflation

- Shoe leather costs
- Menu costs
- Relative price variability
- Tax distortions
- Confusion and inconvenience
- Arbitrary redistribution of wealth

Shoeleather Costs

- Shoeleather costs are the resources wasted when inflation forces people to live with minimal reserves of money.

- Inflation reduces the purchasing power of money. So people have an incentive to keep their wealth in non-money forms, such as stocks, bonds, real estate, gold, etc.

Shoeleather Costs (Cont'd)

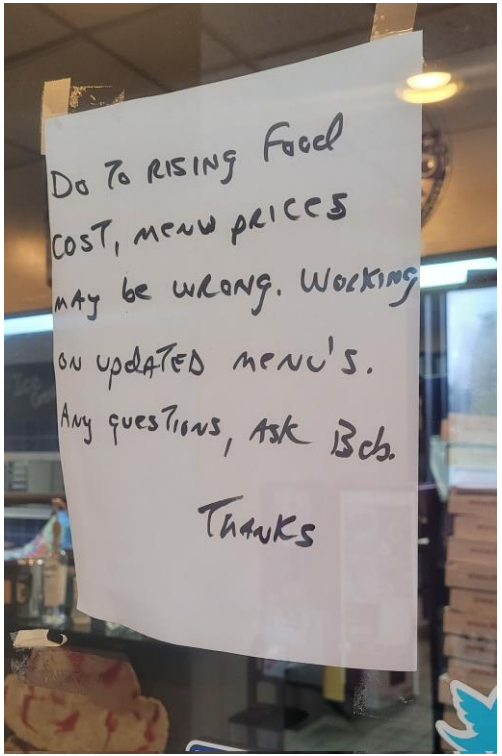
- Living with minimal cash reserves requires more frequent trips to a financial institution to convert interest-bearing non-money assets into cash.

- These extra trips to a financial institution are inconvenient and take time away from productive activities.

Menu Costs

- Menu costs are the costs of adjusting prices.
  - ▹ Printing new menus
  - ▹ Marketing costs of informing customers of the price changes
- During inflationary times, it is necessary to frequently update price lists and other posted prices.
- This is a resource-consuming process that takes away from other productive activities.

Menu Costs (Cont'd)



Relative-Price Variability and the Misallocation of Resources

- We just saw that it is costly for firms to adjust their prices frequently in an inflationary situation.
- So, businesses will adjust their prices, but once in a while.
- An businesses do not coordinate with other businesses when they make these infrequent but large price adjustments.
- So, inflation affects relative prices (such as the price of chicken relative to turkey).
- So, decisions of buyers and sellers get affected by inflation for no economically meaningful reason.

Relative-Price Variability and Misallocation of Resources (Cont'd)

- Change in the relative price of, say, ice cream to apples are desirable when caused by
  - ▻ Demand-related factors (a rise in temperature makes people desire ice cream), and
  - ▻ Supply-related factors (a drought that damages the production of apples)

- Changes in relative prices that are caused by inflation affect the choices of buyers and sellers for no economically useful reasons.

Inflation-Induced Tax Distortion

- Inflation exaggerates the size of capital gains and increases the tax burden on this type of income.
- This reduces the incentive to save for the future, and has a negative long-run effect on the economy.

How Inflation Raises the Tax Burden on Saving

	Economy A (price stability)	Economy B (inflation)
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 (.25 × nominal interest rate)	1	3
After-tax nominal interest rate (.75 × nominal interest rate)	3	9
After-tax real interest rate (after-tax nominal interest rate − inflation rate)	3	1

Inflation-Induced Tax Distortion (Cont'd)

- The income tax system treats all of the nominal interest earned on savings as taxable income, even though part of the nominal interest rate merely compensates for inflation.
- Consequently, when inflation increases the after-tax real interest rate falls, making saving less attractive.
- This reduced incentive for saving in the high-inflation economy could be damaging in the long-run.

Confusion and Inconvenience

- When the Fed increases the money supply and creates inflation, it reduces the purchasing power of a dollar.
- Inflation causes the purchasing power of a dollar to be different at different times.
- Therefore, with rising prices, it is more difficult to compare revenues, costs, and profits over time in inflation-adjusted (or, real) units.

Arbitrary Redistribution of Wealth

- When there's unexpected inflation, lenders lose and borrowers gain.
- When there's unexpected deflation, lenders gain and borrowers lose.
- These redistributions occur because many loans in the economy are specified in terms of the unit of account: money.
- Unexpected inflation redistributes wealth among the population in a way that has nothing to do with either merit or need.

If Inflation is Bad, is Deflation Good?

- Deflation is negative inflation (or falling prices).

- The following costs of inflation, are also costs of deflation:
  - Menu cost
  - Relative-price variability and the misallocation of resources
  - Confusion and inconvenience
  - Arbitrary redistributions of wealth (unexpected deflation)

If Inflation is Bad, is Deflation Good? (Cont'd)

- However, the following costs of inflation are smaller in the case of deflation:
  - ▹ Shoeleather costs
  - ▹ Inflation-induced tax distortions

- For this reason, Milton Friedman, an economist we met in an earlier slide, argued that central banks should aim for mild deflation in the long run (Friedman Rule).

If Inflation is Bad, is Deflation Good? (Cont'd)

- Recall that nominal interest rate = real interest rate + inflation

- The Friedman Rule argues that, to keep shoeleather costs low, we should set nominal interest rate = 0.
  - ▹ Therefore, real interest rate + inflation = 0
  - ▹ Therefore, inflation = -real interest rate, which is usually negative
  - ▹ So, to set nominal interest rate at zero, we should aim for mild deflation.

If Inflation is Bad, is Deflation Good? (Cont'd)

- The Friedman Rule's support of deflation applies in the long run.
- In the short-run, deflation may be the symptom of a sick economy.

Bonus: How to protect your savings from inflation?

- You can lend money to the US government without taking any inflation risk!
  - ▻ The U.S. Treasury sells inflation-protected bonds.
  - ▻ For these bonds, both interest payments and the principal that is repaid when the bond matures are adjusted for inflation.
  - ▻ So, buyers for these bonds are protected from inflation.
  - ▻ These bonds are of two types:
    - -> Treasury Inflation-Protected Securities (TIPS)
    - -> I Savings bonds
    - -> These bonds can be bought directly from www.treasurydirect.gov

- Inflation-indexed bonds are also sold by foreign governments and by private corporations.

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