MACROECONOMICS

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PowerPoint® Slides by Ron Cronovich

SEVENTH EDITION

CHAPTER 4

Money and Inflation

In this chapter, you will learn:

- The classical theory of inflation
  - causes
  - effects
- “Classical” – assumes prices are flexible & markets clear

The connection between money and prices

- Inflation rate = the percentage increase in the average level of prices.
- Price = amount of money required to buy a good.
- Because prices are defined in terms of money, we need to consider the nature of money, the supply of money, and how it is controlled.

Money: Definition

Money is the stock of assets that can be readily used to make transactions.

The money supply and monetary policy definitions

- The **money supply** is the quantity of money available in the economy.
- **Monetary policy** is the control over the money supply.

The central bank

- Monetary policy is conducted by a country's **central bank**.
- In the U.S., the central bank is called the **Federal Reserve** ("the Fed").

The Federal Reserve Building
Washington, DC

Money supply measures, May 2009

symbol	assets included	amount ($ billions)
C	Currency	$850
M1	**C** + demand deposits, travelers' checks, other checkable deposits	$1596
M2	**M1** + small time deposits, savings deposits, money market mutual funds, money market deposit accounts	$8328

The Quantity Theory of Money

- A simple theory linking the inflation rate to the growth rate of the money supply.
- Begins with the concept of **velocity**…

Velocity

- basic concept:
  the rate at which money circulates
- definition: the number of times the average dollar bill changes hands in a given time period
- example: In 2009,
  - $500 billion in transactions
  - money supply = $100 billion
  - The average dollar is used in five transactions in 2009
  - So, velocity = 5

Velocity, cont.

- This suggests the following definition:

$$V = \frac{T}{M}$$

where

V = velocity

T = value of all transactions

M = money supply

Velocity, cont.

- Use nominal GDP as a proxy for total transactions.

Then, $$V = \frac{P \times Y}{M}$$

where

P = price of output (GDP deflator)

Y = quantity of output (real GDP)

$P \times Y$ = value of output (nominal GDP)

The quantity equation

- The **quantity equation**

$$M \times V = P \times Y$$

  follows from the preceding definition of velocity.

- It is an *identity:*
  it holds by definition of the variables.

Money demand and the quantity equation

- M/P = **real money balances**, the purchasing power of the money supply.
- A simple money demand function:

  $(M/P)^d = kY$

  where

  k = how much money people wish to hold for each dollar of income.

  (k is exogenous)

Money demand and the quantity equation

- money demand: $(M/P)^d = kY$
- quantity equation: $M \times V = P \times Y$
- The connection between them: $k = 1/V$
- When people hold lots of money relative to their incomes (k is large), money changes hands infrequently (V is small).

Back to the quantity theory of money

- starts with quantity equation
- assumes V is constant & exogenous: $V = \overline{V}$

Then, quantity equation becomes:

$$M \times \overline{V} = P \times Y$$

The quantity theory of money, *cont.*

$$M \times \overline{V} = P \times Y$$

How the price level is determined:

- With V constant, the money supply determines nominal GDP ($P \times Y$).
- Real GDP is determined by the economy's supplies of K and L and the production function (Chap 3).
- The price level is
  P = (nominal GDP)/(real GDP).

The quantity theory of money, *cont.*

- *Recall from Chapter 2:*
  The growth rate of a product equals the sum of the growth rates.
- The quantity equation in growth rates:

$$\frac{\Delta M}{M} + \frac{\Delta V}{V} = \frac{\Delta P}{P} + \frac{\Delta Y}{Y}$$

The quantity theory of money assumes

V is constant, so $\frac{\Delta V}{V} = 0$.

The quantity theory of money, *cont.*

π (Greek letter "pi") denotes the inflation rate:

$$\pi = \frac{\Delta P}{P}$$

The result from the preceding slide:

$$\frac{\Delta M}{M} = \frac{\Delta P}{P} + \frac{\Delta Y}{Y}$$

Solve this result for π:

$$\pi = \frac{\Delta M}{M} - \frac{\Delta Y}{Y}$$

The quantity theory of money, *cont.*

$$\pi = \frac{\Delta M}{M} - \frac{\Delta Y}{Y}$$

- Normal economic growth requires a certain amount of money supply growth to facilitate the growth in transactions.
- Money growth in excess of this amount leads to inflation.

The quantity theory of money, *cont.*

$$\pi = \frac{\Delta M}{M} - \frac{\Delta Y}{Y}$$

$\Delta Y/Y$ depends on growth in the factors of production and on technological progress (all of which we take as given, for now).

Hence, the Quantity Theory predicts a one-for-one relation between changes in the money growth rate and changes in the inflation rate.

Seigniorage

- To spend more without raising taxes or selling bonds, the govt can print money.
- The "revenue" raised from printing money is called **seigniorage** (pronounced SEEN-your-idge).
- The **inflation tax**:
  Printing money to raise revenue causes inflation. Inflation is like a tax on people who hold money.

Inflation and interest rates

- Nominal interest rate, ***i***
  not adjusted for inflation
- Real interest rate, ***r***
  adjusted for inflation:

$$r = i - \pi$$

The Fisher effect

- The Fisher equation: $i = r + \pi$
- Chap 3: $S = I$ determines r.
- Hence, an increase in π causes an equal increase in i.
- This one-for-one relationship is called the **Fisher effect**.

Two real interest rates

Notation:

- π = actual inflation rate
  (not known until after it has occurred)
- $E\pi$ = expected inflation rate

Two real interest rates:

- $i - E\pi$ = ***ex ante*** real interest rate:
  the real interest rate people expect
  at the time they buy a bond or take out a loan
- $i - \pi$ = ***ex post*** real interest rate:
  the real interest rate actually realized

Money demand and the nominal interest rate

- In the quantity theory of money, the demand for real money balances depends only on real income ***Y***.
- Another determinant of money demand: the nominal interest rate, ***i***.
  - the opportunity cost of holding money (instead of bonds or other interest-earning assets).
- Hence, $\uparrow i \Rightarrow \downarrow$ in money demand.

The money demand function

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

$(M/P)^d$ = real money demand, depends

- negatively on i

  i is the opp. cost of holding money

- positively on Y

  higher $Y \Rightarrow$ more spending

  $\Rightarrow$ so, need more money

("L" is used for the money demand function because money is the most liquid asset.)

The money demand function

$$(M/P)^d = L(i, Y)$$
$$= L(r + E\pi, Y)$$

When people are deciding whether to hold money or bonds, they don't know what inflation will turn out to be.

Hence, the nominal interest rate relevant for money demand is $r + E\pi$.

Equilibrium

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

The supply of real money balances

Real money demand

What determines what

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

variable	how determined *(in the long run)*
M	exogenous (the Fed)
r	adjusts to ensure $S = I$
Y	$\bar{Y} = F(\bar{K}, \bar{L})$
P	adjusts to ensure $\frac{M}{P} = L(i, Y)$

How P responds to ΔM

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

- For given values of r, Y, and $E\pi$,
  a change in M causes P to change by the same percentage – just like in the quantity theory of money.

What about expected inflation?

- Over the long run, people don't consistently over- or under-forecast inflation,

  so $E\pi = \pi$ on average.

- In the short run, $E\pi$ may change when people get new information.

- EX: Fed announces it will increase ***M*** next year. People will expect next year's ***P*** to be higher, so $E\pi$ rises.

- This affects ***P*** now, even though ***M*** hasn't changed yet….

How P responds to $\Delta E\pi$

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

- For given values of r, Y, and M ,

$$\uparrow E\pi \Rightarrow \uparrow i \quad \text{(the Fisher effect)}$$

$$\Rightarrow \downarrow (M/P)^{d}$$

$$\Rightarrow \uparrow P \quad \text{to make } (M/P) \text{ fall to re-establish eq'm}$$

Chapter Summary

Money

- def: the stock of assets used for transactions
- money supply controlled by central bank

Quantity theory of money assumes velocity is stable, concludes that the money growth rate determines the inflation rate.

Chapter Summary

Nominal interest rate

- equals real interest rate + inflation rate
- the opp. cost of holding money
- Fisher effect: Nominal interest rate moves one-for-one w/ expected inflation.

Money demand

- depends only on income in the Quantity Theory
- also depends on the nominal interest rate
- if so, then changes in expected inflation affect the current price level.