

10

MONEY AND PRICES IN THE LONG RUN





The Monetary System

5

Revision

- What is the macroeconomic role of the financial system?

It moves the economy's scarce resources from savers to borrowers.

- What government could do to affect saving and investment?

By applying different policies related to taxes and public investment:

$$S = (Y - T - C) + (T - G)$$

The Monetary System

In a modern society, paying for goods and services by cash, debit card, credit card or cheque is not an odd social custom.

The existence of money makes trade easier!

When economists study monetary policy the following issues need to be taken into account:

- What money is?
- How the central bank controls the quantity of money in circulation?
- What are the long-run effects of changes in the quantity of money on inflation, interest rates, production and unemployment?

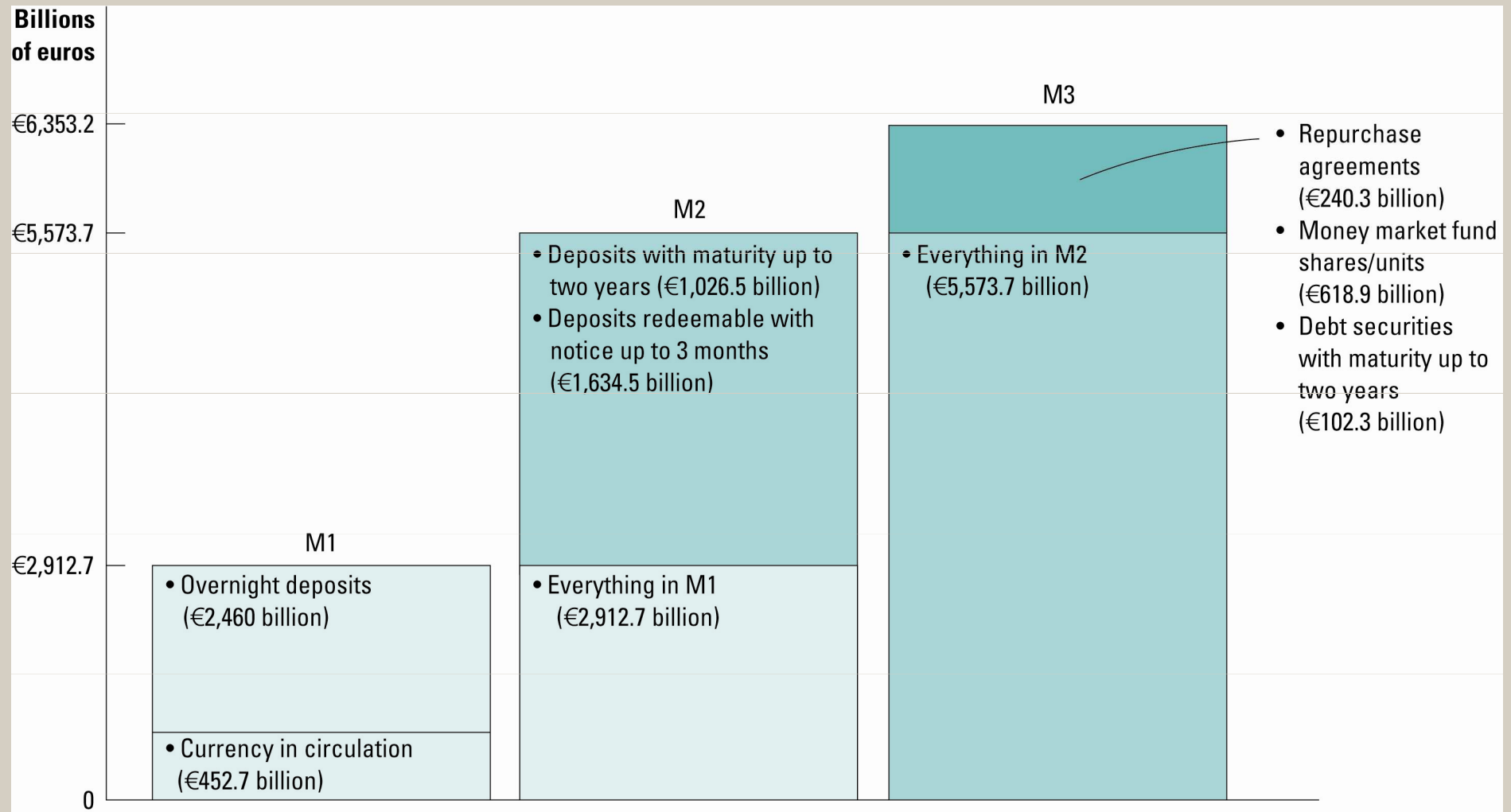
The Meaning of Money

- *Money* is the set of assets in an economy that people regularly use to buy goods and services from other people.
- Money has three functions in the economy:
 - Medium of exchange – the most commonly accepted asset for a buyer to pay to a seller
 - Unit of account – the yardstick with which people post prices and record debts
 - Store of value – to transfer purchasing power from the present to the future
- *Liquidity* is the ease with which an asset can be converted into the economy's medium of exchange.

The Kinds of Money

- *Commodity money* takes the form of a commodity with intrinsic value.
 - Examples: Gold, silver, cigarettes.
- *Fiat money* is used as money because of government decree.
 - It does not have intrinsic value.
 - Examples: Coins, currency, current account deposits.
- *Currency* is the paper bills and coins in the hands of the public.
- *Demand deposits* are balances in bank accounts that depositors can access on demand by writing a cheque or using a debit card.

Figure 1 Three Measures of the Money Stock for the Euro Area



The Role of Central Banks

- Whenever an economy relies on fiat money, there must be some agency that regulates the system.
 - A *central bank* is an institution designed to oversee the banking system and regulate the quantity of money in the economy.
- *Monetary policy* is the set of actions taken by the central bank in order to affect the money supply.

The Role of Central Banks

- The *money supply* is the quantity of money available in the economy.
 - One of the fundamental principles of Economics is that prices rise when too much money is printed.
 - Another of the principles is that society faces a short-run trade-off between inflation and unemployment.
 - The regulation of the money supply is therefore a crucially important task.

The European Central Bank and the Eurosystem

- 1 June 1998 – 11 countries, making up the euro area, decided to enter European Monetary Union (EMU) and have the same currency – EURO
- The *European Central Bank* is the overall central bank of the 17 countries comprising the European Monetary Union.
- The primary objective of the ECB is to promote price stability throughout the euro area.
 - Inflation Target: Year-on-year increase in prices by close to 2% from below as measured by the annual change in a harmonized index of consumer prices throughout the euro area.

The European Central Bank and The Eurosystem

- The *Eurosystem* is the system made up of the ECB plus the national central banks of the 12 countries comprising the European Monetary Union.
 - Executive Board – min. 8-year term – President, Vice-President and 4 other people of high standing in the banking profession
 - Governing Council – Executive Board together with the governors of the national central banks – meets every 2 weeks in Frankfurt
- An important feature of the ECB and the Eurosystem is its independence.

The Bank of England

- The Bank of England was founded in 1694 but was given independence in the setting of interest rates only in 1997.
- The *Bank of England* is the central bank of the United Kingdom.
 - Monetary Policy Committee (MPC) – Governor (5 yr. term), 2 Deputy Governors, 2 members appointed by Exchequer, 4 members appointed by Chancellor (3 year term)
- The Bank of England's primary duty is to deliver price stability
 - Inflation Target (set by UK government): 2% in terms of an annual rate of inflation based on CPI

The Federal Reserve

- The Fed was created in 1914.
- The *Federal Reserve (Fed)* is the central bank of the United States.
 - Board of Governors - Chairman (4-year term), 6 other members (14-year term) who are all appointed by the US President.
 - Federal Reserve System – Federal Reserve Board (in Washington D.C.) and 12 regional Federal Reserve Banks in major U.S. Cities
 - Federal Open Market Committee (FOMC) – Board of Governors together with 12 regional presidents who vote on rotation schedule - meets about every 6 weeks in Washington to make monetary policy (set the int. rate, discount rate etc.)

Banks and the Money Supply

- The amount of money in the economy includes both currency and demand deposits.
- Because demand deposits are held in banks, the behavior of the banks can influence the money supply.
 - *Reserves* are deposits that banks have received but have not loaned out.
 - In a *fractional-reserve banking* system, banks hold a fraction of the money deposited as reserves and lend out the rest.

Money Creation with Fractional-Reserve Banking

- The money supply is affected by the amount deposited in banks and the amount that banks loan.
 - Deposits into a bank are recorded as both assets and liabilities.
 - The fraction of total deposits that a bank has to keep as reserves is called the *reserve ratio*.
 - Loans become an asset to the bank.
- When a bank makes a loan from its reserves, the money supply increases.

Money Creation with Fractional-Reserve Banking

- This T-Account shows a bank that...
 - accepts deposits,
 - keeps a portion as reserves,
 - and lends out the rest.
 - It assumes a reserve ratio of 10%.

First European Bank	
Assets	Liabilities
Reserves €10.00	Deposits €100.00
Loans €90.00	
<hr/> Total Assets €100.00	<hr/> Total Liabilities €100.00

Money Creation with Fractional-Reserve Banking

- When one bank loans money, that money is generally deposited into another bank.
- This creates more deposits and more reserves to be lent out.
- When a bank makes a loan from its reserves, the money supply increases.

The Money Multiplier

First European Bank		Second European Bank	
Assets	Liabilities	Assets	Liabilities
Reserves €10.00	Deposits €100.00	Reserves €9.00	Deposits €90.00
Loans €90.00		Loans €81.00	
<hr/>	<hr/>	<hr/>	<hr/>
Total Assets €100.00	Total Liabilities €100.00	Total Assets €90.00	Total Liabilities €90.00

Money Supply = €190.00!

The Money Multiplier

- How much money is eventually created in this economy?
 - The *money multiplier* is the amount of money the banking system generates with each unit of reserves.
- The money multiplier is the reciprocal of the reserve ratio:

$$M = 1/R$$

- With a reserve requirement, $R = 20\%$ or $1/5$,
- The multiplier is 5.

The Central Bank's Tools of Monetary Control

- A central bank has three main tools in its monetary toolbox:
 - Open-market operations
 - Changing the reserve requirement
 - Changing the refinancing rate

The Central Bank's Tools of Monetary Control

- Open-Market Operations
 - A central bank conducts *open-market operations* when it buys government bonds from, or sells government bonds to the public:
 - When the central bank buys government bonds, the money supply increases.
 - The money supply decreases when the central bank sells government bonds.

The Central Bank's Tools of Monetary Control

- The Refinancing Rate
 - The *refinancing rate* is the interest rate the ECB lends on a short-term basis to the euro area banking sector.
 - Increasing the refinancing rate decreases the money supply.
 - Decreasing the refinancing rate increases the money supply.
 - In the USA, the refinancing rate is called the discount rate and in the UK it's called the repo rate.

The Central Bank's Tools of Monetary Control

- Reserve Requirements
 - *Reserve requirements* are regulations on the minimum amount of reserves that banks must hold against deposits.
 - Increasing the reserve requirement decreases the money supply.
 - Decreasing the reserve requirement increases the money supply.
 - Central banks have tended to change reserve requirements only rarely and the Bank of England no longer sets reserve requirements at all.

Problems in Controlling the Money Supply

- A central bank's control of the money supply is not precise.
- A central bank must wrestle with two problems that arise due to fractional-reserve banking.
 - The central bank does not control the amount of money that households choose to hold as deposits in banks.
 - The central bank does not control the amount of money that bankers choose to lend.

Inflation definition 1/2

- Inflation is an increase in the overall level of prices.
- Inflation is measured by the inflation rate which is defined as the following:

$$\pi_t = \frac{P_{t+1} - P_t}{P_t}$$

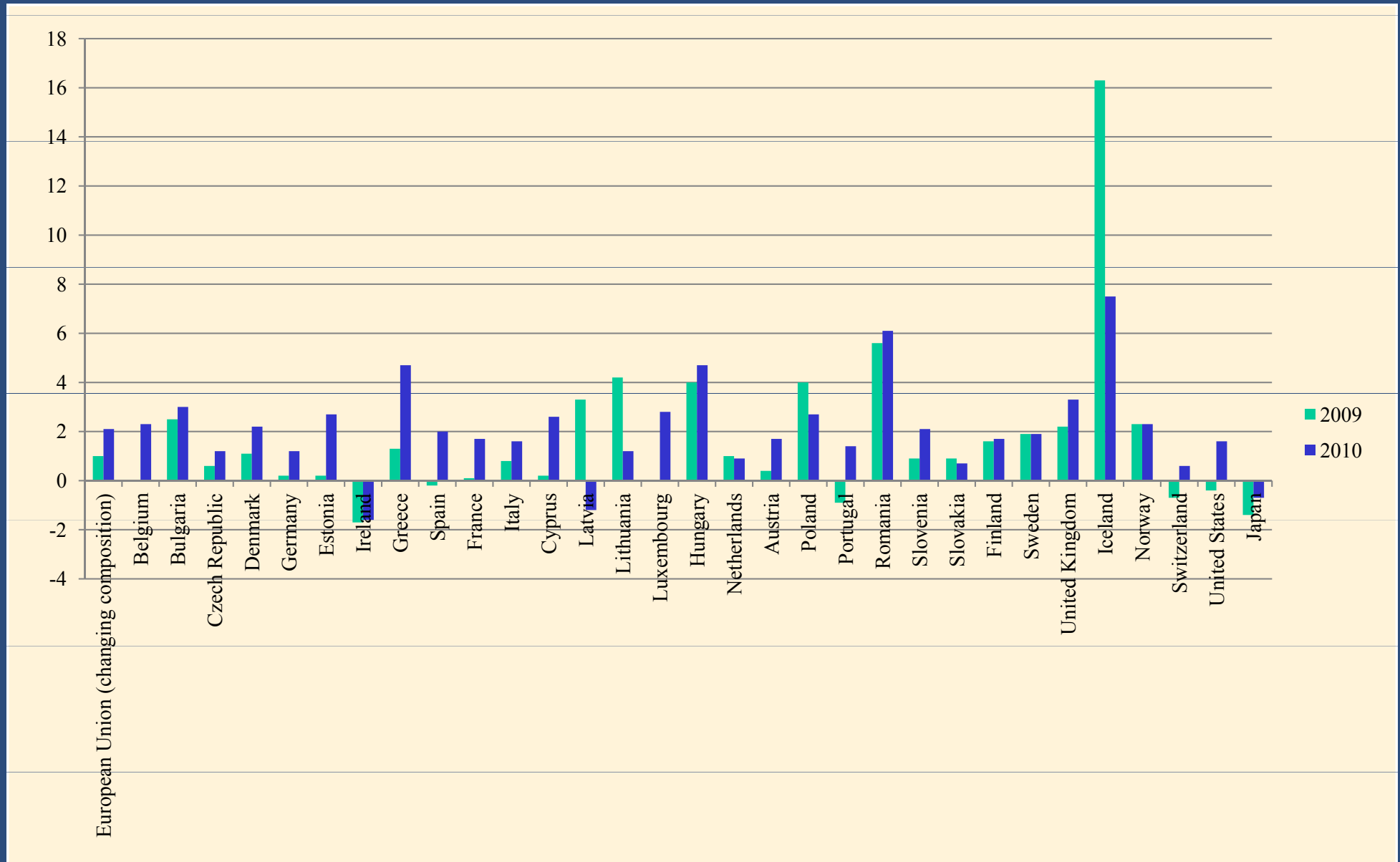
where P_{t+1} is the price level in period $t+1$ and P_t is the price level in period t (price level here is primarily measured by CPI)

- Inflation is a monetary phenomena , which can be used by excess emission of money into circulation

Inflation definition 2/2

- Hyperinflation is an extraordinarily high rate of inflation.
- Inflation: Historical Aspects
 - Inflation in the UK exceeded 20% per year in the mid-1970s.
 - In the late 1990s and early 2000s UK inflation has been low and stable at around 2% per year.
 - For long periods in the nineteenth century, some countries experienced deflation, meaning decreasing average prices.
 - Hyperinflation refers to high rates of inflation such as Germany experienced in the 1920s.

2009-2010 inflation rates in the EU countries, US and Japan



Money Supply, Money Demand, and Monetary Equilibrium 1/2

- The *quantity theory of money* is used to explain the long-run determinants of the price level and the inflation rate.
- Inflation is an economy-wide phenomenon that concerns the value of the economy's medium of exchange.
- When the overall price level rises, the value of money falls.

Money Supply, Money Demand, and Monetary Equilibrium 2/2

- The money supply is a policy variable that is controlled by the central bank.
- Money demand has several determinants, including interest rates and 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 depends on the prices of goods and services.
- In the long run, the overall level of prices adjusts to the level at which the demand for money equals the supply.

Money demand function

- Intuition tells that demand for money should depend on interest rates. Interest rate is the opportunity cost of holding money balances. When a person holds money balances he forgoes nominal interest which he could earn by depositing money in the bank
- When interest rate increases, holding money becomes more expensive since person now forgoes higher interest rate. This leads to decrease of demand for money. **Thus demand for money is negatively related to interest rate**
- It is important to stress that money demand **depends on nominal interest rate**. If lender expects inflation over the period of the loan he requires higher nominal interest rate so that to cover the loss of purchasing of power of money due to inflation. So, for the lender return on lending is the nominal interest rate
- Money demand should also positively depend on real income

$$(M / P)^d = L(Y, i)$$

+ -

Figure 1 Money Supply, Money Demand, and the Equilibrium Price Level

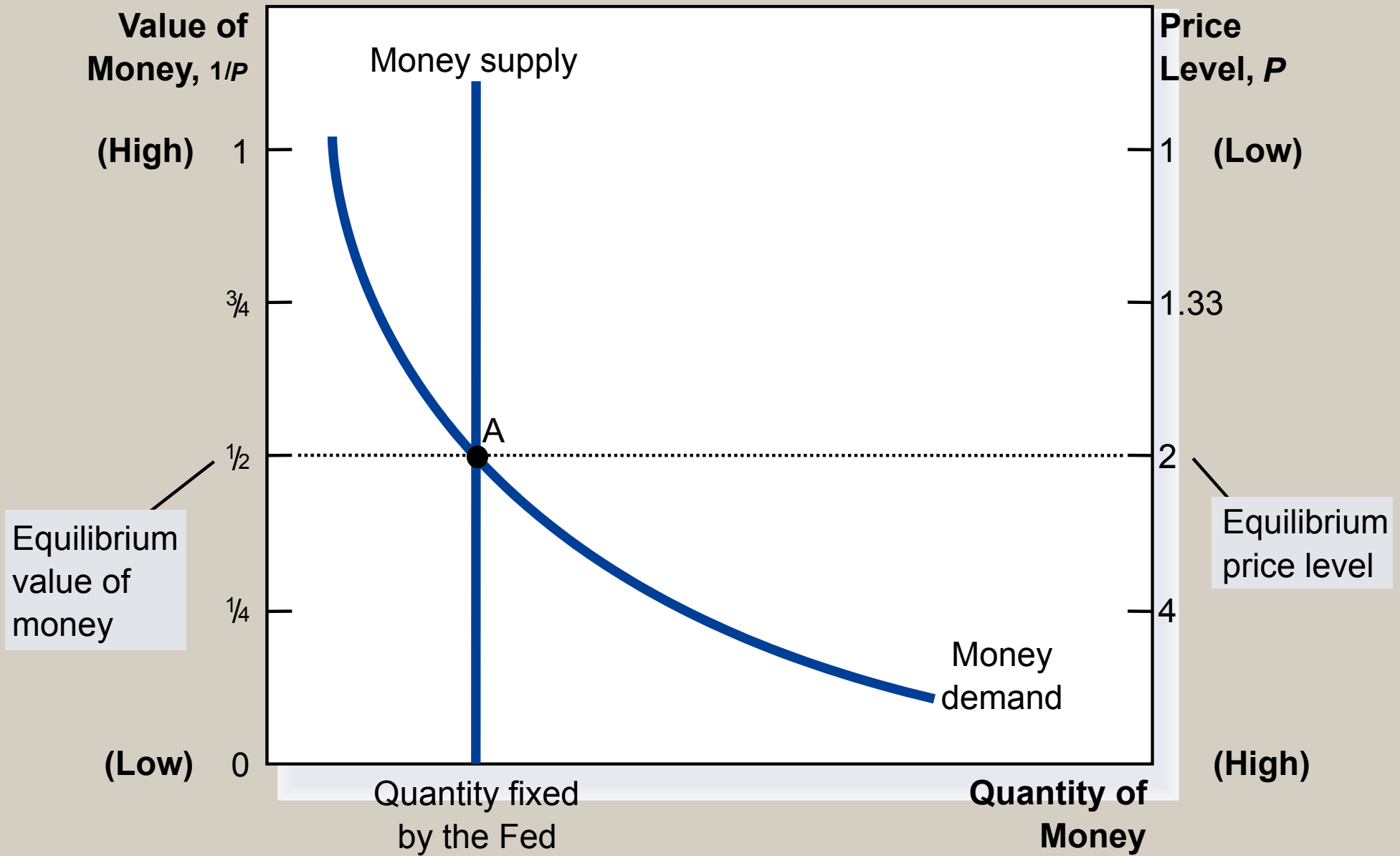
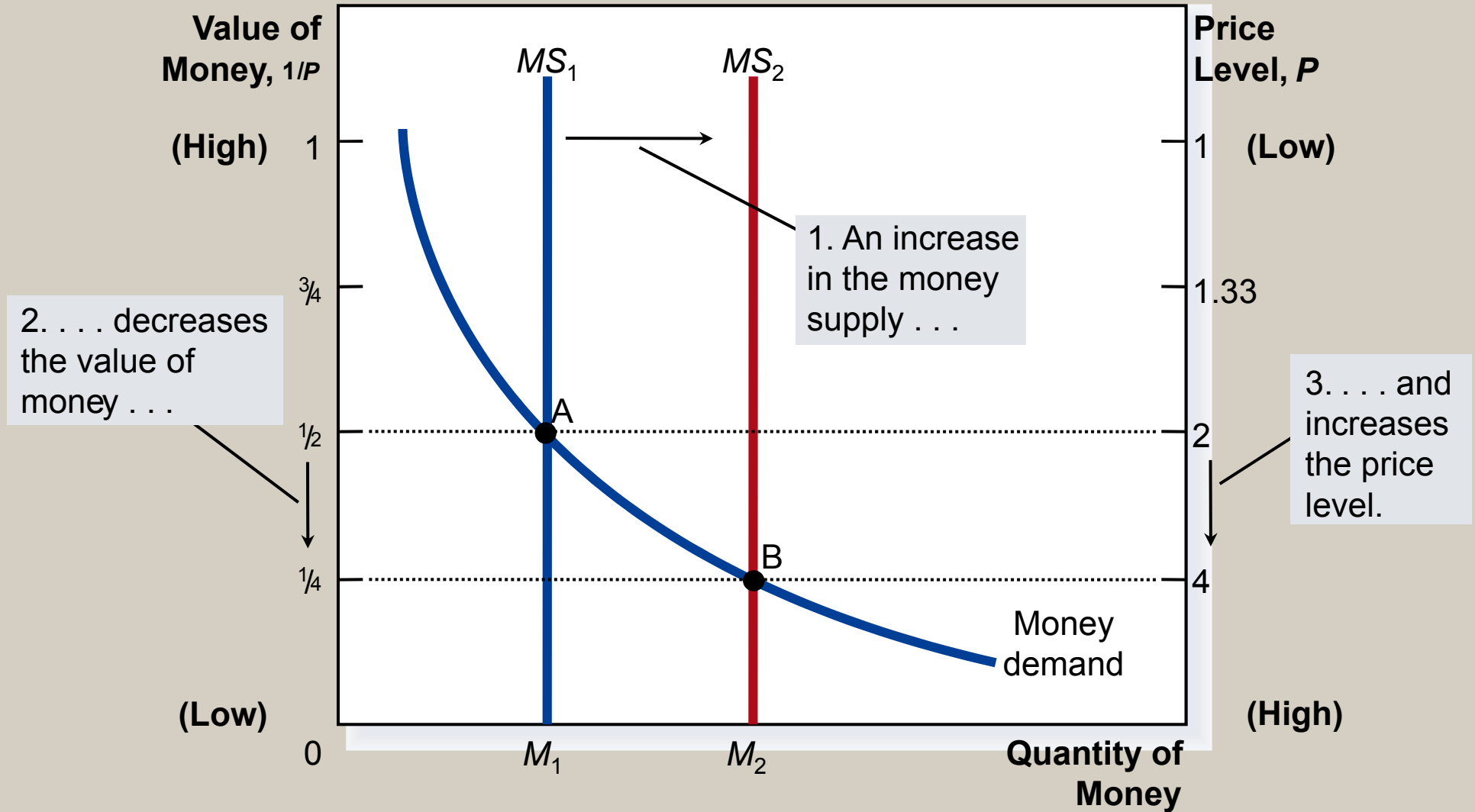


Figure 2 The Effects of Monetary Injection



The Classical Theory of Inflation

- The Quantity Theory of Money
 - How the price level is determined and why it might change over time is called the quantity theory of money.
 - The quantity of money available in the economy determines the value of money.
 - The primary cause of inflation is the growth in the quantity of money.

The Classical Dichotomy and Monetary Neutrality

- According to Hume and others, real economic variables do not change with changes in the money supply.
 - *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.
- Changes in the money supply affect nominal variables but not real variables.
- The irrelevance of monetary changes for real variables is called *monetary neutrality*.

Velocity and the Quantity Equation

- The *velocity of money* refers to the speed at which the money changes hands, travelling around the economy from wallet to wallet.

$$V = (P \times Y) / M$$

- Where: V = velocity

P = the price level

Y = the quantity of output

M = the quantity of money

- Rewriting the equation gives the quantity equation: $M \times V = P \times Y$

Velocity and the Quantity Equation

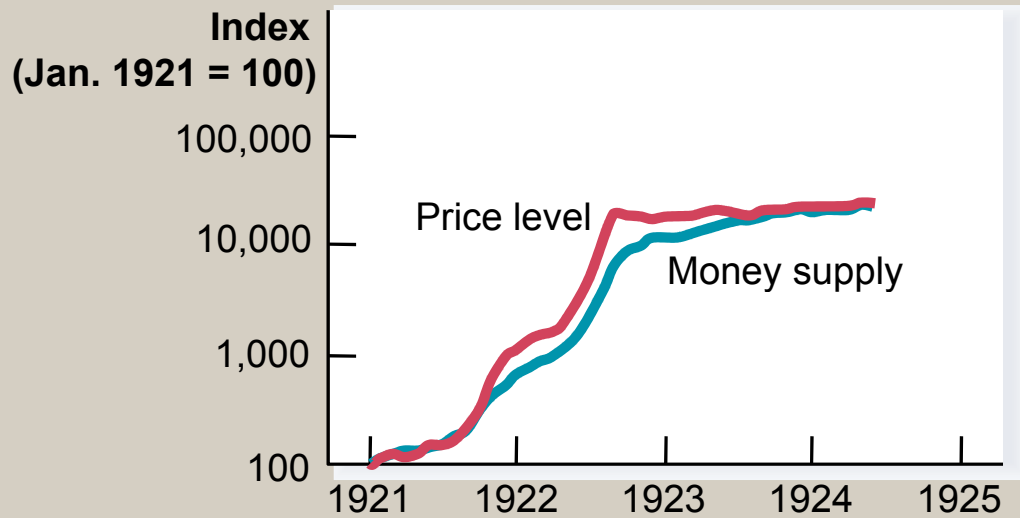
- The *quantity equation* relates the quantity of money (M) to the nominal value of output ($P \times Y$).
- The quantity equation shows that an increase in the quantity of money in an economy must be reflected in one of three other variables:
 - the price level must rise,
 - the quantity of output must rise, or
 - the velocity of money must fall.

Velocity and the Quantity Equation

- The Equilibrium Price Level, Inflation Rate, and the Quantity Theory of Money
 - The velocity of money is relatively stable over time.
 - When the central bank changes the quantity of money, it causes proportionate changes in the nominal value of output ($P \times Y$).
 - Because money is neutral, money does not affect output.
- 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.

Figure 3 Money and Prices During Four Hyperinflations

(a) Austria



(b) Hungary

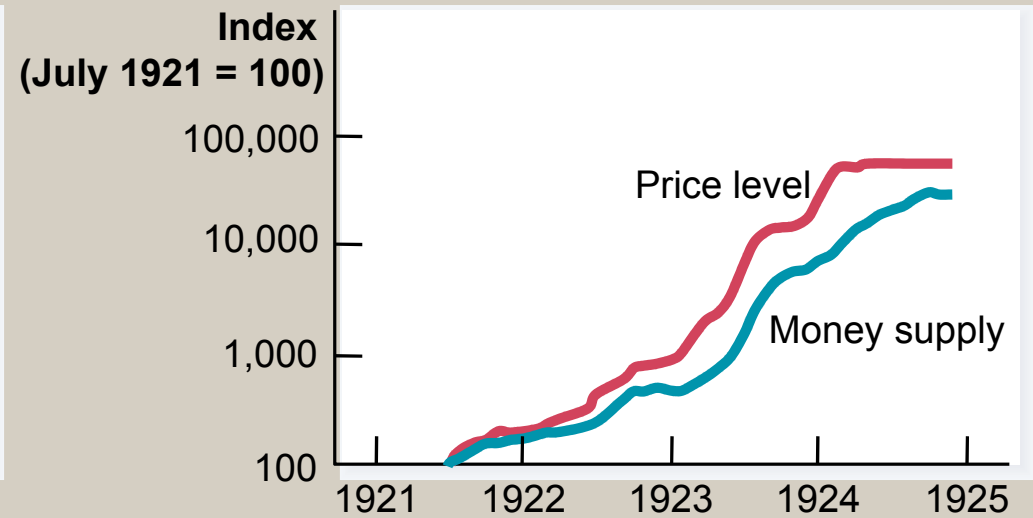
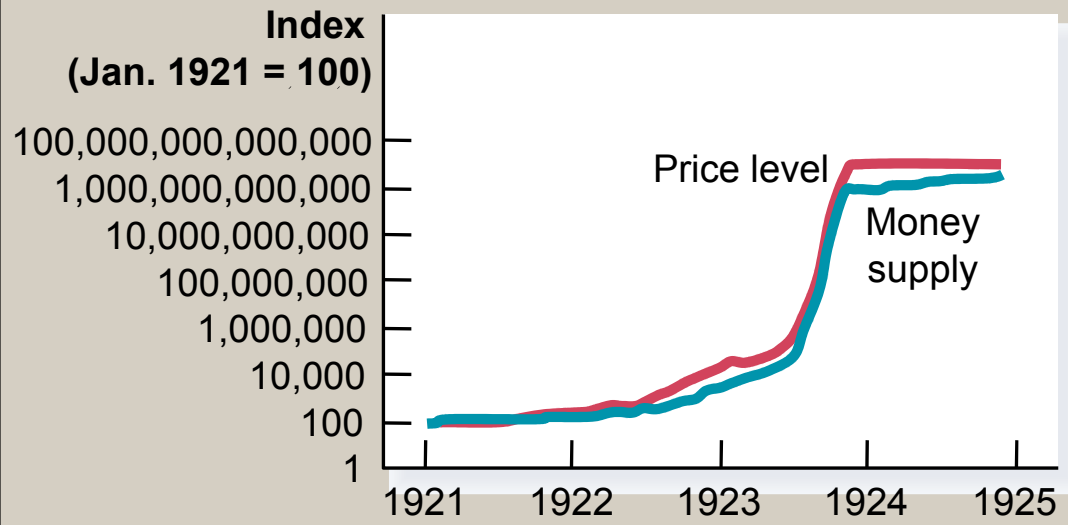
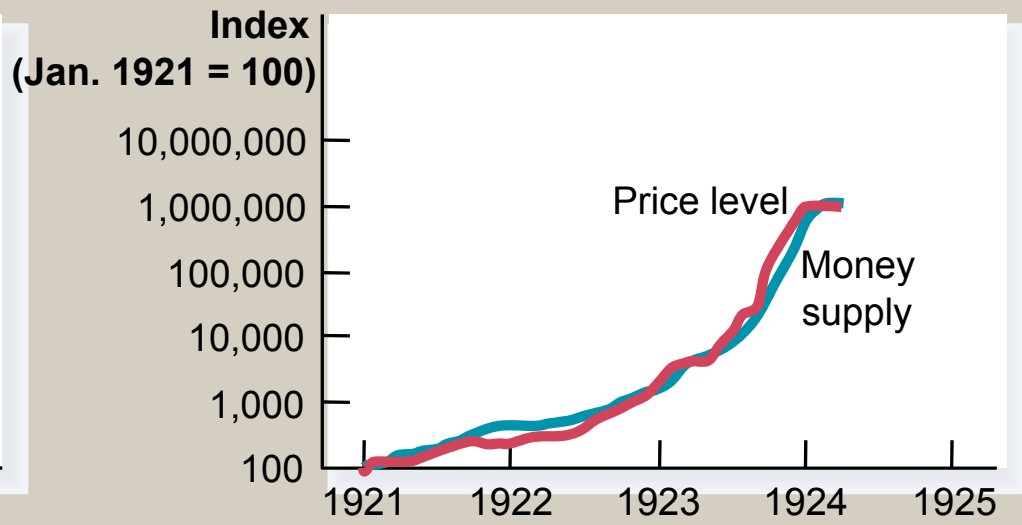


Figure 3 Money and Prices During Four Hyperinflations

(c) Germany



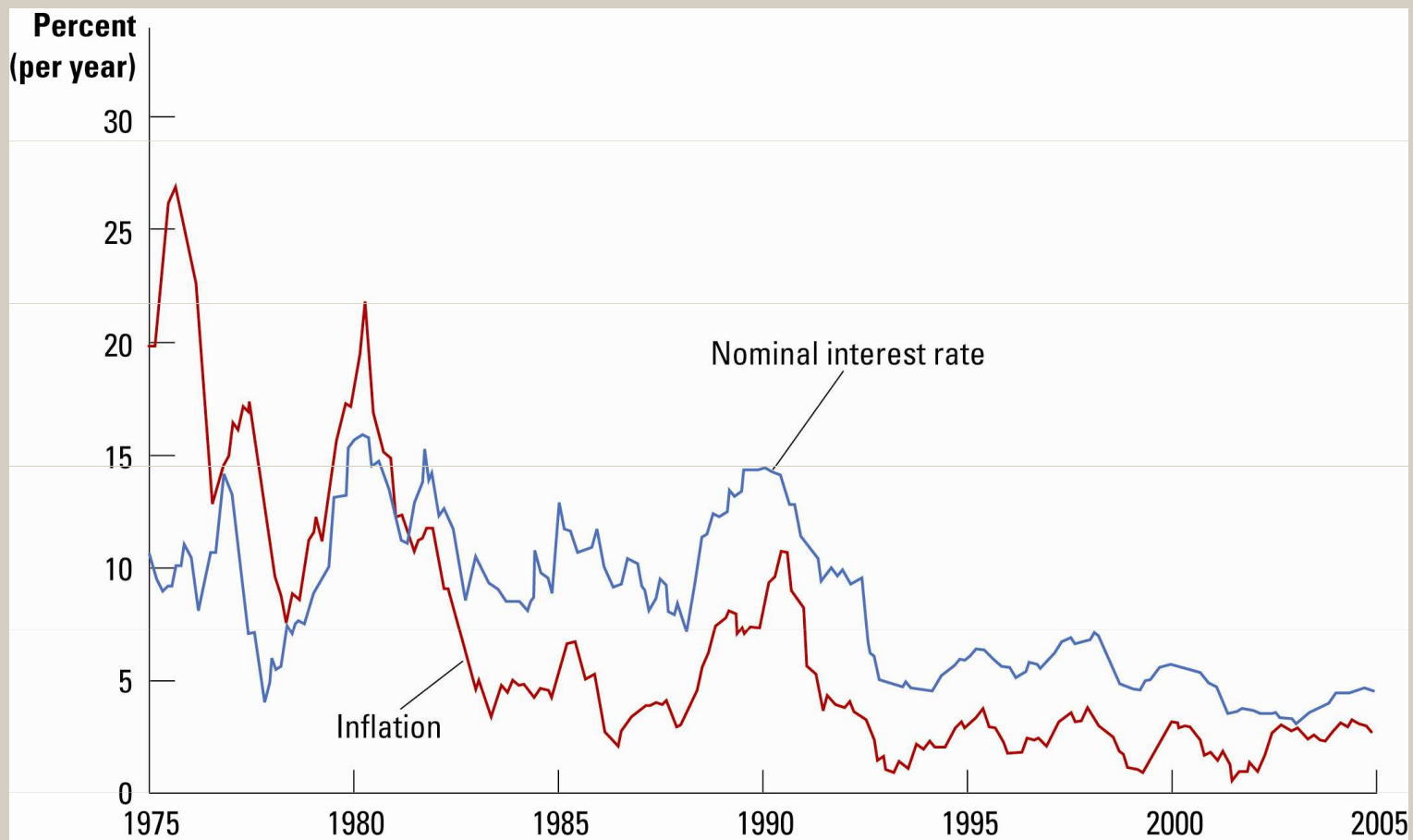
(d) Poland



The Inflation Tax

- When the government raises revenue by printing money, it is said to levy an *inflation tax*.
- An inflation tax is like a tax on everyone who holds money.
- The inflation ends when the government institutes fiscal reforms such as cuts in government spending.
- The *Fisher effect* refers to a one-to-one adjustment of the nominal interest rate to the inflation rate.
- According to the Fisher effect, when the rate of inflation rises, the nominal interest rate rises by the same amount.
- The real interest rate stays the same.

Figure 4 The UK Nominal Interest Rate and the Inflation Rate



The Costs of Inflation

- Does Inflation Cause A Fall in Purchasing Power?
 - Inflation *does not* in itself reduce people's real purchasing power because inflation in prices goes hand in hand with inflation in nominal incomes.
- Inflation is a tax on the holders of money.
 - As most taxes it gives people an incentive to alter their behavior to avoid paying the tax.
 - This distortion causes deadweight losses for society as a whole.

The Costs of Inflation

- Shoeleather 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 encourages people to reduce their money holdings.
- Inflation reduces the real value of money, so people have an incentive to minimize their cash holdings.
- Less cash requires more frequent trips to the bank to withdraw money from interest-bearing accounts.
- The actual cost of reducing your money holdings is the time and convenience you must sacrifice to keep less money on hand.
- Also, extra trips to the bank take time away from productive activities.

Menu Costs

- *Menu costs* are the costs of adjusting prices.
- During inflationary times, it is necessary to update price lists and other posted prices.
- This is a resource-consuming process that takes away from other productive activities.

Relative-Price Variability and the Misallocation of Resources

- Inflation distorts relative prices.
- Consumer decisions are distorted, and markets are less able to allocate resources to their best use.

Inflation-Induced Tax Distortion

- Inflation exaggerates the size of capital gains and increases the tax burden on this type of income.
- With progressive taxation, capital gains are taxed more heavily.
- The nominal interest earned on savings is treated as income for income tax purposes, even though part of the nominal interest rate merely compensates for inflation.
- The after-tax real interest rate falls when inflation rises, making saving less attractive.

Table 1 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

Confusion and Inconvenience

- When the central bank increases the money supply and creates inflation, it erodes the real value of the unit of account.
- Inflation causes money at different times to have different real values.
- Therefore, with rising prices, it is more difficult to compare real revenues, costs, and profits over time.
- In turn, inflation makes investors less able to sort out successful from unsuccessful firms which impedes financial markets.

A Special Cost of Unexpected Inflation: Arbitrary Redistribution of Wealth

- Unexpected inflation redistributes wealth among the population in a way that has nothing to do with either merit or need.
- These redistributions occur because many loans in the economy are specified in terms of the unit of account—money.

N.B. Inflation is especially volatile and uncertain when the average rate of inflation is high.

Phillips curve : tradeoff between unemployment and inflation

- The connection between unemployment rate and inflation was first observed from UK data by A.W. Phillips and was called Phillips curve.
- The Phillips curve represents the inverse relationship between the rate of unemployment and the rate of increase in money wages. It says that the higher is the rate of unemployment, the lower is the rate of increase in wages (wage inflation)

- Let's define the wage inflation . If we denote by W_t the wage this period and by W_{t+1} the wage next period , the rate of wage inflation g_w is given by the following formula :

$$g_w = \frac{W_{t+1} - W_t}{W_t} \quad (1)$$

- The Phillips curve shows that the rate of wage inflation decreases when unemployment rate increases and vice versa

Simple Phillips curve

- If we denote the natural rate of unemployment by u^* , we can write the simple Phillips curve in the following form:

$$g_w = -\varepsilon(u - u^*) \quad (2)$$

where ε is a constant measuring the responsiveness of wages to unemployment .

- The last equation states that wages are falling when the unemployment rate exceeds the natural rate of unemployment and rising when unemployment falls below the natural level of unemployment
- Equation (2) is the original Phillips curve. Gradually term Phillips curve started to be used also for the curve relating the rate of increase of prices to the unemployment rate

The graphical representation of original Phillips curve



The policy tradeoff

- The Phillips curve became the basis of macroeconomic policy analysis. According to it policymakers could have a combination of low unemployment and high inflation such as situation in late 1960's in US. Or they could still have low inflation by maintaining high unemployment as in the early 1960's

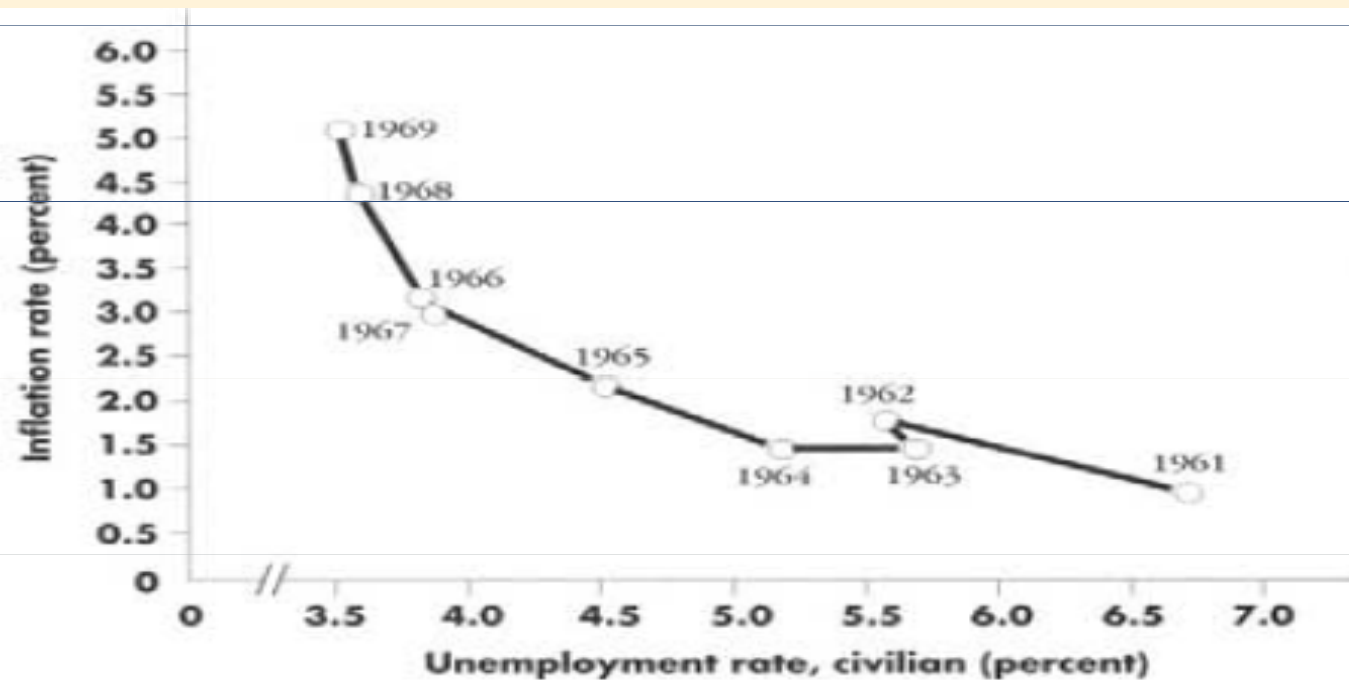
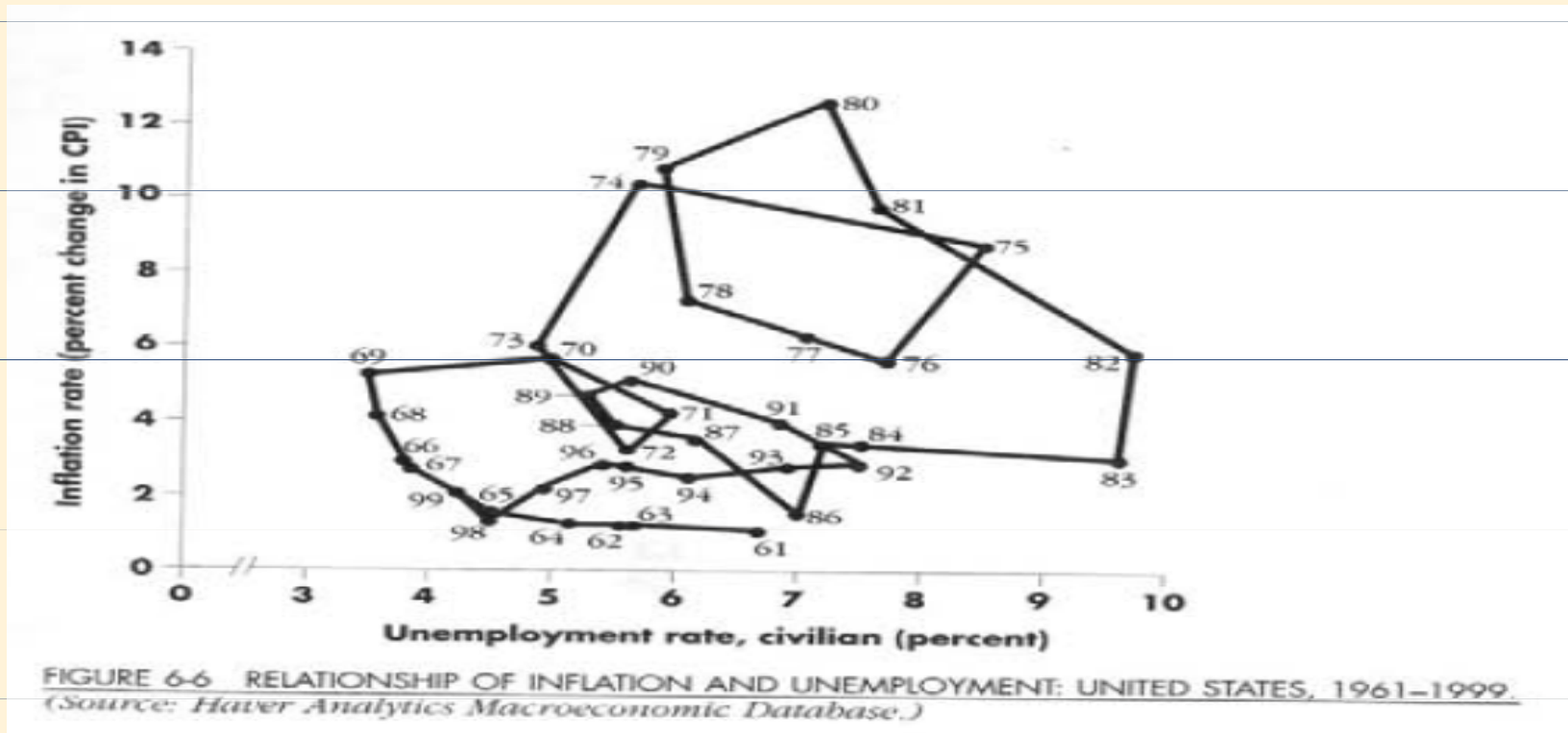


FIGURE 6-5 RELATIONSHIP OF INFLATION AND UNEMPLOYMENT: UNITED STATES, 1961-1969.
(Source: DRI/McGraw-Hill.)

The failure of simple Phillips curve and the role of expected inflation 1/3

- After 1960's the relationship expressed in the original Phillips curve started to fall apart both in Britain and in US .



- The problem was that original Phillips did not take into account expected or anticipated inflation

The failure of simple Phillips curve and the role of expected inflation 2/3

- When the workers and firms agree over wages , they make an agreement over real wages. So they adjust the nominal wages for any inflation which they expect to happen over the contract period.
- Unemployment level depends not on the level of inflation per se , but the excess of actual inflation over what was expected
- So now if we talk about the real wages, the excess of wage inflation over the expected rise in prices or in other words the expected inflation is the important thing for both workers and firms. So we can rewrite the original Phillips curve in the following way :

$$g_w - \pi^e = -\varepsilon(u - u^*) \quad (3)$$

where π^e is the level of expected inflation

The failure of simple Phillips curve and the role of expected inflation 3/3

- If we assume in addition that real wage is constant , it implies that nominal wage inflation rate should be equal to actual inflation rate
- Denoting actual inflation rate by π , we can rewrite the **modern expectations- augmented Phillips curve** in the following way:

$$\pi = \pi^e - \varepsilon(u - u^*) \quad (4)$$

- Two crucial observations about this new Phillips curve are the following:
 - a) The change in expected inflation transfers into the same one-to-one change in actual inflation
 - b) The actual unemployment level equals natural unemployment if actual inflation equals expected inflation

The expectations augmented Phillips curve and the actual data

- The modern expectations augmented Phillips curve is plotted in the following graph together with actual data for different years. Now you can see that the expectations augmented Phillips curve corresponds to actual data although not perfectly but quite well

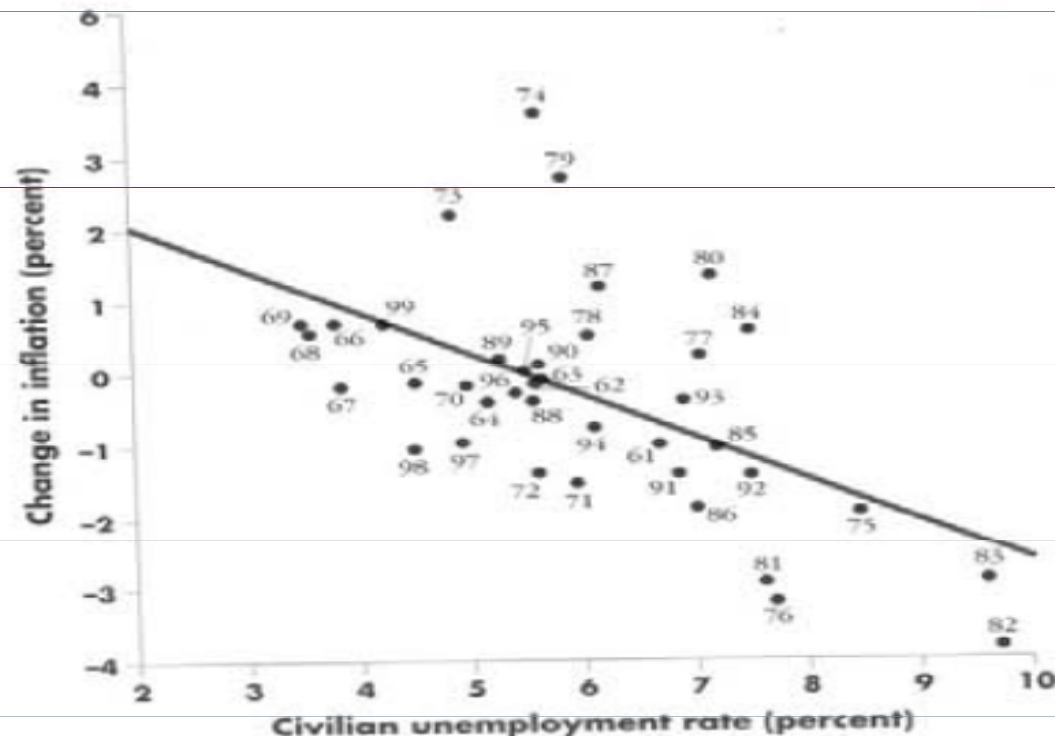


FIGURE 6-8 RELATIONSHIP OF CHANGES IN INFLATION TO UNEMPLOYMENT RATES.
(Source: Haver Analytics Macroeconomic Database.)

Inflation expectations and short run Phillips curve 1/2

- Stylized short-run Phillips curves for the 1980's and 1990's for US economy are given on the next slide
- Now the Phillips curve intersect the natural level of employment line at the level of expected inflation.
- We can see that in 1990's only 2% inflation rate was expected while in 1980's around 7 % of inflation rate was expected.
- If the level of expected inflation rises the Phillips curve shifts up .

Inflation expectations and short run Phillips curve 2/2

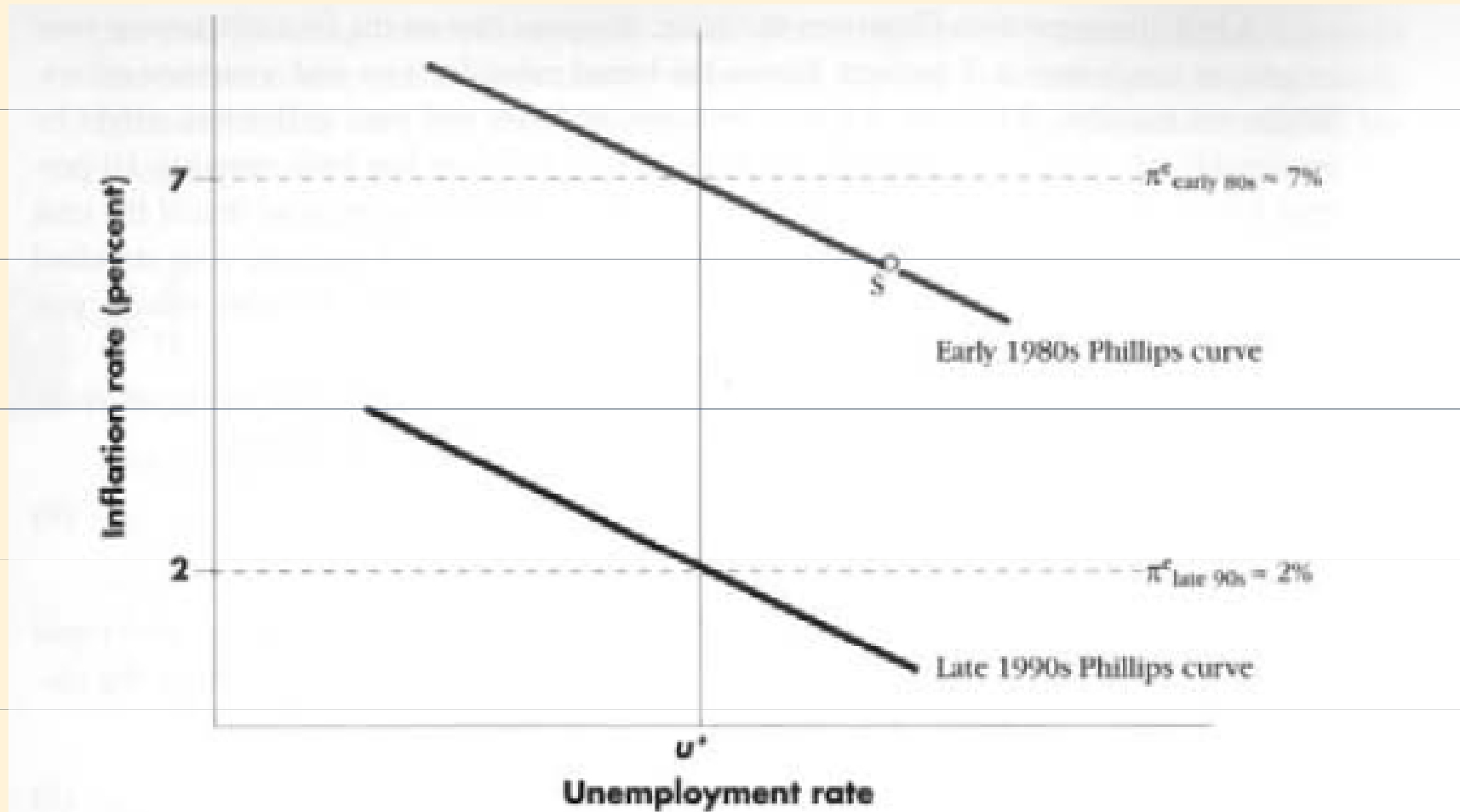


FIGURE 6-7 INFLATION EXPECTATIONS AND THE SHORT-RUN PHILLIPS CURVE.

Summary

- The term money refers to assets that people regularly use to buy goods and services.
- Money serves three functions in an economy: as a medium of exchange, a unit of account, and a store of value.
- Commodity money is money that has intrinsic value.
- Fiat money is money without intrinsic value.

Summary

- It is the function of a central bank to control the money supply through open-market operations, or by changing the refinancing rate, or by adjusting reserve requirements.
- When banks loan out their deposits, they increase the quantity of money in the economy.
- Because the central bank cannot control the amount bankers choose to lend or the amount households choose to deposit in banks, the central bank's control of the money supply is imperfect.

Summary

- The overall level of prices in an economy adjusts to bring money supply and money demand into balance.
- When the central bank increases the supply of money, it causes the price level to rise.
- Persistent growth in the quantity of money supplied leads to continuing inflation.
- A government can pay for its spending simply by printing more money. This can result in an “inflation tax” and hyperinflation.

Summary

- The principle of money neutrality asserts that changes in the quantity of money influence nominal variables but not real variables.
- According to the Fisher effect, when the inflation rate rises, the nominal interest rate rises by the same amount, and the real interest rate stays the same.

Summary

- Many people think that inflation makes them poorer because it raises the cost of what they buy.
- This view is a fallacy because inflation also raises nominal incomes.
- Economists have identified six costs of inflation:
 - Shoeleather costs
 - Menu costs
 - Increased variability of relative prices
 - Unintended tax liability changes
 - Confusion and inconvenience
 - Arbitrary redistributions of wealth