Chapter 8: The Monetary System, Money Growth and Inflation

Readings: Chapter 29-30 of Principles of Economics textbook (Mankiw)

In this chapter, look for the answers to these questions:

• What assets are considered “money”? What are the functions of money? The types of money?
• What is the Federal Reserve?
• How does the money supply affect inflation and nominal interest rates?
• Does the money supply affect real variables like real GDP or the real interest rate?
• How is inflation like a tax?
• What are the costs of inflation? How serious are they?

What Money Is and Why It’s Important

- Without money, trade would require barter, the exchange of one good or service for another.
- Every transaction would require a double coincidence of wants—the unlikely occurrence that two people each have a good the other wants.
- Most people would have to spend time searching for others to trade with—a huge waste of resources.
- This searching is unnecessary with money, the set of assets that people regularly use to buy g&s from other people.

The 3 Functions of Money

- **Medium of exchange**: an item buyers give to sellers when they want to purchase g&s
- **Unit of account**: the yardstick people use to post prices and record debts
- **Store of value**: an item people can use to transfer purchasing power from the present to the future

### The 2 Kinds of Money

- **Commodity money**: takes the form of a commodity with intrinsic value
  Examples: gold coins, cigarettes in POW camps
- **Fiat money**: money without intrinsic value, used as money because of govt decree
  Example: the U.S. dollar

### The Money Supply

- **The money supply** (or **money stock**): the quantity of money available in the economy
- What assets should be considered part of the money supply? Two candidates:
  - **Currency**: the paper bills and coins in the hands of the (non-bank) public
  - **Demand deposits**: balances in bank accounts that depositors can access on demand by writing a check

### Measures of the U.S. Money Supply

- **M1**: currency, demand deposits, traveler’s checks, and other checkable deposits.
  - **M1** = $2.3 trillion (June 2012)
- **M2**: everything in M1 plus savings deposits, small time deposits, money market mutual funds, and a few minor categories.
  - **M2** = $9.9 trillion (June 2012)

The distinction between M1 and M2 will often not matter when we talk about “the money supply” in this course.
Central Banks & Monetary Policy

- **Central bank**: an institution that oversees the banking system and regulates the money supply
- **Monetary policy**: the setting of the money supply by policymakers in the central bank
- **Federal Reserve (Fed)**: the central bank of the U.S.

Introduction to Money Growth

- This chapter introduces the **quantity theory of money** to explain one of the Ten Principles of Economics from Chapter 1: “Prices rise when the govt prints too much money”.
- Most economists believe the quantity theory is a good explanation of the long run behavior of inflation.

The Value of Money

- \( P \) = the price level (e.g., the CPI or GDP deflator)
  - \( P \) is the price of a basket of goods, measured in money.
  - \( 1/P \) is the value of $1, measured in goods.
- **Example**: basket contains one candy bar.
  - If \( P = \$2 \), value of $1 is 1/2 candy bar
  - If \( P = \$3 \), value of $1 is 1/3 candy bar
- Inflation drives up prices and drives down the value of money.

The Quantity Theory of Money

- Developed by 18\(^{th}\) century philosopher David Hume and the classical economists
- Advocated more recently by Nobel Prize Laureate Milton Friedman
- Asserts that the quantity of money determines the value of money
We study this theory using two approaches:

1. A supply-demand diagram
2. An equation

**Money Supply (MS)**

- In real world, determined by Federal Reserve, the banking system, consumers.
- In this model, we assume the Fed precisely controls MS and sets it at some fixed amount.

**Money Demand (MD)**

- Refers to how much wealth people want to hold in liquid form.
- Depends on $P$: An increase in $P$ reduces the value of money, so more money is required to buy g&s.
- Thus, quantity of money demanded is negatively related to the value of money and positively related to $P$, other things equal.

(These “other things” include real income, interest rates, availability of ATMs.)

**The Money Supply-Demand Diagram**

![Money Supply-Demand Diagram]

- As the value of money rises, the price level falls.
- Quantity of Money
The Fed sets MS at some fixed value, regardless of P.

A fall in value of money (or increase in P) increases the quantity of money demanded.
The Money Supply-Demand Diagram

Value of Money, $1/P$  

Price Level, $P$

Quantity of Money

$P$ adjusts to equate quantity of money demanded with money supply.

The Effects of a Monetary Injection

Suppose the Fed increases the money supply.

Then the value of money falls, and $P$ rises.

Value of Money, $1/P$  

Price Level, $P$

Quantity of Money
A Brief Look at the Adjustment Process

Result from graph: Increasing MS causes P to rise.

How does this work? Short version:

At the initial P, an increase in MS causes excess supply of money.

People get rid of their excess money by spending it on g&s or by loaning it to others, who spend it. Result: increased demand for goods.

But supply of goods does not increase, so prices must rise.
(Other things happen in the short run, which we will study in later chapters.)

Real vs. Nominal Variables

Nominal variables are measured in monetary units. Examples: nominal GDP,
nominal interest rate (rate of return measured in $) nominal wage ($ per hour worked)

Real variables are measured in physical units. Examples: real GDP,
real interest rate (measured in output)
real wage (measured in output)

Real vs. Nominal Variables

Prices are normally measured in terms of money.

Price of a compact disc: $15/cd
Price of a pepperoni pizza: $10/pizza

A relative price is the price of one good relative to (divided by) another

Relative price of CDs in terms of pizza:

\[
\frac{\text{price of cd}}{\text{price of pizza}} = \frac{\$15/\text{cd}}{\$10/\text{pizza}} = 1.5 \text{ pizzas per cd}
\]

Relative prices are measured in physical units, so they are real variables.
Real vs. Nominal Wage

An important relative price is the real wage:

\[ W = \text{nominal wage} = \text{price of labor, e.g., } \$15/\text{hour} \]

\[ P = \text{price level} = \text{price of g&s, e.g., } \$5/\text{unit of output} \]

Real wage is the price of labor relative to the price of output:

\[
\frac{W}{P} = \frac{\$15/\text{hour}}{\$5/\text{unit of output}} = 3 \text{ units output per hour}
\]

The Classical Dichotomy

- **Classical dichotomy**: the theoretical separation of nominal and real variables

- Hume and the classical economists suggested that monetary developments affect nominal variables but not real variables.

- If central bank doubles the money supply, Hume & classical thinkers contend

  - all nominal variables—including prices—will double.

  - all real variables—including relative prices—will remain unchanged.

The Neutrality of Money

- **Monetary neutrality**: the proposition that changes in the money supply do not affect real variables

- Doubling money supply causes all nominal prices to double; what happens to relative prices?

  - Initially, relative price of cd in terms of pizza is

\[
\frac{\text{price of cd}}{\text{price of pizza}} = \frac{\$15/\text{cd}}{\$10/\text{pizza}} = 1.5 \text{ pizzas per cd}
\]

  - The relative price is unchanged.

- After nominal prices double

\[
\frac{\text{price of cd}}{\text{price of pizza}} = \frac{\$30/\text{cd}}{\$20/\text{pizza}} = 1.5 \text{ pizzas per cd}
\]
Similarly, the real wage \( \frac{W}{P} \) remains unchanged, so
- quantity of labor supplied does not change
- quantity of labor demanded does not change
- total employment of labor does not change
- The same applies to employment of capital and other resources.
- Since employment of all resources is unchanged, total output is also unchanged by the money supply.
- Most economists believe the classical dichotomy and neutrality of money describe the economy in the long run.
- In later chapters, we will see that monetary changes can have important short-run effects on real variables.

The Velocity of Money
- **Velocity of money**: the rate at which money changes hands
- Notation: \( P \times Y \) = nominal GDP = (price level) \( \times \) (real GDP)
  \[
  M = \text{money supply} \\
  V = \text{velocity}
  \]
- **Velocity formula**: \[
  V = \frac{P \times Y}{M}
  \]

Example with one good: pizza. In 2012,
- \( Y \) = real GDP = 3000 pizzas
- \( P \) = price level = price of pizza = $10
- \( P \times Y \) = nominal GDP = value of pizzas = $30,000
- \( M \) = money supply = $10,000
- \( V \) = velocity = $30,000/$10,000 = 3
The average dollar was used in 3 transactions
**Exercise 1.**

One good: corn. The economy has enough labor, capital, and land to produce $Y = 800$ bushels of corn. In 2008, $MS = 2000$, $P = 5/bushel$.

Compute nominal GDP and velocity in 2008.

**Answers**

Given: $Y = 800$, $V$ is constant, $MS = 2000$ and $P = 5$ in 2005.

Compute nominal GDP and velocity in 2008.

Nominal GDP = $P \times Y = 5 \times 800 = 4000$

$$V = \frac{P \times Y}{M} = \frac{4000}{2000} = 2$$

**The Quantity Equation**

- Velocity formula:
  $$V = \frac{P \times Y}{M}$$

- Multiply both sides of formula by $M$:
  $$M \times V = P \times Y$$

- Called the quantity equation

**Exercise 2.**

One good: corn. The economy has enough labor, capital, and land to produce $Y = 800$ bushels of corn. $V$ is constant. In 2008, $MS = 2000$, $P = 5/bushel$.

For 2009, the Fed increases MS by 5%, to $2100$.

**a.** Compute the 2009 values of nominal GDP and $P$. Compute the inflation rate for 2008–2009.

**b.** Suppose tech. progress causes $Y$ to increase to 824 in 2009. Compute 2008–2009 inflation rate.
Answers

Given: \( Y = 800, V \) is constant, \( MS = 2000 \) and \( P = 5 \) in 2008.

For 2009, the Fed increases \( MS \) by 5%, to 2100.

a) Nominal GDP = \( P \times Y = M \times V \) (Quantity Eq’n)

b) First, use Quantity Eq’n to compute \( P \) in 2009:

Summary

- If real GDP is constant, then inflation rate = money growth rate.

- If real GDP is growing, then inflation rate < money growth rate.

- The bottom line:
  - Economic growth increases # of transactions.
  - Some money growth is needed for these extra transactions.
  - Excessive money growth causes inflation.
Hyperinflation

- Hyperinflation is generally defined as inflation exceeding 50% per month.
- Recall one of the Ten Principles from Chapter 1:
  “Prices rise when the government prints too much money”.
- Excessive growth in the money supply always causes hyperinflation.
- Large govt budget deficits led to the creation of large quantities of money and high inflation rates.

The Inflation Tax

- When tax revenue is inadequate and ability to borrow is limited, govt may print money to pay for its spending.
- Almost all hyperinflations start this way.
- The revenue from printing money is the inflation tax: printing money causes inflation, which is like a tax on everyone who holds money.
- In the U.S., the inflation tax today accounts for less than 3% of total revenue.

The Fisher Effect

- Rearrange the definition of the real interest rate:

  | Nominal interest rate = Inflation + Real interest rate |

- The real interest rate is determined by saving & investment in the loanable funds market.
- Money supply growth determines inflation rate. So, this equation shows how the nominal interest rate is determined.
• In the long run, money is neutral, so a change in the money growth rate affects the inflation rate but not the real interest rate.

• So, the nominal interest rate adjusts one-for-one with changes in the inflation rate.

• The inflation tax applies to people’s holdings of money, not their holdings of wealth.

• The Fisher effect: an increase in inflation causes an equal increase in the nominal interest rate, so the real interest rate (on wealth) is unchanged

The Costs of Inflation

• The inflation fallacy: most people think inflation erodes real incomes.

• But inflation is a general increase in prices of the things people buy and the things they sell (e.g., their labor).

• In the long run, real incomes are determined by real variables, not the inflation rate.

• Shoeleather costs: the resources wasted when inflation encourages people to reduce their money holdings (Includes the time and transactions costs of more frequent bank withdrawals).

• Menu costs: the costs of changing prices such as printing new menus, mailing new catalogs, etc.

• Misallocation of resources from relative-price variability: Firms don’t all raise prices at the same time, so relative prices can vary which distorts the allocation of resources.

• Confusion & inconvenience: Inflation changes the yardstick we use to measure transactions. Complicates long-range planning and the comparison of dollar amounts over time.

• Tax distortions: Inflation makes nominal income grow faster than real income. Taxes are based on nominal income, and some are not adjusted for inflation. So, inflation causes people to pay more taxes even when their real incomes don’t increase.
Exercise 3,

You deposit $1000 in the bank for one year.

**CASE 1**: inflation = 0%, nom. interest rate = 10%

**CASE 2**: inflation = 10%, nom. interest rate = 20%

a. In which case does the real value of your deposit grow the most? Assume the tax rate is 25%.

b. In which case do you pay the most taxes?

c. Compute the after-tax nominal interest rate, then subtract inflation to get the after-tax real interest rate for both cases.

Answers

a) In both cases, the real interest rate is 10%, so the real value of the deposit grows 10% (before taxes).

b) Case 1: interest income =

    Case 2: interest income =

C) Case 1: nominal =

    real =

    Case 2: nominal =

    real =

Summary

- Inflation raises nominal interest rates (Fisher effect) but not real interest rates
- Increases savers’ tax burdens
- Lowers the after-tax real interest rate