CHAPTER

30

Money Growth and Inflation

Goals

In this chapter you will

- See why inflation results from rapid growth in the money supply
- Learn the meaning of the classical dichotomy and monetary neutrality
- See why some countries print so much money that they experience hyperinflation
- Examine how the nominal interest rate responds to the inflation rate
- Consider the various costs that inflation imposes on society

Outcomes

After accomplishing these goals, you should be able to

- Demonstrate the link between money and prices with the quantity equation
- Explain why money has no impact on real variables in the long run
- Explain the concept of an inflation tax
- Show the relationship between the nominal interest rate, the real interest rate, and the inflation rate
- Explain who gains and who loses on a loan contract when inflation rises unexpectedly

Strive for a Five

Chapter 30 discusses the growth of the money supply and its effect on inflation. Material in this chapter is tested on the AP macroeconomics test. Some specific topics covered on the test are:

- The money supply and money demand
- The money supply and its effect on inflation
- The money market model
- Costs of inflation
- The theory of the quantity of money
- Nominal versus real interest rates
- The Fisher effect

Key Terms

- *Inflation*—An increase in the overall level of prices
- *Deflation*—A decrease in the overall level of prices
- *Hyperinflation*—Extraordinarily high inflation
- *Quantity theory of money*—The theory that the quantity of money determines prices and the growth rate of money determines inflation
- *Nominal variables*—Variables measured in monetary units
- *Real variables*—Variables measured in physical units
- *Classical dichotomy*—The theoretical separation of nominal and real variables
- *Monetary neutrality*—The property that changes in the money supply affect nominal variables but not real variables
- *Velocity of money*—Rate at which money circulates
- *Quantity equation*—$M \times V = P \times Y$
- *Inflation tax*—The practice of a government raising revenue by printing money
- *Nominal interest rate*—Interest rate uncorrected for inflation
- *Real interest rate*—Interest rate corrected for inflation
- *Fisher effect*—The one-to-one adjustment of the nominal interest rate to inflation
- *Shoeleather costs*—Resources wasted when inflation causes people to economize on money holdings
- *Menu costs*—The costs associated with changing prices
- *Capital gains*—Profits made from selling an asset for greater than the purchase price

Chapter Overview

Context and Purpose

Chapter 30 is the second chapter in a two-chapter sequence dealing with money and prices in the long run. Chapter 29 explained what money is and how the Federal Reserve controls the quantity of money. Chapter 30 establishes the relationship between the rate of growth of money and the inflation rate.

The purpose of this chapter is to acquaint you with the causes and costs of inflation. You will find that, in the long run, there is a strong relationship between the growth rate of money and inflation.You will also find that there are numerous costs to the economy from

high inflation but that there is not a consensus on the importance of these costs when inflation is moderate.

Chapter Review

Introduction *Inflation* is an increase in the overall level of prices. *Deflation* is a decrease in the overall level of prices. *Hyperinflation* is extraordinarily high inflation. There is great variation in inflation over time and across countries. In this chapter, we address two questions: What causes inflation, and why is inflation a problem? The answer to the first question is that inflation is caused when the government prints too much money. The answer to the second question requires more thought and will be the focus of the second half of this chapter.

The Classical Theory of Inflation

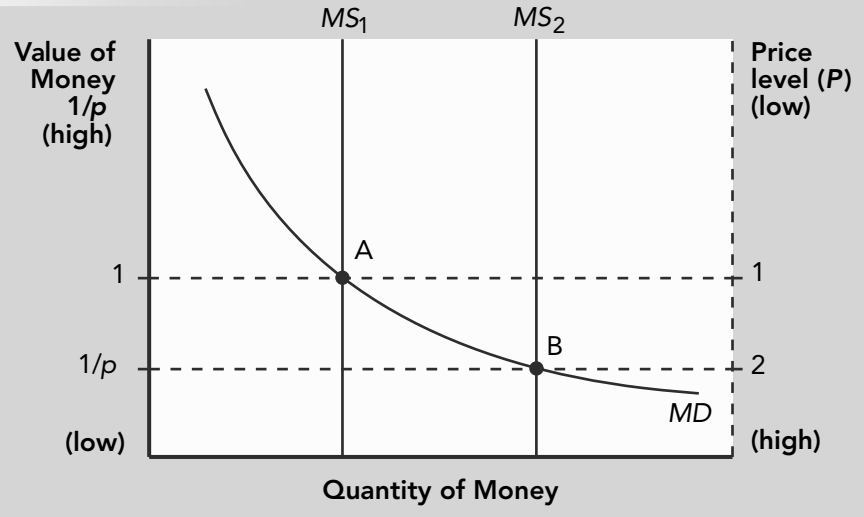
This section develops and employs the quantity theory of money as an explanation of the price level and inflation.

When prices rise, it is rarely because products are more valuable but rather because the money used to buy them is less valuable. Thus, *inflation is more about the value of money than about the value of goods.* An increase in the overall price level is equivalent to a proportionate fall in the value of money. If P is the price level (the value of goods and services measured in money), then $1/P$ is the value of money measured in terms of goods and services. If prices double, the value of money has fallen to 1/2 its prior value.

The value of money is determined by the supply and demand for money. If we ignore the banking system, the Fed controls the money supply. Money demand reflects how much wealth people want to hold in liquid form. While money demand has many determinants, in the long run, one is dominant—the price level. People hold money because it is a medium of exchange. If prices are higher, more money is needed for the same transaction, and the quantity of money demanded is higher.

Money supply and money demand need to balance for there to be monetary equilibrium. Monetary equilibrium is shown in Exhibit 1 for money supply MS_1 at point A. Recall that the value of money measured in goods and services is $1/P$. When the value of money is high, the price level is low and the quantity of money demanded is low. Therefore, the money demand curve slopes negatively in the graph. Since the Fed fixes the quantity of money, the money supply curve is vertical. In the long run, the overall level of prices adjusts to equate the quantity of money demanded to the quantity of money supplied.

EXHIBIT 1



Suppose the Fed doubles the quantity of money in the economy from MS_1 to MS_2. There is now an excess supply of money at the original price level. Since people now are holding more money than they desire, they will rid themselves of the excess supply of money by buying things—goods and services or bonds. Even if people buy bonds (lend money), the bond issuer (borrower) will take the money and buy goods and services. Either way, an injection of money increases the demand for goods and services. Since the ability of the economy to produce goods and services has not changed, an increase in the demand for goods and services raises the price level. The price level will continue to rise (and the value of money will fall) until the quantity of money demanded is raised to the level of the quantity of money supplied (point B). That is, the price level adjusts to equate money supply and money demand. Thus, the conclusions of the *quantity theory of money* are: (1) The quantity of money in the economy determines the price level (and the value of money), and (2) an increase in the money supply increases the price level, which means that growth in the money supply causes inflation.

The classical dichotomy suggests that economic variables can be divided into two groups—nominal variables (those measured in monetary units) and real variables (those measured in physical units). Although prices are nominal variables, relative prices are real variables. For example, the ratio of your earnings per hour to the price of candy bars is a real variable measured in candy bars per hour. Changes in the money supply affect nominal variables but not real variables. Real output is determined by productivity and factor supplies, and not by the quantity of money. However, the value of nominal variables is determined by and is *proportional* to the quantity of money. For example, if the money supply doubles, prices double, wages double, and all dollar values double but real output, employment, real interest rates, and real wages remain unchanged. This result is known as monetary neutrality. Money is unlikely to be neutral in the short run, but it is likely to be neutral in the long run.

The classical dichotomy and monetary neutrality can be demonstrated with the quantity equation. To begin, we define the velocity of money as the speed of circulation of money. Then $V = (P \times Y)/M$ where V is the velocity of money, P is the price of output, and Y is the amount of real output (and $P \times Y$ = nominal GDP), and M is the quantity of money. If nominal output is \$500 (500 items at \$1 each) and M is \$100, then $V = 5$. That is, in order for \$100 to accommodate \$500 of purchases and sales, each dollar must be spent, on average, five times.

Rearranged, we get the quantity equation: $M \times V = P \times Y$. If the quantity of money increases, P or Y must rise, or V must fall. Our theory of inflation takes five steps:

- V is relatively stable in the long run.
- Therefore, changes in M cause proportional changes in nominal output ($P \times Y$).
- Real output (Y) is determined by productivity and factor supplies in the long run and is not affected by changes in M.
- If Y is fixed, an increase in M causes *proportional* changes in P.
- Thus, inflation results from rapid growth in the money supply.

Hyperinflation is sometimes defined as inflation that exceeds 50 percent per month. In those cases, the data show that there is a close link between money growth and inflation. This supports the conclusions of the quantity theory.

Why do countries print too much money if they know it causes inflation? Governments do it to pay for expenditures. When governments spend, they get the money by taxing, borrowing, or printing more money. Countries that have high spending, inadequate tax revenue, and limited ability to borrow may turn to printing money. When a government raises revenue by printing money, it has engaged in an inflation tax. When the government prints money and prices rise, the value of the existing money held by people falls. An inflation tax is a tax on people who hold money.

If money is neutral, changes in money will have no effect on the *real interest rate.* Recall the relationship between the real interest rate, *nominal interest rate,* and inflation:

real interest rate = nominal interest rate – inflation rate

Solving for the nominal interest rate:

nominal interest rate = real interest rate + inflation rate

The real interest rate depends on the supply and demand for loanable funds. In the long run, money is neutral and only affects nominal variables, not real variables. Thus, when the Fed increases the growth rate of money, there is an increase in the inflation rate and a one-for-one increase in the nominal interest rate while the real interest rate remains unchanged. The one-for-one adjustment of the nominal interest rate to inflation is called the Fisher effect. Note that the nominal interest rate is set when the loan is first made, and thus, the Fisher effect actually says that the nominal interest rate adjusts one-for-one with *expected inflation*.

The Costs of Inflation

People often argue that inflation is a serious economic problem because when prices rise, their incomes can't buy as many goods and services. Thus, they believe that inflation directly lowers their standard of living. This argument, however, has a fallacy. Since people earn incomes by selling services, such as labor, inflation in nominal incomes goes hand in hand with inflation in prices. Therefore, inflation generally does not directly affect people's real purchasing power.

There are, however, a number of more subtle costs of inflation:

- *Shoeleather costs:* Recall, inflation is a tax on people who hold money. To avoid the tax, people hold less money and keep more invested in interest-bearing assets when inflation is high than they do when inflation is low. As a result, people have to go to the bank and withdraw money more often than they would if there were no inflation. These costs are sometimes metaphorically called shoeleather costs (since your shoes are worn out from all those trips to the bank). The actual cost of holding less cash is wasted time and inconvenience. At high rates of inflation, this cost is more than trivial.
- *Menu costs:* There are numerous costs associated with changing prices—the cost of printing new menus, price lists, and catalogs; mailing costs to distribute them; the cost of advertising new prices; and the cost of deciding the new prices themselves.
- *Relative-price variability and the misallocation of resources:* Since it is costly to change prices, firms change prices as rarely as possible. When there is inflation, the relative price of goods whose price is held constant for a period of time is falling with respect to the average price level. This misallocates resources because economic decisions are based on relative prices. A good whose price is changed only once per year is artificially expensive at the beginning of the year and artificially inexpensive by the end of the year.
- *Inflation-induced tax distortions:* Inflation raises the tax burden on income earned from saving and, thus, discourages saving and growth. Inflation affects two types of taxes on saving:
  (1) *Capital gains* are the profits made from selling an asset for more than its purchase price. Nominal capital gains are subject to taxation. Suppose you buy a stock for $20 and sell it for $50. Also suppose the price level doubles while you owned the stock. You only have a $10 real gain (because you would need to sell the stock for $40 just to break even), yet you must pay taxes on the $30 nominal capital gain because the tax code does not account for inflation.
  (2) *Nominal interest* is taxed even though part of the nominal interest rate is to compensate for inflation. When government takes a fixed percent of the nominal interest rate as taxes, the after-tax real return grows smaller as inflation increases. This is because the nominal interest rate rises one-for-one with inflation and taxes increase with the nominal interest rate, yet the pretax real return is unaffected by inflation. Therefore, the after-tax real return falls.

Because there are taxes on nominal capital gains and nominal interest, inflation lowers the after-tax real return on saving, and thus, inflation discourages saving and growth. This problem can be solved by eliminating inflation or by indexing the tax system so that taxes are assessed only on real gains.

- *Confusion and inconvenience:* Money serves as the unit of account, which means that the dollar is the yardstick by which we measure economic values. When the Fed increases the money supply and causes inflation, it decreases the value of money and shrinks the size of the economic measuring stick. This makes accounting for firms' profits more difficult and, thus, makes choosing investments more complicated. It also makes daily transactions more confusing.
- *A special cost of unexpected inflation—arbitrary redistribution of wealth:* The costs of inflation previously described exist even if inflation is stable and predictable. Inflation has an additional cost to the economy, however, if it is unexpected because it arbitrarily redistributes wealth. For example, the terms of a loan are generally expressed in nominal values based on a certain amount of expected inflation (see the Fisher effect equation). However, if inflation becomes higher than expected, borrowers are allowed to repay the loan with dollars that purchase less than expected. Borrowers gain at the expense of lenders. The opposite is true when inflation is less than expected. If inflation were perfectly predictable, regardless of its size, this redistribution would not take place. However, high inflation is never stable. Therefore, low inflation is preferred because it is more stable and predictable.

Helpful Hints

1. The price of money is $1/P$. Since we measure the price of goods and services in terms of money, we measure the price of money in terms of the quantity of goods and services for which money can be exchanged. For example, if a basket of goods and services costs \$5, then $P = \$5$. The price of a dollar is then $1/P$ or 1/5 of the basket of goods. That is, one dollar exchanges for 1/5 of the basket of goods. If the price of the basket of goods doubles so that it now sells for \$10, the price of money has fallen to one-half its original value. Numerically, since the price of the basket is now \$10, or $P = \$10$, the price of money has fallen to $1/P$ or 1/10 of the basket of goods. To summarize, when the price of a basket of goods and services doubles from \$5 to \$10, the price of money falls by half from 1/5 to 1/10 of the basket of goods.

2. When dealing with the quantity theory, imagine you are at an auction. At the end of the auction, we can calculate the number of items sold and the average price of each item sold. Suppose we repeat the auction, only now the doorman doubles the money each buyer takes into the auction—if you had \$20, you now have \$40, and so on. If all participants spend the same percent of their money as at the prior auction (equivalent to a constant velocity) and if the items available to buy are unchanged (equivalent to a constant real output), what must happen to the average price of goods sold at the auction? Prices at the auction will precisely double, showing that prices are proportional to the quantity of money.

3. Unexpected inflation works like a tax on future receipts. We know that unexpected inflation redistributes wealth. Although it can be difficult to remember who wins and who loses on nominal contracts through time, you can always keep things straight if you remember that *unexpected inflation works like a tax on future receipts and a subsidy to future payments.* Therefore, when inflation turns out to be higher than we thought it would be when a loan contract was written, the recipient of the future payments is worse off because they receive dollars with less purchasing power than they had bargained for. The person who borrowed is better off because they were able to use the money when it had greater value, yet they were allowed to repay the loan with money of lower value. Therefore, when inflation is higher than expected, wealth is redistributed from lenders to borrowers. Alternatively, when inflation is less than expected, winners and losers are reversed.

   This concept can be applied to any contract that extends through time. Consider a labor contract. Recall, when inflation is greater than we expected, those who receive money in the future are harmed and those who pay are helped. Therefore, firms gain at the expense of workers when inflation is greater than anticipated. When inflation is less than expected, winners and losers are reversed.

Self-Test

Multiple-Choice Questions

1. In which of the following cases was the inflation rate 10 percent over the last year?
   a. One year ago, the price index had a value of 110, and now it has a value of 120.
   b. One year ago, the price index had a value of 120, and now it has a value of 132.
   c. One year ago, the price index had a value of 126, and now it has a value of 140.
   d. One year ago, the price index had a value of 145, and now it has a value of 163.
   e. One year ago, the price index had a value of 90, and now it has a value of 100.

2. If $M = 10{,}000$, $P = 2$, and $Y = 20{,}000$, then velocity =
   a. 4.Velocity will rise if money changes hands more frequently.
   b. 4.Velocity will rise if money changes hands less frequently.
   c. 8.Velocity will rise if money changes hands more frequently.
   d. 8.Velocity will rise if money changes hands less frequently.
   e. 8.Velocity will fall if money changes hands more frequently.

3. Which of the following combinations of real interest rates and inflation implies a nominal interest rate of 7 percent?
   a. a real interest rate of 2.5 percent and an inflation rate of 2 percent
   b. a real interest rate of 4 percent and an inflation rate of 11 percent
   c. a real interest rate of 6 percent and an inflation rate of 1 percent
   d. a real interest rate of 5.5 percent and an inflation rate of 3 percent
   e. a real interest rate of 7 percent and an inflation rate of 7 percent

4. When the price level falls, the number of dollars needed to buy a representative basket of goods
   a. increases, so the value of money rises.
   b. increases, so the value of money falls.
   c. decreases, so the value of money rises.
   d. decreases, so the value of money falls.
   e. remains constant to offset the fall in the value of money.

5. An associate professor of physics gets a $200 a month raise. With her new monthly salary, she can buy more goods and services than she could buy last year.
   a. Her real and nominal salaries have risen.
   b. Her real and nominal salaries have fallen.
   c. Her real salary has risen and her nominal salary has fallen.
   d. Her real salary has fallen and her nominal salary has risen.
   e. Her real salary has remained constant but her nominal salary has risen.

6. On its website, your bank posts the interest rates it is paying on savings accounts. Those posted rates
   a. are real values.
   b. are nominal values.
   c. are gross values.
   d. are net values.
   e. are adjusted for inflation.

7. In 1898, prospectors on the Klondike River discovered gold. This discovery caused an unexpected price level
   a. decrease that benefited creditors at the expense of debtors.
   b. decrease that benefited debtors at the expense of creditors.
   c. increase that benefited creditors at the expense of debtors.
   d. increase that benefited debtors at the expense of creditors.
   e. increase that benefited debtors and creditors equally.

8. Wealth is redistributed from creditors to debtors when inflation was
   a. expected to be high and it turns out to be high.
   b. expected to be low and it turns out to be low.
   c. expected to be low and it turns out to be high.
   d. expected to be high and it turns out to be low.
   e. unexpected and turns out to be low.

9. In order to maintain stable prices, a central bank must
   a. maintain low interest rates.
   b. keep unemployment low.
   c. tightly control the money supply.
   d. engage in counter-cyclical monetary policy.
   e. back the money supply with gold.

10. When inflation rises, people desire to hold
    a. less money, and firms make less frequent price changes.
    b. less money, and firms make more frequent price changes.
    c. more money, and firms make less frequent price changes.
    d. more money, and firms make more frequent price changes.
    e. more money, and firms do not make price changes.

11. You bought some shares of stock and, over the next year, the price per share increased by 5 percent, as did the price level. Before taxes, you experienced
    a. both a nominal gain and a real gain, and you paid taxes on the nominal gain.
    b. both a nominal gain and a real gain, and you paid taxes only on the real gain.
    c. a nominal gain, but no real gain, and you paid taxes on the nominal gain.
    d. a nominal gain, but no real gain, and you paid no taxes on the transaction.
    e. a real gain, but no nominal gain, and you paid taxes on the real gain.

12. For a given real interest rate, an increase in inflation makes the after-tax real interest rate
    a. decrease, which encourages savings.
    b. decrease, which discourages savings.
    c. increase, which encourages savings.
    d. increase, which discourages savings.
    e. increase, but has no effect on savings.

Free Response Questions

1. Define each of the symbols and explain the meaning of $M \times V = P \times Y$.

2. Identify each of the following as nominal or real variables.
   a. the physical output of goods and services
   b. the dollar price of apples
   c. the price of apples relative to the price of oranges
   d. the amount that shows up on your paycheck after taxes
   e. the amount of goods you can purchase with the wage you get each hour
   f. the taxes that you pay the government

Solutions

Multiple-Choice Questions

1. b TOP: Inflation rate
2. a TOP: Quantity equation
3. c TOP: Real interest rate | Nominal interest rate
4. c TOP: Value of money
5. a TOP: Nominal variables | Real variables
6. b TOP: Nominal variables | Real variables
7. d TOP: Wealth redistribution | Inflation
8. c TOP: Wealth redistribution | Inflation
9. c TOP: Inflation
10. b TOP: Menu costs of inflation | Shoeleather costs of inflation
11. c TOP: Taxes | Inflation
12. b TOP: Taxes | Inflation | Real interest rate

Free Response Questions

1. M is the quantity of money, V is the velocity of money, P is the price level, and Y is the quantity of output. PY is nominal GDP. The amount people spend should equal the amount of money in the economy times the average number of times each unit of currency is spent.

TOP: Velocity

2. a. real variable
   b. nominal variable
   c. real variable
   d. nominal variable
   e. real variable
   f. nominal variable

TOP: Nominal variables | Real variables