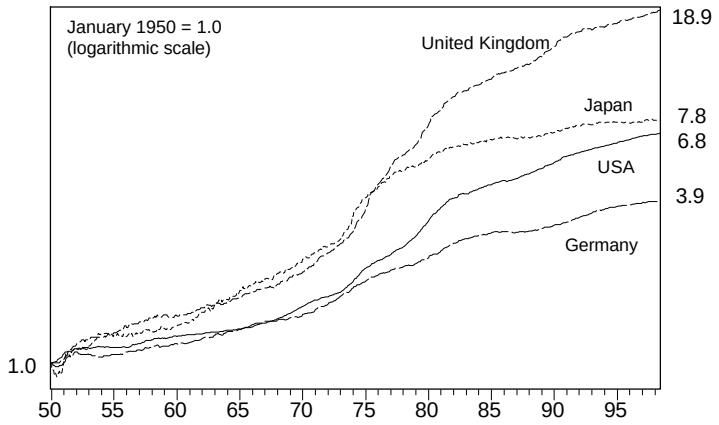
Money, Inflation, and Interest Rates

Module Objectives

- Know what money is
- Know what the demand for money depends on
- Know the major cause of inflation
- Know how the inflation rate, the real interest rate, and the nominal interest are related

Consumer Prices



The price level indicates the price of goods in terms of money.

Because different countries have different currencies, they have different price levels.

A price index is normalized to equal 1.0 (or 100) in some base period. The index measures the prices of a basket of goods compared to the prices in the base period.

The inflation rate is the rate of change of the price level.

Why have these countries had such different inflation rates since 1950?

The average annual inflation rates (compounded) are:

Britain 6.2%

Japan 4.3%

USA 4.1%

Germany 2.9%

Money

- Functions
  - medium of exchange
  - store of value
  - unit of account
- *Money* is an asset that is generally accepted as a means of payment

Only a small fraction of total wealth is held in the form of money, but money is the most liquid asset.

Types of money

- commodity money
  - -- precious metals with inherent value (opportunity costs)
  - -- shells, etc., with little inherent value
- government paper currency
- private paper currency
- deposits
- accounting entries
  - -- possibly only electronic
  - -- like deposits, but what is the relevant quantity?
  - -- unused credit line?

Role of government

- money does not have to be declared legal tender
- government mints provided standardization
  - -- seigniorage

Money Demand

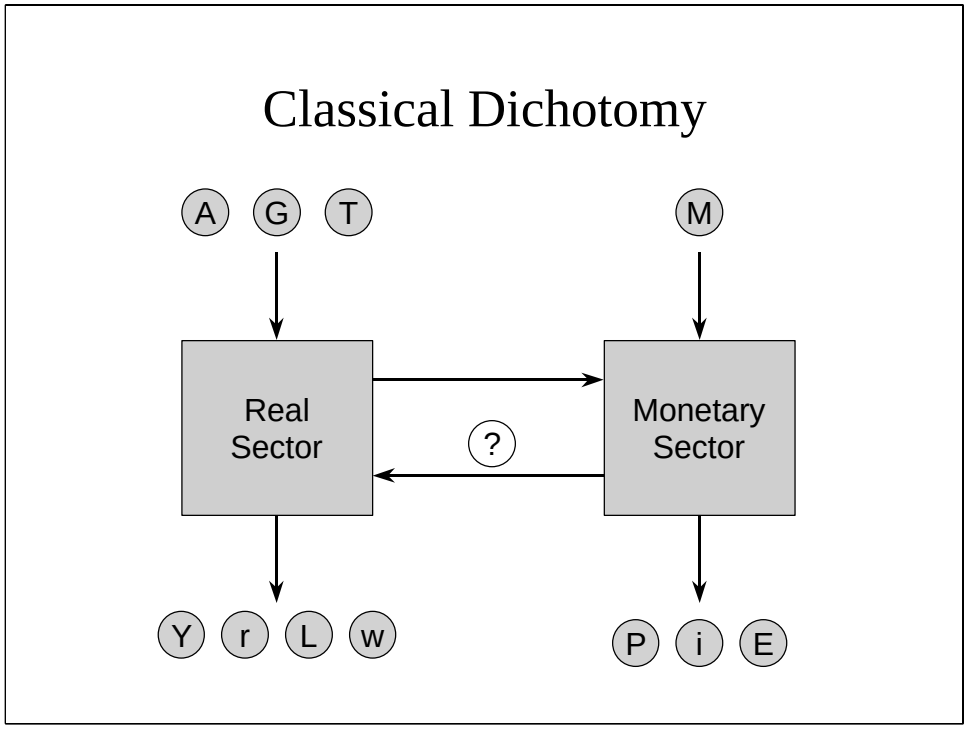
- Money demand depends on
  - volume of transactions
  - opportunity cost of holding money
  - cost of shifting between money and other assets
- Demand is for *real money balances*
- Simple money demand function

$$M/P = kY$$

Focus on money as a medium of exchange.

Assume the government directly controls M.

Demand is expressed in terms of the average level of cash balances, since the actual level varies from day to day.



Does the monetary sector affect the real sector?

Early economists assumed the answer was "NO". If there is no feedback from the monetary sector to the real sector, we say that there is a dichotomy between the monetary and real sectors.

This classical dichotomy seems to hold in the long run.

The classical dichotomy breaks down in the short run.

For now, we will focus on the long run. We will return to the short run later.

Money Market Clearing

- For now, assume k is constant
- Assume government controls M
- Equilibrium condition

$$M/P = kY$$

- If the classical dichotomy holds
  - Y is determined in the real sector
  - P adjusts to clear the money market
  - Money is said to be *neutral*

Question: What happens if the government doubles M?

Velocity

- Define velocity as

$$V = PY/M$$

- *Velocity* is the number of times each dollar turns over per time period in generating $1 of GDP

- $V = 1/k$

There are several different definitions of money, such as currency, M1, and M2. We could compute a measure of velocity using each of these different measures of money. To distinguish among them, we would have to specify the monetary aggregate being used. For example, we could speak of "the velocity of M1" or "the velocity of M2."

Likewise, GDP (denoted Y) is only one proxy for the volume of transactions. Some people use narrower proxies, such consumption, while others use broader measures that include transactions not counted in GDP or other measures of income. To be completely specific, we should also specify the transactions variable being used. For example, we could speak of "the income velocity of M2", "the consumption velocity of M1", etc.

Quantity Equation

- The *Quantity Equation* is

$$MV = PY$$

- This is obtained by rearranging the definition of velocity

- The Quantity Equation in growth rates

$$\% \Delta M + \% \Delta V = \% \Delta P + \% \Delta Y$$

The quantity equation is just an identity. It is true by definition (i.e., by the definition of velocity).

Example: In 1992

- Nominal GDP = $6 trillion
- M1 = $967 billion
- velocity = 6.2

Quantity Theory of Money

- Obtained by adding assumptions to the Quantity Equation
- Assumptions
  - V is a stable function
  - M exerts no long-run effect on Y
  - variation in M is large relative to variation in V or Y
- Conclusion: Inflation is primarily a monetary phenomenon

Evidence:

- Scatter plot of money growth and inflation

  -- 83 countries over 1950-83 or substantial subperiod

  time-series plot for U.S.
- U.S. historical evidence (20-year periods)
- OPEC evidence

Real and Nominal Interest Rates

- Define ex post real return as

$$r \approx i - \pi$$

- Contracts can be written to offset expected inflation by setting

$$i = E(r) + E(\pi)$$

- Unexpected returns and inflation

$$r - E(r) = -[\pi - E(\pi)]$$

Why do we care if there is inflation?

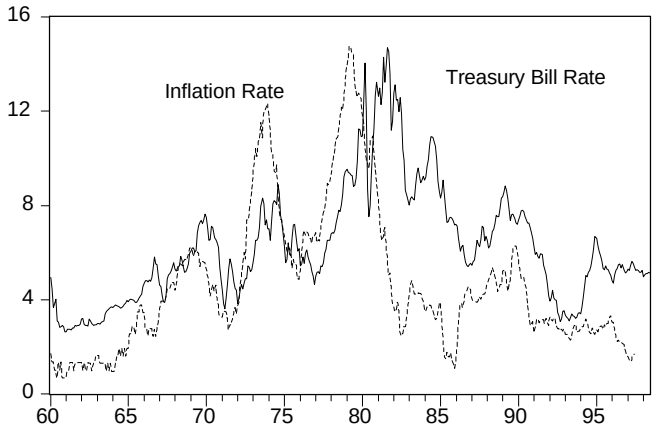
- redistributive effects of inflation if there are nominal contracts
- example: nominal debt contracts
- example: labor contracts

The terms of these contracts can easily be specified to take account of expected inflation.

Numerical example to illustrate that inflation premium is principal repayment.

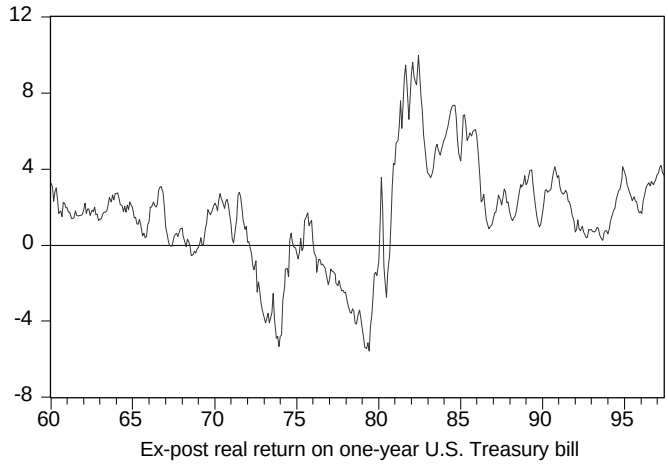
- consider one-period loan: borrow $100 at time 0
- 4 percent interest, 0 inflation
    - time-1 payments are: $100 principal, $4 interest
- 10 percent inflation; implies 14 percent nominal interest rate
    - time-1 payments are:
        - $100 clearly principal
        - $4 clearly interest
        - $10 how should this be classified? what is its purpose?
            - The purpose is to replace principal lost to inflation.

Inflation and Interest Rates



One-year U.S. Treasury bill rate and subsequent one-year CPI inflation rate

Real One-Year Treasury Bill Rate



The real return on this particular short-term financial instrument is often about 2%. Real interest rates were negative for much of the 1970s, however, and were extraordinarily high during the early 1980s.

Costs of Inflation

- Redistribution of wealth and income
  (unexpected inflation)
- Reduction in real money balances
  (expected inflation)
  – higher nominal interest rates raise opportunity cost of holding money
  – results in higher transactions costs
- Possibly higher tax rates

What about unexpected inflation?

- In principle, contracts can be indexed to take account of actual inflation, both expected and unexpected.
- Example: index bonds.

Is i or r the relevant interest rate?

- r is relevant for consumption-saving decisions
- r is relevant for investment decisions
- i is opportunity cost of holding money
  - real return on money is $-\pi$

Hyperinflation

- Caused by excessive increases in the money supply
  - Governments use money creation as a source of revenue
- Results in higher cost of holding money
  - reduced money demand
  - higher velocity

Adjustment to higher inflation:

Compare two steady states:

- same r, $\%\Delta V$, $\%\Delta Y$
- different $\%\Delta M$
- implies different π and i

In the high money growth steady state, people hold less real money because the opportunity cost is higher.

Term Structure of Interest Rates

- Pure discount bonds
- Implied forward rates

  $(1 + i_{0,2})^2 = (1 + i_{0,1})(1 + f_{1,1})$
- Expectations theory

  $f_{1,1} = E_0(i_{1,1})$
- Liquidity preference theory

  $f_{1,1} > E_0(i_{1,1})$

If the expectations theory holds, then

- $i_{0,2} > i_{0,1}$ implies $E(i_{1,1}) > i_{0,1}$.
- $i_{0,2} < i_{0,1}$ implies $E(i_{1,1}) < i_{0,1}$.

If the liquidity preference theory holds, then

- $i_{0,2} > i_{0,1}$ does not imply $E(i_{1,1}) > i_{0,1}$, but
- $i_{0,2} < i_{0,1}$ still implies $E(i_{1,1}) < i_{0,1}$.