Chapter 4: Money and Inflation (Long-Run Theory of Monetarism)

The overall increase in prices is called inflation

A price is the rate at which money is exchanged for a good or a service. In reality, the general price level is measured by either CPI or GDP deflator.

The inflation rate is defined as the percentage change in the price level.

In this chapter we study a long run theory called Monetarism. Monetarism assumes price is flexible and it shows the relationship between money and inflation. Monetarism is advocated by Milton Friedman.

Basic facts about money

Money is defined as the stock of assets that can be readily used to make transaction. For example, because a shell can be used for transaction in certain island countries, shell is money.

A brief history of Money:

Gold (commodity money) → gold coins → gold certificates → fiat money (without intrinsic value)

Money can perform the functions of (1) store of value; (2) unit of account; and (3) medium of exchange.
Legal restriction gives the government (central bank) a monopoly on controlling the money. The US central bank is Federal Reserve (Fed). The Open Market Committee under Fed is in charge of monetary policy.

Fed changes the money supply through open-market operation. More explicitly, Fed increases money supply by purchasing government bonds from the public. Fed decreases money supply by selling government bonds to the public.

There are several measures of Money:

1. Currency is the sum of outstanding paper money (banknotes) and coins
2. $M_1 = \text{currency} + \text{demand deposits, traveler’s check and other checkable deposit.}$
3. $M_2 = M_1 + \text{savings deposits, etc}$

See Table 4-1 for details.

Now we look at how the quantity of money affects the economy. The theory (or model) we will use is called quantity theory of money.

The quantity equation can be written as

$$MV \equiv PT$$

where $M$ denotes the quantity of money, $V$ the transaction velocity of money, $P$ the price level, $T$ the total number of transaction.
Note: the quantity equation is an identity because the definitions of the four variables make it true. If one of the variables changes, one or more of the others must change to maintain the equality.

Because T is hard to measure, but is related to total income Y, we can rewrite the quantity equation as

$$ MV = PY \quad (1) $$

Using the arithmetic trick that (see FYI on page 26) the percentage change of product equals the sum of percentage changes, we can get

$$ M\% + V\% = P\% + Y\% \quad (2) $$

where $X\%$ denotes the percentage change of variable $X$. Equation (2) is the percentage-change form of quantity equation.

We assume $Y\%=0$ because $\bar{Y} = F(\bar{K}, \bar{L})$
We assume $V\%=0$ so velocity remains constant. Then (2) becomes

$$ M\% = P\% \quad (3) $$

In words, under the assumptions of constant income and velocity, the price level is proportional to the money supply, or equivalently, the growth rate of money supply equals the inflation rate.

Case Study on page 88
We look at the relationship between growth rate of money supply and inflation rate in US over time (Figure 4-1), and for a couple of countries (Figure 4-2)

Critical Thinking:

If (3) is correct, what does the scatterplot look like?

What are the variables on the vertical and horizontal axis in Figure 4-1?

What happens in 1930s and 1870s in Figure 4-1?

In history, some countries like Germany had experienced periods with very high inflation rate called hyperinflation. Now we know hyperinflation must be caused by big increase in money supply.

Government wants to print more money because it can get the revenue called seigniorage. When the government prints new money for its uses, it makes the old money in hands of the public less valuable (because as price rises, purchasing power of old money falls). Inflation is like a tax on holders of money.

If government has huge budget (fiscal) deficit, and it cannot raise tax or borrow from public, then the only revenue available to the government is seigniorage, which will causes hyperinflation for sure. Next hyperinflation will cause public to lose faith in the current currency, and the country may have to change the official currency to, say, US dollar. This process is called dollarization. See case study on page 108.
Current issues:

Why does Germany hate to print more Euros to help Greece? See the case study on page 106.

On page 90, Dr Mankiw claims that in US, the amount of seigniorage is small, and usually accounts for less than 3% of the government revenue. If you take into account the fact that half of US dollars are held by foreigners (see handout), do you think 3% underestimates or overestimates the true seigniorage? Do you understand why US hates to see Euro to compete with US dollar for the role of the reserve currency?

The interest rate the bank pays is called the nominal interest rate (denoted by i); the increase in your purchasing power is called real interest rate (denoted by r).

The Fisher equation states that there is a relation between the nominal and real interest rate:

\[ i = r + \pi \]  (4)

where \( \pi \) denotes the inflation rate.

Proof (optional)
Three steps to obtain the nominal interest rate:

Step 1: We obtain real interest rate by equilibrating saving and investment (or equilibrating supply and demand for loanable funds, see chapter 3). Mathematically,

\[ s = I(r) \]

Step 2: In this chapter we know that under assumptions of constant velocity and income

\[ \pi = M\% \]

Step 3: We get the nominal exchange rate according to Fisher equation.

The one-for-one relation between the inflation rate and the nominal interest rate is called Fisher effect.

Case Study on page 92

What is the nominal interest rate used in Figure 4-3?

How to measure inflation rate in Figure 4-3?

We see inflation rate and nominal interest rate tend to move together in Figure 4-3. What does this mean?

We see the gap between inflation rate and nominal interest rate sometime is big, sometimes is small. What does this mean?
We see sometime the nominal interest rate is below the inflation rate, like in year 1979. What does this mean?

Why do people care about interest rate? Consider a bond buyer and a house buyer.

More precisely we should rewrite the Fisher Equation as

$$i = r + E\pi$$  \hspace{1cm} (5)

where $E\pi$ denotes the expected inflation rate. If inflation is persistent, then $E\pi = \pi_{-1}$ where $\pi_{-1}$ denotes the observed inflation rate in the previous period.

See case study on page 94.

We finish the money supply. Now we look at the demand for money.

The money demand function is given by

$$\left(\frac{M}{P}\right)^d = L(i,Y)$$  \hspace{1cm} (6)

where $M/P$ denotes real money balance. We assume

$$\frac{\partial L}{\partial i} < 0, \hspace{0.5cm} \frac{\partial L}{\partial Y} > 0$$
So everything else equal, higher real income \((Y)\) leads to higher demand for real money balance. Higher nominal interest rate \((i)\) leads to higher opportunity cost of holding money, so lower demand for real money balance.

When the money market is in equilibrium, supply of real money balance equals the demand of real money balance:

\[
\frac{M}{P} = \left(\frac{M}{P}\right)^d
\]

Jointly we have

\[
\frac{M}{P} = L(i, Y) \quad (7)
\]

Equation (7) is the key equation for analyzing money market.

Consider a temporary increase in money supply. The expected inflation rate \((< \quad > \quad =) 0\). So nominal interest rate (rises, falls, remains unchanged). The price level moves __________ with the money supply.

Consider a permanent increase in money supply. The expected inflation rate \((< \quad > \quad =) 0\). So nominal interest rate (rises, falls, remains unchanged). The price level moves __________ with the money supply.
Real vs. Nominal Variables

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

For example

Real GDP is the quantity of goods and services produced in a given year.

Real wage is the quantity of output a worker earns for each hour of work.

Real interest rate is the quantity of output a person earns in the future by lending one unit of output today.

Variables expressed in terms of money are called nominal variables.

For example

Nominal GDP is the monetary value (at current price) of goods and services produced in a given year.

Nominal interest rate is the dollar a person earns in the future by lending one dollar today.
Classical Dichotomy

According to classical economic theory, money is neutral in long run: the money supply does not affect real variables (such as real GDP, real interest rate). Therefore classical theory allows us to study how real variables are determined without reference to the money supply.

Then the equilibrium in the money market, equation (7), determines the price level and, as a result, all other nominal variables.

This theoretical separation of real and nominal variables is called classical dichotomy. Keep in mind that monetary neutrality is approximately correct, particularly in long run.

Critical thinking:

Show how to use classical dichotomy to determine the real and nominal wages.

In the next chapter, we will apply classical dichotomy in order to determine the real and nominal exchange rates.