

## Chapter 4 Money and Inflation

Inflation refers to a general increase in the nominal price of goods.

In the U.S., inflation is rather mild,

1960s	1970s	1980s	1990s
2.4%	6.7%	5.0%	2.8%

But sometimes hyperinflation occurs, e.g.

- 50% in Russia in 1998
- 500% PER MONTH in Germany in 1923

The classical theory of the causes, effects, and social costs of inflation

Inflation is a monetary phenomenon.

# 1 What is Money?

**Definition 1.1** *Money is the stock of assets that can be readily used to make transactions. Money has three purposes. It is*

- A store of value: transferring purchasing power from the present to the future
- A unit of account: providing the terms in which prices are quoted
- A medium of exchange: being used to buy goods and services (money's liquidity)

A barter economy requires *double coincidence of wants*.

## 1.1 The Types of Money

**Definition 1.2** *Money that has no intrinsic value is called fiat money.*

**Definition 1.3** *Money that has some intrinsic value is called commodity money, gold for example.*

**Definition 1.4** *When people use gold as money (or use paper money) that can be redeemable for gold), the economy is said to be on a gold standard.*

## 1.2 How Fiat Money Evolves

1. Governments began to mint coins of uniform purity and weight.
2. For large transactions, governments began to issue gold certificates, which were pieces of paper that entitled the bearer to ownership of gold stored somewhere else.
3. Since the paper was rarely redeemed for gold, gold backing became irrelevant, and governments began to issue unbacked currency.

Example: Money on the island of Yap

## 1.3 How the Quantity of Money is Controlled

Legal restrictions give the government a monopoly on the printing of money.

The control over the money supply is called monetary policy.

In the U.S., the money supply is largely determined by the Federal Open Market Committee, or FOMC.

- 7 Governors of the Federal Reserve Board, who are appointed by the President,
- Presidents of 12 regional Federal Reserve Banks, who are appointed by their local boards of directors.

## 1.4 Open Market Operations

The Fed controls the money supply by buying and selling U.S. government securities on the bond market in New York.

To increase the money supply, it buys government bonds and credits the bank account of the seller. This increases the quantity of bank reserves, which is part of the monetary base.

To reduce it, the Fed sells government securities and debits the account of the buyer. This reduces the monetary base.

## 1.5 How the Quantity of Money is Measured

## 2 The Quantity Theory of Money

### 2.1 Transactions and the Quantity Equation

$$MV = PT$$

- $T$  represents the total number of transactions during some period of time.
- $P$  is the price of a typical transaction.
- $V$  is called the transaction velocity of money and measures the rate at which money circulates in the economy.

The quantity equation is an *identity*.

## 2.2 From Transactions to Income

$$MV = PY$$

- $Y$  is total income
- $V$  is the income velocity of money

## 2.3 The Money Demand Function and the Quantity Equation

*Definition 2.1 The quantity of money in terms of the quantity of goods and services it can buy,  $\frac{M}{P}$ , is called real money balances.*

*Definition 2.2 A money demand function is an equation that shows what determines the quantity of real money balances people wish to hold. A simple money demand function is*

$$\left(\frac{M}{P}\right)^d = kY$$

- $k$  is a constant that tells us how much money people want to hold for every dollar of income.

In equilibrium,

$$\begin{aligned}\left(\frac{M}{P}\right)^d &= \frac{M}{P} \\ \Rightarrow M \left(\frac{1}{k}\right) &= PY \\ \Rightarrow V &= \frac{1}{k}\end{aligned}$$

The link between the demand for money and the velocity of money

## 2.4 Quantity Theory of Money

Assume that the velocity of money is constant,

$$M\bar{V} = PY$$

Three building blocks of quantity theory of money:

1. The factors of production and the production function determine the level of output  $Y$ .
2. The money supply determines the nominal value of output,  $PY$ .
3. The price level  $P$  is the ratio of the nominal value of output,  $PY$ , to the level of output  $Y$ .

In terms of percentage change

$$\begin{aligned} & \% \text{ change in } M + \% \text{ change in } V \\ = & \% \text{ change in } P + \% \text{ change in } Y \end{aligned}$$

The quantity theory of money states that the central bank, which controls the money supply, has ultimate control over the rate of inflation.

Example: Inflation and Money Growth

### 3 Seigniorage: The Revenue from Printing Money

Governments can finance expenditures in three ways:

- Taxes
- Borrowing (selling bonds)
- Printing money

Printing money generates inflation, which reduces the value of pre-existing money, so inflation works like a tax on anyone who was holding money.

This accounts for about 3% of government revenue in the US.

If the government generates a surprise increase in inflation, it lowers the real value of the interest payments and principal. So a surprise inflation works like a tax on government debt.

Inflation taxes are more important when governments have large deficits that are difficult to finance by direct taxation.

High inflation is often a symptom of a more fundamental fiscal problem.

Example:

American Revolution, Weimar Germany, Russian Republic

Lesson: Fiscal reform is the key to achieving credible monetary reform.

## 4 Inflation and Interest Rates

**Definition 4.1** *The real interest rate is the difference between the nominal interest rate and the rate of inflation.*

$$r = i - \pi$$

**Definition 4.2** *Fisher equation is obtained by rearranging the above equation*

$$i = r + \pi$$

1. Recall: The real interest rate adjusts to equilibrate saving and investment.
2. The quantity theory of money shows that the rate of money growth determines the rate of inflation.

As a result,

1. According to the quantity theory, an increase in the rate of money growth of 1% causes a 1% increase in the rate of inflation;
2. According to the Fisher equation, a 1% increase in the rate of inflation in turn causes a 1% increase in the nominal interest rate.
3. The one-for-one relation between the inflation rate and the nominal interest rate is called the *Fisher effect*.

Example: Inflation and Nominal Interest Rate in the US and abroad

## 4.1 Two Real Interest Rates: Ex Ante and Ex Post

**Definition 4.3** *The real interest rate the borrower and lender expect when the loan is made is called the ex ante real interest rate. It can be denoted as  $i - \pi^e$ .*

**Definition 4.4** *The real interest rate actually realized is called the ex post real interest rate. It can be denoted as  $i - \pi$ .*

The Fisher effect is more precisely written as

$$i = r + \pi^e$$

**Example:** Nominal interest rate in the nineteenth century

## 5 The Demand for Money

The quantity theory is based on a simple money demand function: it assumes that the demand for real money balances is proportional to income.

Now we incorporate the opportunity cost of holding money: the nominal interest rate

The general money demand function is

$$\left(\frac{M}{P}\right)^d = L(i, Y)$$

- The higher the level of income  $Y$ , the greater the demand for real money balances.
- The higher the nominal interest rate  $i$ , the lower the demand for real money balances.

In equilibrium,

$$\frac{M}{P} = L(i, Y)$$

Using Fisher equation:

$$\frac{M}{P} = L(r + \pi^e, Y)$$

Implications from this more sophisticated theory:

1. The level of real money balance depends upon the expected rate of inflation.
2. The nominal interest rate is an additional channel through which money supply affects the price level.
3. Higher expected money growth in the future leads to a higher price level today.

## 6 The Social Costs of Inflation

### 6.1 The Costs of Expected Inflation

- Shoeleather cost by the public
- Menu costs by firms
- Greater variability in relative prices because of infrequent changes in menus
- Altered individuals' tax liability
- Inconvenience of living in a world with a changing price level.

## 6.2 The Costs of Unexpected Inflation

- Arbitrary redistribution of wealth among individuals
- Greater uncertainty both debtors and creditors face
- High inflation is variable inflation.

Social security benefits for the elderly are adjusted to changes in CPI.

## 7 Hyperinflation

Hyperinflation is defined as inflation that exceeds 50% per month.

The power of compounding:

$$\begin{aligned}(1 + 1.36\%)^1 &= 1.0136 \\(1 + 1.36\%)^{10} &= 1.1446 \\(1 + 1.36\%)^{30} &= 1.4997\end{aligned}$$

1.36% per day  $\Leftrightarrow$  50% per month  $\Leftrightarrow$  more than 100-fold increase over a year  $\Leftrightarrow$  more than 2-million-fold increase over three years

## 7.1 The Costs of Hyperinflation

Qualitatively the same as those discussed earlier, but much more severe.

Example: Keynes on the Cost of Inflation

## 7.2 The Causes of Hyperinflation

1. To stop the hyperinflation, the central bank must simply reduce the rate of money growth.
2. The ends of hyperinflations almost always coincide with fiscal reform.

Example: hyperinflation in Germany

## 8 The Classical Dichotomy

**Definition 8.1** *All variables measured in physical units, such as quantities and relative prices, are called real variables.*

**Definition 8.2** *Nominal variables are variables expressed in terms of money.*

**Observation:** Prior to this chapter, we explain real variables without introducing money. This is called classical dichotomy, a hallmark of classical macroeconomic theory.

This irrelevance of money for real variables is called monetary neutrality.

Monetary neutrality is approximately correct in the long run.