12 Inflation

12-1 Introduction

In the preceding chapters we have concentrated primarily on the problem of unemployment for three reasons. First, the development of the branch of economic theory now known as macroeconomics began with the publication in 1936 of Keynes's *The General Theory*. At that time unemployment was the primary economic problem in the industrial nations and therefore the topic to which Keynes addressed himself. Keynes was well aware that the policy prescriptions he offered to alleviate unemployment could not be successfully employed during inflationary periods, but his followers, the so-called Keynesians, erroneously believed that fiscal policy could cure inflation as well. Second, many economists and politicians since the 1930s have considered the problem of unemployment to be of greater social importance than the problem of inflation. This judgment was not shared by Keynes, who observed that "There is no subtler, no surer means of overturning the existing basis of society than to debauch the currency. The process engages all the hidden forces of economic law on the side of destruction . . . ." Third, the simultaneous occurrence of unemployment *and* inflation was an event most economists felt was unlikely to occur—until it happened.

In this chapter we explore the theory of inflation, examine some of the possible causes of inflation, and consider the relationship between unemployment and inflation.

12-2 Demand-pull Inflation

When there is a high level of employment, an increase in aggregate demand usually produces inflationary pressures in the economy. Inflation caused by a shift in the aggregate demand curve is called *demand-pull inflation*. An increase in demand can originate in the real sector or in the monetary sector, or in some combination of these two. First, we examine an increase in demand that originates in the real sector. Throughout this and the next section we retain our earlier assumption that the expected future price level is always the existing price level. In addition, to simplify our analysis without altering any of its basic conclusions, we assume that the Pigou effect portion of the real-balance effect is not present.

Inflation Originating in the Real Sector

When an economy is at or near full employment, an increase in aggregate demand usually results in an excess aggregate demand that in turn causes the price level to rise until equilibrium is restored. Although it is possible for this increase in aggregate demand to originate in the household sector or the business sector (rather than in the government sector), this does not usually happen, because the private sectors lack the authority to tax and to print money. Households and business firms can increase their aggregate demand only by drawing on accumulated savings or by borrowing. Both of these methods are self-limiting and will probably produce only a minor increase in demand. Because government has the power to tax and to print money as well as the ability to borrow from the public, it can often be a source of inflationary pressure. For this reason, in this subsection we concentrate on inflation that originates in the government sector.

Suppose that we are initially in the state of full-employment equilibrium illustrated in Figure 12-1. The level of investment *plus* government expenditure is given by the MEI + G curve in Figure 12-1(a). The savings function, plotted against national income when there are no taxes, is given by curve S in Figure 12-1(c). Given that taxes T are equal to G, the relevant savings function becomes S'. This is simply curve S shifted to the right by an amount T, so that savings, which is a function of disposable income, can be plotted against national income. The curve giving the level of savings *plus* taxes for any level of income is $S' + T$, which is obtained by adding the amount of the tax, T vertically to S'. The MEI + G and the $S' + T$ curves yield the initial IS curve IS_1 graphed in Figure 12-1(d). Also shown in Figure 12-1(d) are the three LM curves LM_1, LM_2, and LM_3, whose subscripts designate the respective price levels P_1, P_2, and P_3 to which each curve applies. The intersection of these LM curves with the initial IS curve IS_1 produces the initial aggregate demand curve AgD_1 in Figure 12-1(e). The intersection of AgD_1 with the full-employment aggregate supply curve AgS in Figure 12-1(e) gives us our initial full-employment equilibrium conditions. Specifically, the level of income is Y_{FE} at price level P_2. The interest rate is the natural rate of interest i_N that prevails in Figure 12-1(d).

Now suppose that there is an increase in autonomous government expenditure by an amount ΔG, as shown in Figure 12-1(a), and that this increase is financed by

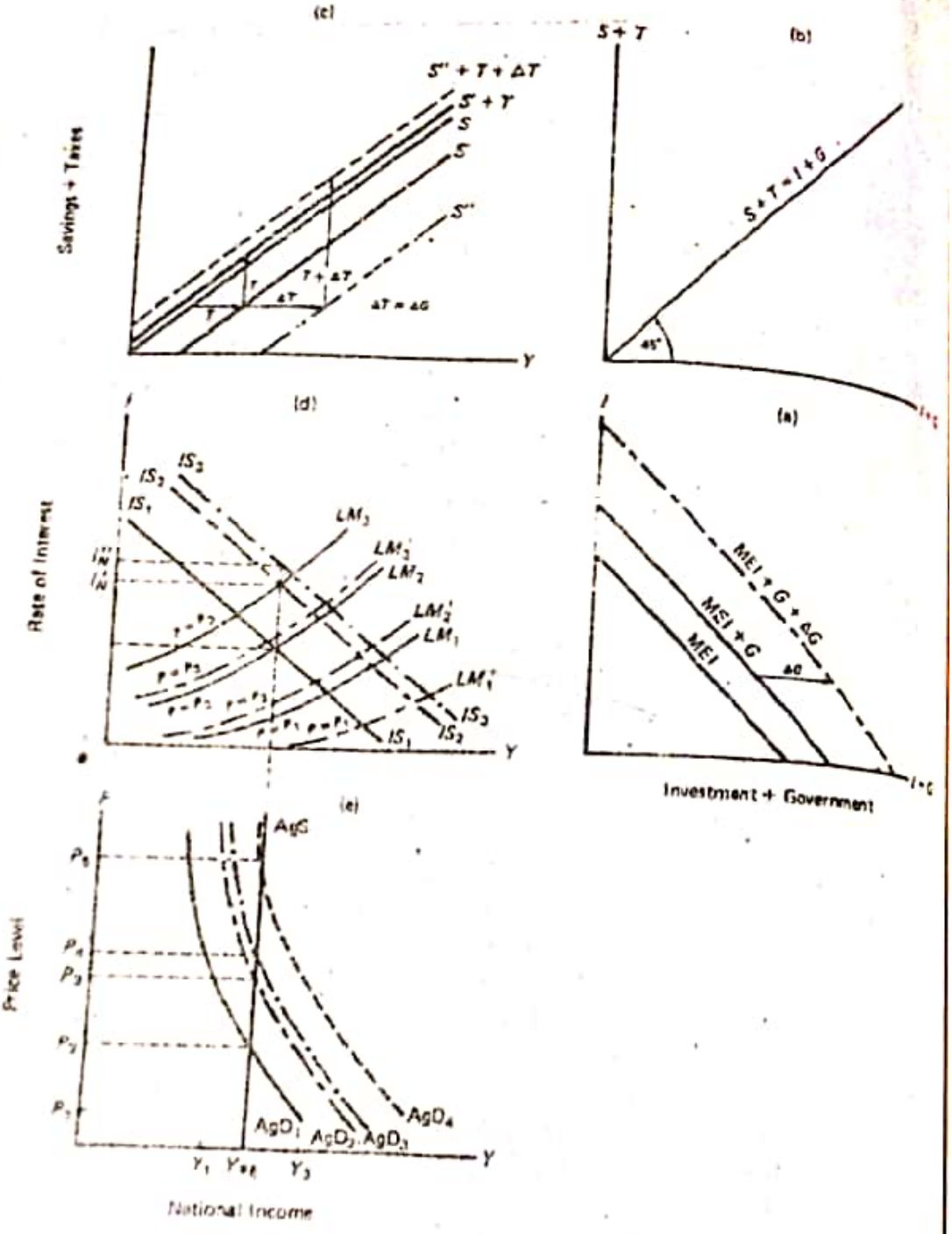

FIGURE 12-1 *The Effect of Increased Government Expenditure on the Price Level When Alternative Methods of Financing Are Employed*

an increase in taxes of $\Delta T = \Delta G$. Because total taxes are now $T + \Delta T$, the relevant savings function in Figure 12-1(c) becomes S'' and the curve that represents savings *plus* taxes is therefore $S'' + T + \Delta T$. This curve in conjunction with the

MEI + G + ΔG curve gives us the new IS curve IS_2. The intersection of IS_2 with the original set of LM curves yields a new aggregate demand curve AgD_2, which intersects the AgS curve in Figure 12-1(e) at the higher equilibrium price level P_3. The natural rate of interest now becomes i'_N, which is given by the point at which IS_2 intersects the LM curve LM_3 that exists at this price level at the full-employment level of aggregate demand.

Instead of financing its increased expenditure by raising taxes, the government could raise the necessary revenue by the sale of bonds to the public sector. This means that the relevant savings *plus* taxes curve reverts to $S + T$ in Figure 12-1(c), and using the MEI + G + ΔG curve, we now obtain the IS curve IS_3. The intersection of IS_3 with the original set of LM curves increases aggregate demand, shifting the curve to AgD_3. The equilibrium price level now rises to P_4, and the natural rate of interest increases to i''_N.

The government can also raise the money needed for the increased expenditure by a method equivalent to printing it. In the United States, the Department of the Treasury can sell government bonds to the Federal Reserve, which in return creates bank deposits in the Treasury's account, or equivalently, prints Federal Reserve notes and exchanges them for the bonds. Whereas theoretically the government must pay interest on these bonds, in practice it does not. The Federal Reserve pays its stockholders (the member commercial banks) a fixed percentage on their investment and, after deducting operations costs, returns *all* excess revenue to the Treasury. Thus, in effect, the sale of bonds by the Treasury to the Federal Reserve is a costless operation identical to merely printing money, provided the Federal Reserve is willing to absorb these additional bonds and does not sell them to the public. All such money is high-powered money, which becomes part of the monetary base from which commercial banks can expand the money supply.

Let us assume that the government deficit is financed by simply printing the money, so that the resulting inflation originates in the real sector but is produced by a combination of monetary and fiscal operations. High-powered money will increase by an amount equal to ΔG, so that the nominal money supply increases by some multiple of ΔG, as we saw in Chapter 8. As we demonstrated in Chapter 11, an increase in the nominal money supply will shift the set of LM curves in Figure 12-1(d) to the right, producing the new set of curves LM'_1, LM'_2, and LM'_3. The intersection of these new LM curves with IS_3 gives us the new aggregate demand curve AgD_4, which determines the new and higher equilibrium price level P_5. Because the IS curve does not shift but remains at IS_3, the interest rate at the full-employment level of income remains at i''_N.

From the preceding analysis we can conclude that the least inflationary means of financing an increase in government expenditure is to increase taxes by an equal amount, but even such an increase is inflationary. The only way to avoid inflation is to increase taxes by some amount greater than the increase in expenditure. The next least inflationary method is to obtain the required money by selling bonds to the public and thereby maintain a constant nominal money supply. By far the most inflationary method is to print an amount of money equal to the increase in

government expenditure. In fact, this method of financing the deficit is even more inflationary than the one just described, because we have shown only what Friedman calls the "first-round effect."[1] As long as the deficit persists the government will increase the quantity of high-powered money in each successive expenditure period and the price level will continue to rise. This will not be the case if either of the other two methods of expenditure financing is employed and the first-round inflationary effect illustrated in Figure 12-1 will be the final effect.

It is important to keep in mind that these conclusions are based on a model of an economy whose output is constant in the short run. As long as we have net investment, the capital stock will grow and, with it, income. Thus it is entirely possible that within a dynamic framework, increases in government expenditure may be less than or more than those required to maintain a stable price level.

In this subsection we have limited our analysis of inflation originating in the real sector to government expenditure. Of course, a shift of the *IS* curve to the right could also be produced by a rightward shift to the MEI curve or a downward shift of the savings function. However, neither firms nor individuals have the legal power to tax or to print money, so that their increased expenditures would have to be taken either from past and present savings or from borrowed funds. The net effect on the aggregate demand curve would be analogous to the case when increased government expenditure is financed by the sale of bonds. Because private savings are fixed and rising interest rates limit the borrowing capacity of the private sector, it is unlikely that the private sector will be a source of major and sustained inflation. However, one condition can invalidate this generalization. Suppose that the central bank pursues a policy of maintaining the interest rate below a specified value. If there is an increase in aggregate demand originating in the private sector and the market rate of interest rises above the central bank's maximum allowable rate, then the bank will increase the nominal money supply in an attempt to lower the interest rate. The increase in the money supply allows aggregate demand to increase, so that once again the price level and the interest rate rise, and once again the central bank increases the nominal money supply. As long as the central bank pursues this policy, inflation will persist.

Inflation Originating in the Monetary Sector

We have analyzed how an increase in aggregate demand originating in the government, household, or business sectors can cause inflation when the economy is at or near full employment. We have also learned how this inflation will be worsened if the actions of government, business, or households are aided and abetted by an increase in the money supply. We now demonstrate how the monetary authorities can initiate an increase in aggregate demand that subsequently causes inflation.

Suppose that we are originally in a state of full-employment equilibrium, as depicted in Figure 12-2. The equilibrium rate of interest is the natural interest rate

[1] Milton Friedman, "Comments on the Critics," in "Symposium on Friedman's Theoretical Framework," *Journal of Political Economy* 80 (September/October 1972), 916–17.

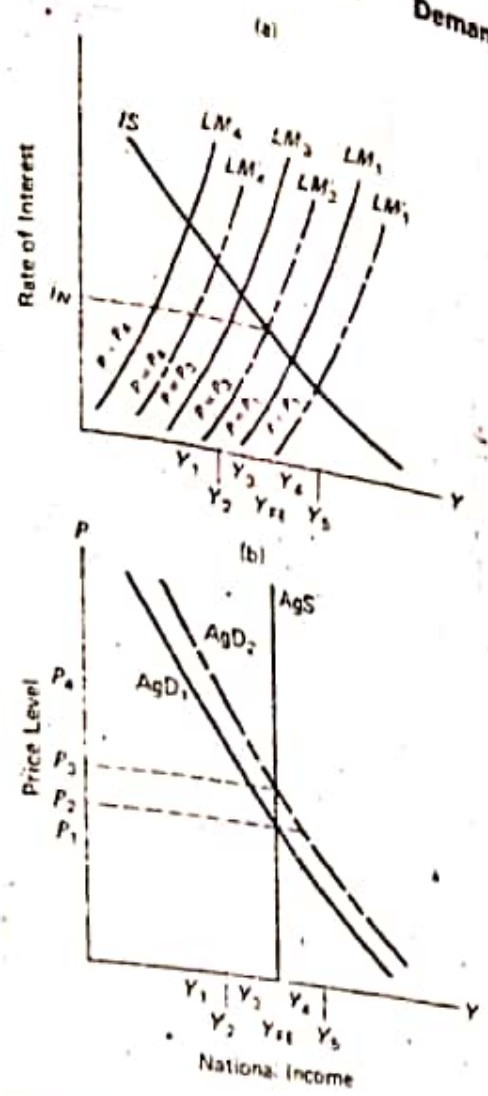

FIGURE 12-2 ***The Effect of an Increase in the Nominal Money Supply on the Equilibrium Price Level and the Interest Rate***

i_N shown in Figure 12-2(a), the equilibrium price level P_2 is shown in Figure 12-2(b). Now assume that for some reason the nominal money supply is increased by the central bank, so that the original *LM* curves LM_1, LM_3, and LM_4 all shift to the right[2] to become LM'_1, LM'_3, and LM'_4.

As an immediate consequence of the increase in the nominal money supply, the aggregate demand curve shifts to AgD_2, where at price level P_2 the excess aggregate demand is $Y_4 - Y_{FE}$ and individuals hold excess real cash balances. As individual wealth holders attempt to dispose of their excess real cash balances, the price level rises. The market rate of interest is below the natural interest rate immediately after the increase in the nominal money supply, producing a rise in desired investment that further increases the pressure on the price level. As the

[2] The *LM* curve corresponding to price level P_2 (that is, LM_2) is omitted from Figure 12-2(a) for clarity. If it were drawn, it would coincide with LM_3.

price level rises, the real money supply shrinks and the market rate of interest begins to return to the natural interest rate. This process continues as long as there is any excess demand. When the economy achieves equilibrium again, the price level is determined by the intersection of the aggregate demand curve and the aggregate supply curve, or P_3 in this example. The price level must rise in proportion to the increase in the nominal money supply; otherwise, an excess of real cash balances would continue to exist. As long as there are excess real cash balances, the price level will continue to rise. However, the interest rate returns to the equilibrium or natural interest rate determined by the *IS* curve when income is at the full-employment level. Thus the natural interest rate in this model is determined exclusively by the real sector and cannot be influenced by the monetary sector. If the central bank refuses to accept this result and attempts to peg the interest rate below the natural rate, then continuous inflation will result as the monetary authorities repeatedly increase the nominal money supply in their attempt to prevent the interest rate from rising.

12-3 Cost-push Inflation

Thus far all the inflations we have analyzed have resulted from a shift in the aggregate demand curve. For this reason we call them *demand-pull inflations*. In this section we consider inflation that results from a shift of the aggregate supply curve, which is usually referred to as *cost-push inflation*. Cost-push inflation arguments are usually associated with nonmonetary forces and imperfectly competitive aggregate supply models. Here we examine two cost-push arguments that are based on market imperfections in either the demand for labor or the supply of labor.

Imperfect Competition and the Demand for Labor

Many people view the American economy as a far cry from the textbook economy of perfect competition. It is argued that economic power is concentrated in the hands of a few sellers, enabling monopolistic firms to raise prices whenever they please; mass advertising based on motivational psychology is then employed to persuade the consumer to buy products at these prices.[3]

Initially, we assume that perfect competition prevails in both the demand for and the supply of labor. These assumptions are illustrated in Figures 12-3(a) and

[3] An exposition of this view can be found in John Kenneth Galbraith, *The New Industrial State* (Boston: Houghton Mifflin, 1967). For a critical microeconomic examination of this view, see P.L. Burgess and F.R. Glahe, "Pricing in the American Automobile Industry and the Galbraith Hypothesis," *Rivista Internazionale di Scienze Economiche e Commerciali* XVII (December 1970), 1176–86.

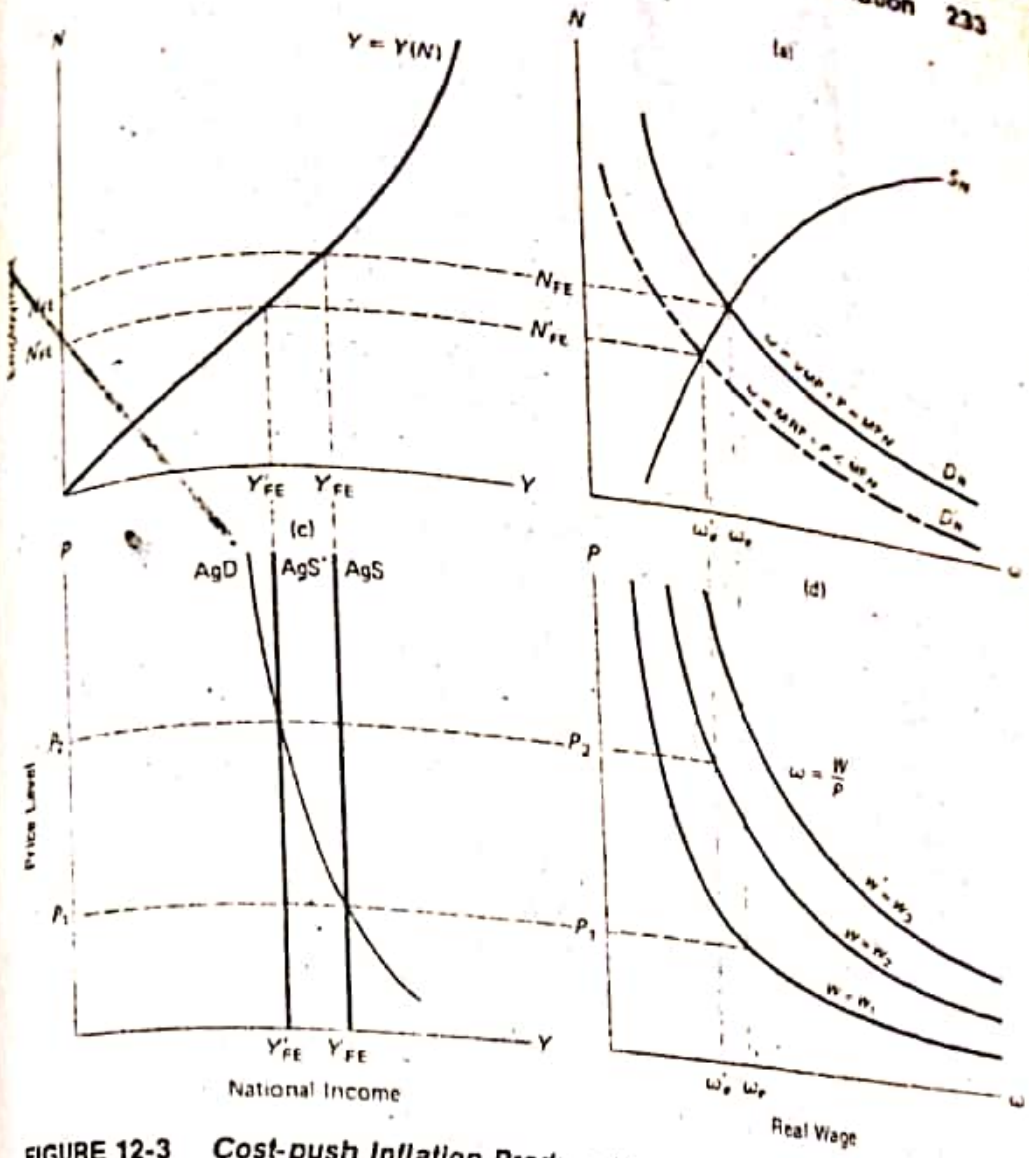

FIGURE 12-3 ***Cost-push Inflation Produced by Business Monopoly Power***

12-3(d). The demand for labor curve D_N in Figure 12-3(a) specifies that the real wage paid to labor ω is equal to the value of the marginal product of labor VMP divided by the price level, and this in turn is equal to the marginal product of labor MP_N. In Chapter 2 we showed that in perfect competition the real wage of labor would be equal to its marginal product. This means that the D_N curve in Figure 12-3(a) is a perfectly competitive demand for labor curve. The intersection of the labor suply curve S_N with D_N in Figure 12-3(a) determines the labor market equilibrium real wage ω_e. Figure 12-3(d) tells us that money wages are flexible upward or downward and therefore that perfect competition exists in the supply of labor.

Because we have perfect competition in the demand for and the supply of labor, the level of employment will be the full-employment level N_{FE}. With employment at N_{FE}, the production function in Figure 12-3(b) specifies that the level of output is equal to the full-employment level of national income Y_{FE}. Thus, the perfectly competitive aggregate supply curve AgS in Figure 12-3(c) is produced. Given an aggregate demand of AgD, the equilibrium price level under perfect competition is P_1 and the nominal wage is W_1, as shown in Figure 12-3(d).

We now modify our assumption that the business sector is perfectly competitive and assume that imperfect competition prevails in this sector. In Chapter 2 we showed that a perfectly competitive firm will hire workers up to the point when the money wage paid to workers is exactly equal to the value of their marginal product, VMP. In the context of our aggregate economic model

$$W = \text{VMP} = P \cdot MP_N \tag{12-1}$$

For a profit-maximizing, imperfectly competitive firm, however, the money (or nominal) wage paid to workers is equal to the *marginal revenue product* of labor, MRP. The MRP is defined as the net addition to the firm's total revenue TR due to the additional employment of one unit of labor, or

$$W = \text{MRP} = \frac{\Delta TR}{\Delta N} \tag{12-2}$$

Equivalently,

$$\text{MRP} = \text{MR} \cdot MP_N \tag{12-3}$$

where MR, the marginal revenue of the firm, is defined as the net addition to the firm's total revenue that results from a one-unit increase in the sale of the firm's total product TP, or

$$\text{MR} = \frac{\Delta TR}{\Delta TP} \tag{12-4}$$

We have previously defined the marginal product of labor by

$$MP_N = \frac{\Delta TP}{\Delta N} \tag{12-5}$$

We now can rewrite equation (12-4)

$$\Delta TR = \Delta TP \cdot \text{MR} \tag{12-6}$$

and equation (12-5)

$$\Delta N = \frac{\Delta TP}{MP_N} \tag{12-7}$$

Substituting equations (12-6) and (12-7) into (12-2), we obtain

$$W = \text{MRP} = \frac{\Delta TP \cdot \text{MR}}{\Delta TP / MP_N} = \text{MR} \cdot MP_N \tag{12-8}$$

† For a proof of this profit-maximizing condition, see C.E. Ferguson and J.P. Gould, *Microeconomic Theory*, Fourth Edition (Homewood, Ill.: Richard D. Irwin, 1975), p. 403.

This proves that equation (12-3) is equivalent to equation (12-2).

One of the most important characteristics that differentiates the imperfectly competitive firm from the perfectly competitive firm is that the former has a negatively sloped product demand curve but the latter has a horizontal one. This means that the MR of the imperfectly competitive firm is always less than product price and the MR of the perfectly competitive firm is always equal to product price.[5]

Now if we divide equation (12-8) by the price level, we obtain

$$\frac{W}{P} = \omega = \frac{MR}{P} \cdot MP_N \tag{12-9}$$

the real wage that an imperfectly competitive firm pays to labor. Because MR is less than price in imperfect competition, it follows that the real wage paid to labor will be less than its marginal product, or

$$\omega < MP_N \tag{12-10}$$

The extent to which ω is less than MP_N is directly related to the degree of monopolistic imperfection existing in the economy. As monopolistic imperfection increases and the economy moves further away from perfect competition, the real wage paid to workers declines relative to their marginal productivity.

We can now examine the inflationary effect of going from perfect competition to imperfect competition. We assume that there is no change in the supply side of the labor market, that is, perfect competition in the supply of labor still prevails. The demand for labor is altered, however, because firms are now imperfectly competitive. This causes the demand for labor curve in Figure 12-3(a) to shift downward to D_N', because the real wage paid to labor will be less than its marginal product. The imperfectly competitive demand for labor curve now intersects S_N at a lower equilibrium real wage ω_2, and the level of full employment falls to N_{FE}'. This decline in the level of full employment produces an accompanying decline in aggregate supply, and the aggregate supply curve shifts to the left, to AgS'. The equilibrium price level now rises to P_2, as shown in Figure 12-3(c), and the money wage rises to W_2, as shown in Figure 12-3(d).

[5] Proof: Total revenue is price × quantity sold, or

$$TR = P \cdot Q$$

Marginal revenue is the derivative of total revenue with respect to output, or

$$MR = \frac{dTR}{dQ} = P + Q\frac{dP}{dQ}$$

Since dP/dQ is the slope of the demand curve, in perfect competition $dP/dQ = 0$ and therefore

$$MR = P$$

In imperfect competition, the slope of the demand curve is negative, that is, $dP/dQ < 0$, so that

$$MR < P$$

If we had chosen to assume in this analysis that imperfections did exist in the supply of labor (that is, that money wages are rigid downward), then it would not have altered our conclusions here in any way. This is so because the aggregate demand curve would continue to intersect the aggregate supply curve in its vertical portion after it shifts to the left.

We have just demonstrated that introducing market imperfection into our model causes a reduction in output and an increase in the price level, but it is quite another thing to attribute an observed secular rise in the price level to this phenomenon. For any given degree of market imperfection there will be a unique equilibrium price level, and profit-maximizing firms will not be motivated to increase prices. A secularly rising price level can be attributed to monopoly power only if the extent of this power continually increases over time.

There appears to be little or no empirical evidence that the extent of monopoly power in the United States has significantly increased since 1900. One way of measuring an increase or a decrease in market imperfection in an industry over time is the so-called *concentration ratio*. The concentration ratio is simply the percentage of an industry's assets (or sales, or value added, or employment) that can be assigned to the industry's four largest firms. Because an increase in monopoly power over time in an industry is generally recorded as an increase in the concentration ratio, this ratio can serve as an index of market imperfection in that industry. This is admittedly a crude measure, but it is, unfortunately, one of the best available.

Data required to calculate concentration ratios accurately did not become available until 1947; however, in a pioneering study G. Warren Nutter estimated the trend in market concentration from 1899 to 1939.[6] Nutter considered industries in which the four largest firms were responsible for at least one-half the output and then estimated the fraction of national income produced by these four firms in each industry. He concluded that from 1899 to 1939 market concentration increased only in finance, declined in transportation, manufacturing, communications, and mining, and remained constant in retail trade, services, agriculture, public utilities, and construction. In a similar study, George Stigler examined the trend of market concentration from 1900 to 1939 and reached essentially the same conclusions Nutter did.[7] In a review of the work of Nutter and Stigler, Solomon Fabricant pointed out numerous contradictions and analytical problems but nevertheless concluded that

> the essential validity of their conclusion must stand. All the doubts that can be raised do not destroy, rather they support, the conclusion that there is no basis for believing that the economy of the United States is largely monopolistic and has been growing more monopolistic.[8]

[6] G. Warren Nutter, *The Extent of Enterprise Monopoly in the United States, 1899–1939: A Quantitative Study of Some Aspects of Monopoly* (Chicago: University of Chicago Press, 1951).

[7] George J. Stigler, "Competition in the U.S.," *Five Lectures on Economic Problems* (London: Longmans, Green and Co., 1949).

[8] Solomon Fabricant, "Is Monopoly Increasing?" *Journal of Economic History* (Winter 1953), 93.

TABLE 12-1 Average Concentration Ratios by Type of Industry, 1947–1966

	213 Total Industries	132 Capital Goods Industries	81 Consumer Goods Industries
1966	41.9	43.4	39.6
1963	41.4	43.3	38.2
1958	40.2	43.1	35.5
1954	40.6	43.8	35.4
1947	41.2	45.1	34.8
Change, 1947–1966	.7	-1.7	4.8

SOURCE *Studies by the Staff of the Cabinet Committee on Price Stability* (Washington, D.C.: U.S. Government Printing Office, January 1969), p. 58.

Since 1947 the availability and quality of data classified by industry has improved significantly, primarily due to the Census of Manufacturers conducted by the Bureau of the Census. In Table 12-1, data on the change in market concentration between 1947 and 1966 in 213 manufacturing industries are summarized. These data indicate that the average level of concentration for all industries shows no marked tendency to increase or to decrease over the period. In 1947 the average market concentration ratio was 41.2%; in 1966 it was 41.9%. If we categorize these industries by capital-goods production and consumer-goods production, then the results indicate that market concentration declined in the former and was offset by a rise in the latter.

Another way to measure the degree of competitiveness in the economy is to compute the fraction of value added in manufacturing by industries in which the four largest firms produce at least 50% of the output. The results of this computation appear in Table 12-2 for selected years from 1901 to 1970. This approach indicates that the trend in monopoly concentration in this century has been

TABLE 12-2 The Trend in Concentration in Manufacturing

	1901	1947	1954	1958	1963	1966	1970
Percentage of value added in industries with a four-firm concentration greater than 50%	32.9	24.4	29.9	30.2	33.1	28.6	26.3

SOURCE Paul W. McCracken and Thomas Gale Moore, *Competition and Market Concentration in the American Economy*, Reprint No. 25 (Washington, D.C.: American Enterprise Institute, June 1974), p. 4.

downward and, most important to the discussion in this section, that monopoly power increased from 1954 to 1963, when price stability existed in the American economy, and decreased from 1963 to 1970, when inflation prevailed. This evidence directly contradicts the theory that monopolistic firms have been the source of the recent inflation.

A different approach to the question of market concentration and inflation is to compare pricing behavior in concentrated industries with that in nonconcentrated industries. Steven Lustgarten did just this for the period from 1954 to 1973 and concluded that an inverse correlation exists between industry concentration and price increase.[9] In other words, according to Lustgarten, prices in concentrated industries rise more slowly than they do in nonconcentrated industries. Once again we see that evidence directly contradicts the theory.

In summary, we can conclude that no overall increase in market concentration appears to have occurred in the American economy since the turn of the century. With respect to recent U.S. inflation, the evidence from market concentration and pricing behavior directly contradicts the theory. It therefore does not seem reasonable to attribute periods of inflation in the twentieth century to monopolistic business power.

Imperfect Competition in the Labor Sector

Another popular explanation for inflation can be summarized as follows. Labor unions are powerful enough to monopolize the supply of labor. Union leaders who are anxious to remain in office must negotiate labor contracts that grant union members ever-increasing money wages. Employers faced with the monopolistic power of unions must give in, and when wage increases exceed productivity gains, as it is believed they often do, production costs also rise. Increased production costs are passed on to the consumer in the form of higher prices, causing inflation. Of course, certain difficulties arise when this explanation is applied to the American experience, but before exploring them we examine this form of cost-push argument to see if it contains any kernels of truth.

Let us assume that there is a perfect monopoly in the labor sector; that is, there is only one labor union, every worker is a member of that labor union, and all workers are paid the union money wage, which is perfectly inflexible downward. The aggregate supply curve that results under these conditions is identical to the one we derived in Figure 2-8 (page 27).

Suppose that initially we are in the condition of full employment depicted in Figure 12-4(c). Given an initial imperfectly competitive aggregate supply curve AgS and an initial aggregate demand curve AgD, the full-employment price level is P_0 and the nominal wage is W_1, as shown in Figure 12-4(d). Now suppose that the monopolistic labor union demands and is given an increase in the nominal wage to W_2. Because W_2 is the lowest money wage that workers can now accept, the aggregate supply curve in Figure 12-4(c) shifts upward to AgS'. At the initial price

[9] Steven Lustgarten, *Industrial Concentration and Inflation* (Washington, D.C.: American Enterprise Institute, 1975).

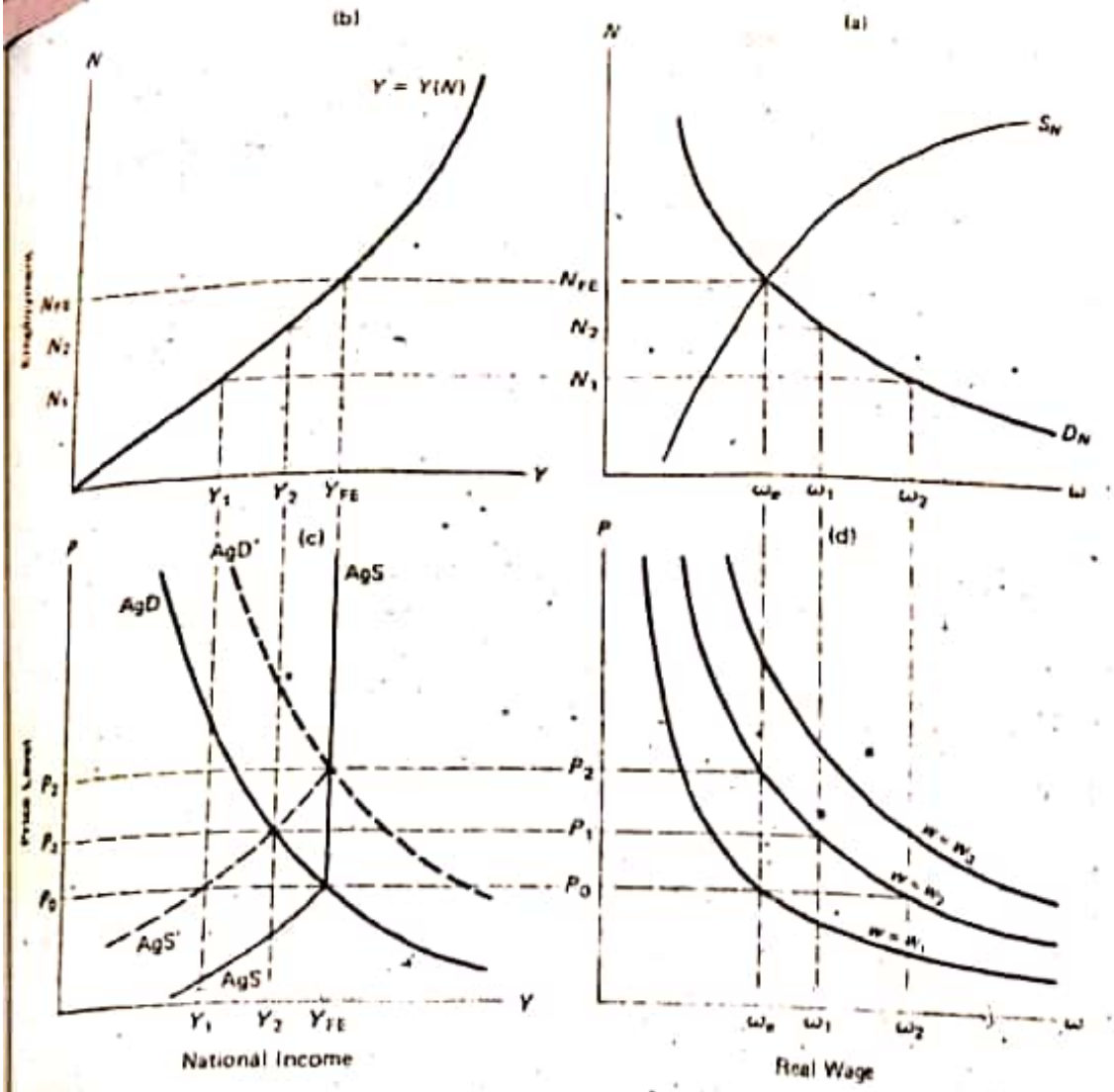

FIGURE 12-4 ***Cost-push Inflation Produced by Monopolistic Labor Power***

level P_0 the real wage is ω_2, N_1 workers are employed, and the level of national income supplied is Y_1. An excess aggregate demand exists that is equal to $Y_{fl} - Y_1$, and the price level consequently rises to P_1, where aggregate demand is equal to aggregate supply at the less than full-employment stable disequilibrium level of income Y_2. The rise in the price level is less than proportional to the increase in money wages, and the real wage paid to employed workers ω_1 is therefore greater than the equilibrium real wage ω_e, as shown in Figure 12-4(d). Since $\omega_1 > \omega_e$, the quantity of workers employed is $N_2 < N_{FE}$, as shown in Figure 12-4(a), the level of national income supplied is therefore $Y_2 < Y_{FE}$ as shown in Figure 12-4(c).

The labor union can create full employment by demanding a reduction in money wages. However, this is unlikely to occur, because it would worsen conditions for

most workers and a union leader who advocated such a policy would soon be voted out of office. The most probable course of action would be to demand government action via monetary or fiscal policy. If a government pledges to maintain full employment, as the U.S. government did in the 1946 Employment Act, then the pressure to take action will shift to the government. One possible policy would be to apply antitrust action against the monopolistic union, thereby moving toward perfect competition in the labor market. But in an elected government, antitrust action might not be popular with the electorate, most of whom are union members. The only alternative for the government would then be expansionary monetary or fiscal policy.

Expansionary fiscal or monetary policy shifts the aggregate demand curve in Figure 12-4(c) to AgD′ and restores full employment at the higher price level P_2. As a result of this increase in the price level, real wages return to the equilibrium real wage ω_e as shown in Figure 12-4(d), the level of employment rises to N_{FE}, and national income once again achieves the full-employment level.

The mechanism that produced the inflation in this analysis is not necessarily self-limiting, as it is in the business-sector monopoly example in Figure 12-3. In fact, we could expect workers who suffered due to the price rise from P_1 to P_2, which reduced their real wage from ω_1 to ω_e, to demand a return to their former real wage. This would pressure union leaders to demand increased money wages from business, and the whole cycle would repeat itself.

The degree to which the model of cost-push inflation is applicable to the American economy is debated by economists. Those who feel that this model is unrealistic point out that only 25% of all workers in the United States are members of labor unions and that there are many different independent unions. Thus, they argue, the actual performance of the labor market is much closer to perfect competition than to perfect monopoly. Other economists view the situation quite differently. They argue that if a single union represents workers in a major industry (for example, the United Auto Workers) and if many major industries are organized in this way, then unions will have the power to drive up wages beyond the equilibrium rate in those industries. This will increase the prices of the commodities produced by these industries, and because many of them are basic industries such as steel and chemicals, the cost and price of other products will rise as well. Thus the monopolistic power of less than one-fourth of the labor force can create aggregate cost-push inflation. This form of inflation also produces unemployment, as we demonstrated in the preceding analysis. If the government pledges to maintain full employment, then aggregate demand is increased, and this sets the stage for another inflationary period. For this reason, the resulting continuous inflation is sometimes referred to as a *wage-price spiral*. Not surprisingly, economists who hold this view of union power recommend that some form of wage controls be imposed on labor.

Empirical evidence tends to refute the conclusion that labor unions are the source of inflation in the United States. Because the power of American unions is greatest in highly concentrated industries, we would expect prices in these industries to increase faster in the beginning stages of inflation. However, Lustgar-

...en's study, cited in the preceding subsection, indicates exactly the opposite result ...concentrated industries with greater union power exhibited relatively smaller price ...creases than did the less concentrated and less unionized industries.

12-4 Employment and Inflation

Thus far we have considered full employment to be a condition in which everyone who wishes to work at the prevailing wage has a job. A labor market that exhibits this characteristic is frictionless or, as we have called it, perfect. In the real world, however, this perfection is impossible to obtain due to imperfections in the product and labor markets, the training and skills required for most jobs, the cost of obtaining and providing information regarding job vacancies, and the time and cost involved in transferring from one job to another. Due to these imperfections, the labor market can remain uncleared and exhibit no change in the wage rate. This condition holds when the number of workers seeking employment is equal to the number of job vacancies. The resulting unemployment is defined as *frictional unemployment*.[10] When the *unemployment rate* (the number of workers seeking employment *divided by* the number of workers employed *plus* those seeking employment) is equal to the frictional unemployment rate (the number of frictionally unemployed workers *divided by* the number of workers wishing to work at the market wage rate), full employment is said to exist.

Figure 12-5 illustrates this concept. In a frictionless market, N_2 workers are

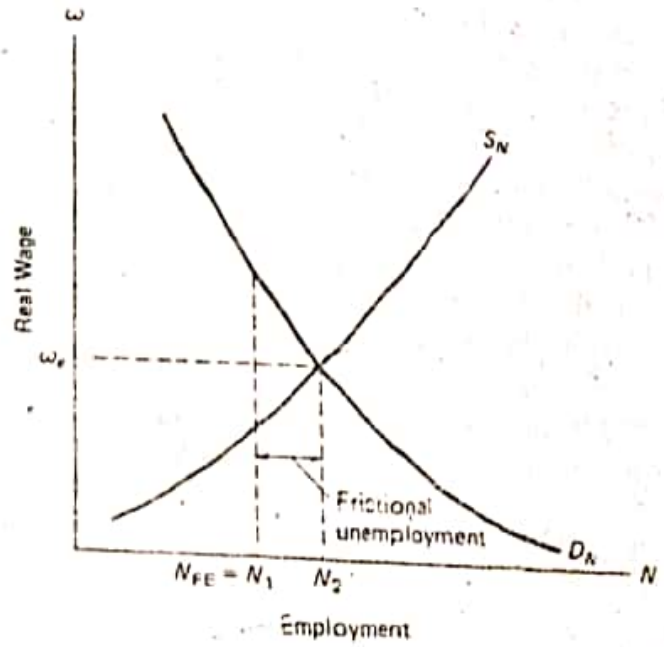

FIGURE 12-5 ***Full Employment When Frictional Imperfections Exist in the Labor Market***

[10] This is not a necessary condition; for example, individuals may be unemployable for various reasons. We ignore this possibility here to simplify exposition.

employed when the real wage is ω_e, but due to imperfection in the market [illegible] maximum amount of employment consistent with an equilibrium wage of ω_e is N_1. At employment level N_1, the number of job vacancies is exactly equal to the number of job seekers. Thus excess supply is equal to excess demand, and there is no tendency for the wage rate to change. The frictional unemployment rate is therefore $(N_2 - N_1) \div N_2$. If the prevailing level of employment is N_1, then the unemployment rate $(N_2 - N_1) \div N_2$ is identical with the frictional rate and full employment exists. For a smaller degree of market imperfection, there is a decline in both the frictional rate of unemployment and the rate of unemployment consistent with the definition of full employment.

In the early 1960s the full-employment rate of unemployment was estimated at about 4%. This percentage is now considered to have been a low approximation; a more realistic figure for the period would be closer to 5%. Since the 1960s the composition of the labor force has shifted to include a greater fraction of demographic groups such as teen-agers and women that tend to have relatively high unemployment rates. Members of these groups change jobs more often and remain unemployed longer while searching for new jobs, so that the full-employment rate of unemployment has increased in the last decade.[11] Franco Modigliani and Lucas Papademos estimate that the full employment rate is currently about 5.6%.[12]

As we have just seen, the rate of frictional unemployment is not immutable. To the extent that imperfections in the market influence this rate, they should be reduced. To achieve this end, policy should be directed toward reducing the monopolistic power of unions and corporations, providing already existing educational and job-training subsidies to all individuals equally, eliminating minimum-wage laws, and ensuring that information concerning job vacancies and people seeking jobs is available at the lowest possible cost.

In recent years an economic debate has evolved over the policy measures required to achieve full employment in our imperfect real world. This debate was sparked by empirical research into the relationship between unemployment and wages by British economist A.W. Phillips,[13] who concentrated on the relationship between the rate of change in money wages and the rate of unemployment. Phillips discovered that periods of low unemployment were highly correlated with periods of rapidly rising money wages in the United Kingdom. This relationship was also found to hold for U.S. data. In Figure 12-6, annual unemployment and money-wage data are plotted for the American economy from 1961 to 1969. The rounded L-

[11] For a fuller discussion of this phenomenom, see Robert E. Hall, "Why Is the Unemployment Rate So High at Full Employment?" *Brookings Papers on Economic Activity* 3 (1970), 369–402.

[12] Franco Modigliani and Lucas Papademos, "Monetary Policy for the Coming Quarters: The Conflicting Views," *New England Economic Review* (March/April 1976), 12.

[13] A.W. Phillips, "The Relationship Between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861–1957," *Economica* XXV (November 1958), 283–99. Actually, the pioneer in this area was Irving Fisher, not Phillips. See Fisher's "A Statistical Relation Between Unemployment and Price Changes," *International Labor Review* (June 1926), 785–92. Reprinted in the *Journal of Political Economy* (March/April 1973), 496–502.

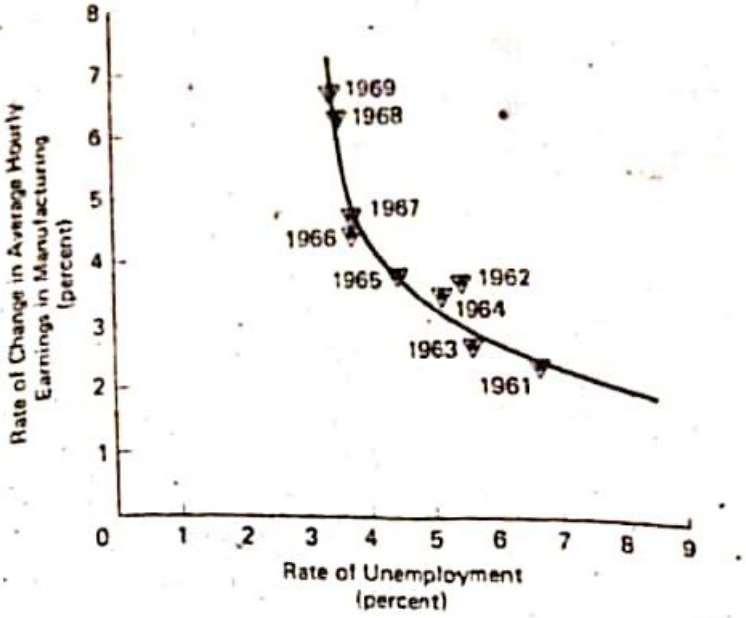

FIGURE 12-6 ***The Relationship Between the Rate of Change in Money Wages and the Rate of Unemployment: 1961–1969***

shaped curve that is fitted to these data points is called a *Phillips curve*, and we can visually ascertain that it fits the data quite well.

Phillips's original contribution was subsequently extended to an examination of the relationship between the rate of unemployment and the rate of change in the price level. Annual data for the rate of unemployment and the rate of change in the GNP implicit price deflator are plotted in Figure 12-7. The L-shaped curve that is fitted to these data points is also called a Phillips curve. Here again it is visually apparent that this curve fits the data quite well.

It is not surprising that this similarity between Figures 12-6 and 12-7 should hold. In a period of rising prices, money wages must increase at a faster rate than the secular growth rate in real wages, or real wages will experience a relative decline. In the long run, the growth in real wages closely parallels the growth in labor productivity. The rate of change in labor productivity in U.S. manufacturing has averaged about 3% per year since 1947. Therefore, in a period of approximately stable prices, the rate of change in money wages should be about 3%, which was indeed the case in 1961, as indicated in Figure 12-6. When the price level starts to rise, workers, after some lag, demand and receive increases in money wages in excess of 3% per year. Thus there tends to be a strong relationship between a rising price level and rising money wages.

The extremely good fit of the data to the Phillips curves drawn in Figures 12-6 and 12-7 led many economists (who have not read Fisher's forgotten work) to conclude that the relationships depicted are stable. As a result of this analysis these economists also felt that full employment, which they defined as approximately 4% unemployment, cannot be reached unless it is accompanied by a rate of

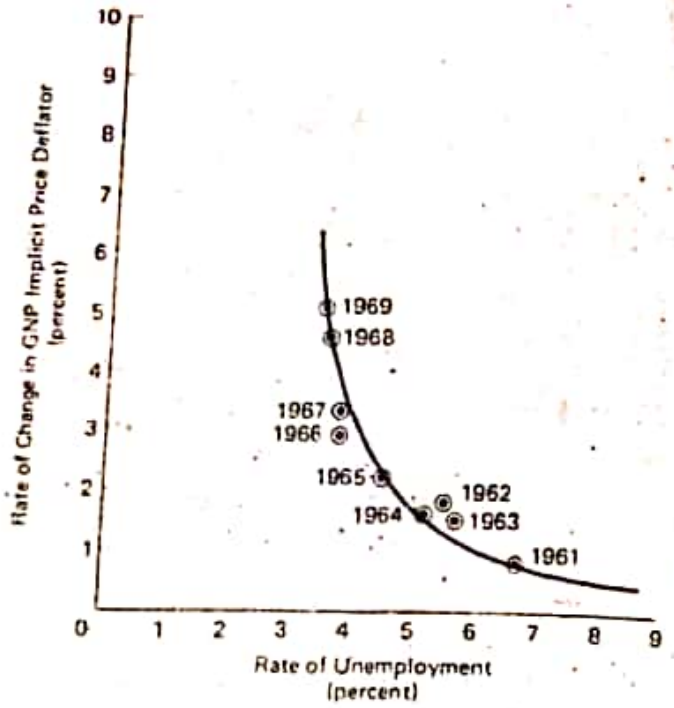

FIGURE 12-7 ***The Relationship Between the Rate of Change in Prices and the Rate of Unemployment: 1961–1969***

inflation close to 2–3% They considered this rate of inflation a small price to pay for the benefits of low unemployment. To reach the goal of full employment, they argued, the goal of price stability must be abandoned. In other words, they believed that the traditional macroeconomic policy goals of full employment *and* price stability are incompatible *if* the tradeoff between the rate of change in the price level and the rate of unemployment is stable.

These revolutionary conclusions were short-lived, however. As the inflation of the mid-1960s and 1970s unfolded, data generated in the United States and elsewhere destroyed all faith in the alleged stability of the Phillips curve. In Figures 12-8 and 12-9 annual American data for the period 1970–1975 are superimposed on the data originally given in Figures 12-6 and 12-7. The 1970–1975 data reveal that there is no predictable tradeoff between unemployment and inflation. In fact, these data suggest that rather than reducing unemployment, inflation may actually increase it. Given hindsight, we can now see that the original formulation and policy conclusions of the Phillips curve were faulty.

Fortunately, some economists did not need hindsight to recognize the shortcomings of the original Phillips-curve analysis. One such economist was Milton Friedman.[14] We can better understand his new view of the Phillips curve if we begin with a review of the original explanation of the unemployment–wage tradeoff

[14] Milton Friedman, "The Role of Monetary Policy," *The American Economic Review* 58 (March 1968), 1–17; see also Edmund S. Phelps, "Money Wage Dynamics and Labor Market Equilibrium," in E.S. Phelps (ed.), *Microeconomic Foundations of Employment and Inflation Theory* (New York: Norton Press, 1970).

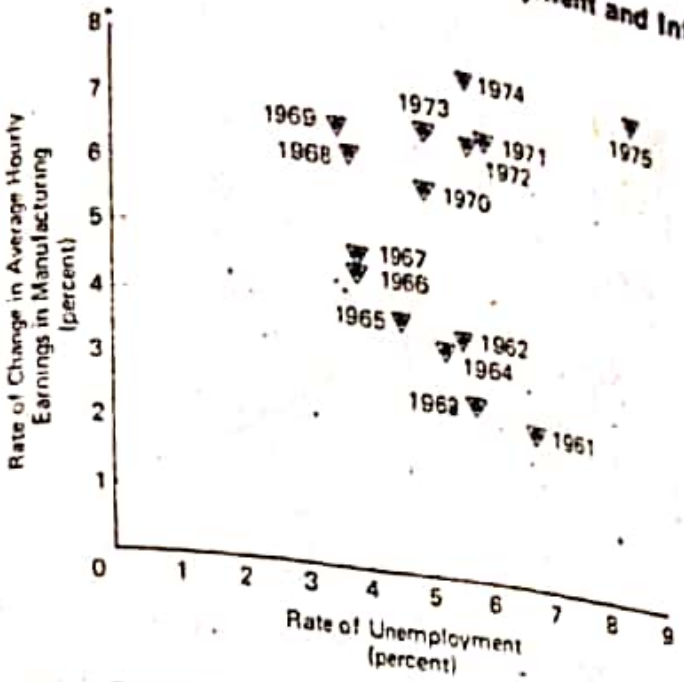

FIGURE 12-8 *The Relationship Between the Rate of Change in Money Wages and the Rate of Unemployment: 1961–1975*

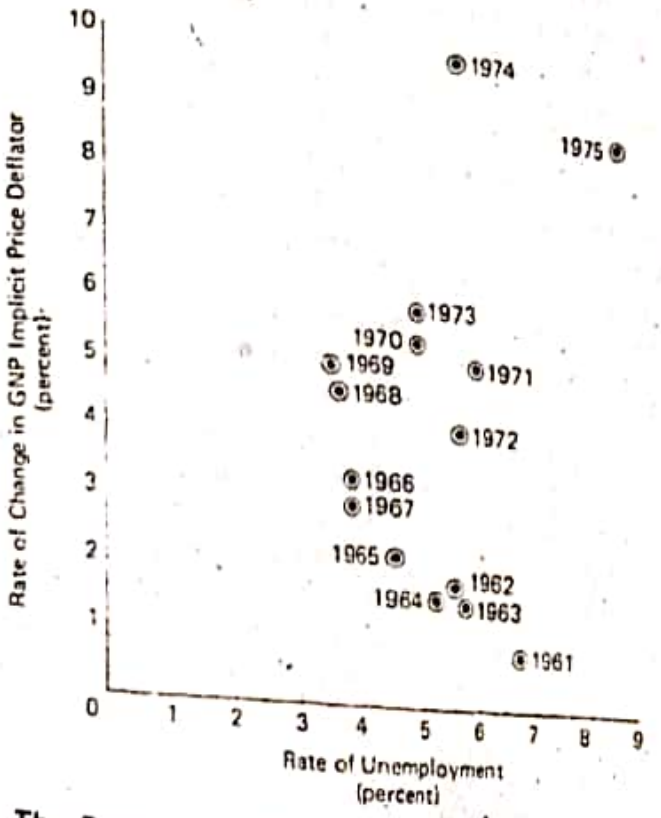

FIGURE 12-9 *The Relationship Between the Rate of Change in Prices and the Rate of Unemployment: 1961–1975*

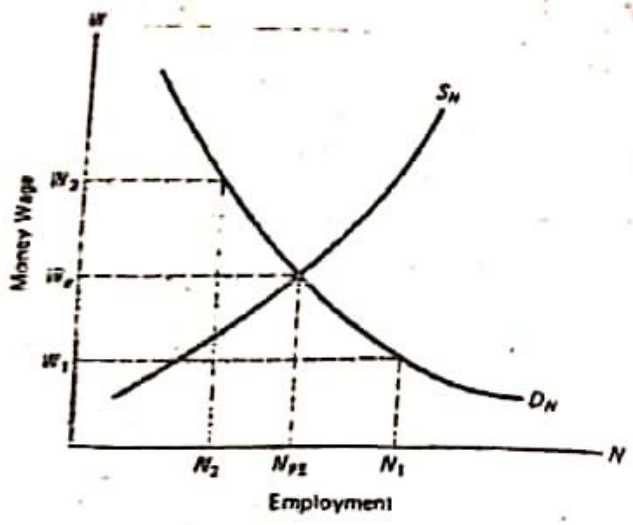

FIGURE 12-10 *The Labor Market of A.W. Phillips*

offered by Phillips.[15] The supply of and the demand for labor curves are graphed as functions of the nominal wage in Figure 12-10. When these two curves intersect, the nominal wage is the equilibrium wage W_e and the level of employment is the full-employment level N_{FE}. (Frictional unemployment exists in this analysis, but it is not explicitly illustrated as it is in Figure 12-5.) Now suppose that the money wage is W_1, which is less than the equilibrium wage. At this wage there is an excess demand for labor, wages increase, and the level of employment rises (that is, unemployment declines). On the other hand, if the money wage is W_2, then the quantity demanded is N_2, there is an excess supply of labor, and wages decrease as unemployment increases (as employment decreases). Phillips theorized that the rate at which the money wage changes over time is a function of the level of excess demand: the greater the excess demand, the more rapidly money wages will increase; conversely, the greater the excess supply, the more rapidly money wages will decrease.

It follows from the line of reasoning embodied in Figure 12-10 that when unemployment is equal to the full-employment rate, the rate of change in nominal wages $\Delta W/W$ is zero. At less than the full-employment rate of unemployment, money wages increase at a rate that becomes greater as unemployment decreases. Conversely, if unemployment exceeds the full-employment rate, then money wages decrease at a rate (the rate of negative increase) that becomes greater as unemployment increases. These results are illustrated in Figure 12-11. At an

[15] The theoretical explanation that follows draws heavily on Milton Friedman's *Unemployment versus Inflation?—An Evaluation of the Phillips curve*, Occasional Paper 44 (London: The Institute of Economic Affairs, 1975).

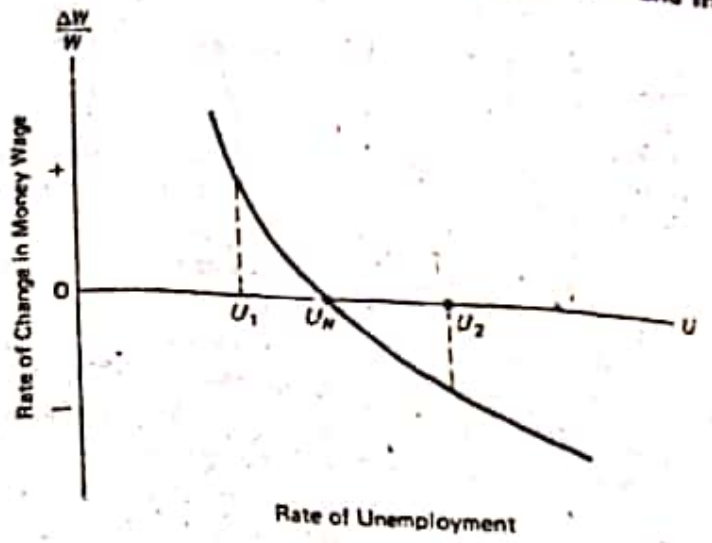

FIGURE 12-11 ***Phillips's Relation Between the Rate of Change in Money Wages and the Rate of Unemployment***

unemployment rate of U_N corresponding to an employment level of N_{FE}, the rate of change in money wages is zero. When unemployment reaches U_1, the demand for labor exceeds the full-employment rate and the rate of wage increase is positive. The greater the demand (the less the unemployment), the greater the rate of change in money wages. The opposite results are obtained when unemployment exceeds U_N.

Although our analysis of the Phillips theory seems to be reasonable and correct thus far, it contains a fatal flaw: Phillips assumed that the demand for and the supply of labor are functions of the *nominal wage*. Throughout this book, we have argued that the quantities of labor that are demanded and supplied are functions of the *real wage*. This case is presented in Figure 12-5, where the equilibrium real wage $\frac{W}{P}_e$ is consistent with both money wages and the price-level constant, rising, or falling at the same rate. For Example, if prices were rising at 5% and the money wage was also rising at 5%, the real wage would nevertheless remain constant. The same result would occur if prices and wages were both falling at a constant rate.

The fact that we have rejected Phillips's theoretical explanation of the obvious tradeoffs illustrated in Figures 12-6 and 12-7 is only the first step toward understanding these tradeoffs and their subsequent breakdown in Figures 12-8 and 12-9. The clue required to solve our problem can be found in the earlier work of Irving Fisher, who wrote:

> When the dollar is losing value, or in other words when the price level is rising, a business man finds his receipts rising as fast, on average, as the general rise in prices, but not his expenses, because his expenses consist, to a large extent, of things that are contractually fixed. . . . Employment is then stimulated—for a time at least.[18]

[18] Fisher, "Unemployment and Price Changes," p. 786.

In other words, the price of goods and services responds more quickly to increased demand that is generated by a monetary expansion, for example, than does the wage for the labor employed to produce these goods and services. This lag is the result of either formal contractual agreements such as union contracts or informal arrangements such as customary money wages. Of course, this means that the prices workers pay for the products they buy are increasing faster than their money wages and their real wages are decreasing, so that we observe an increase in employment and output in the *short run*.

This decrease in real wages occurs because workers do not correctly anticipate the future behavior of prices when they enter into their wage bargains. For example, if prices have been stable for a long time, workers will expect the rate of change in the price level to be zero. When business activity increases due to monetary stimulation, firms attract additional workers by offering higher money wages. Because workers expect the price level *not* to rise, they interpret these higher money wages as higher real wages. The traditional Phillips curve can therefore be interpreted as a relationship between the rate of change in money wages and the rate of unemployment for a given expectation about future inflation. This result is illustrated in Figure 12-12, where the Phillips curve is now drawn for a given expected rate of change in the price level $\Delta P^*/P$, where ΔP^* is the expected change in the price level and P is the current price level. In Figure 12-12 $\Delta P^*/P = 0$, so that if money wages are constant, unemployment remains at the equilibrium level U_N, or what Milton Friedman calls (after Wicksell) the *natural rate of unemployment*. When the rate of change in money wages is greater than zero, workers expect real wages to increase and the unemployment rate then falls below the natural rate. Conversely, when money wages decline, workers expect real wages to decrease and unemployment increases as workers seek jobs that pay the expected real wage they require to remain in the labor force.

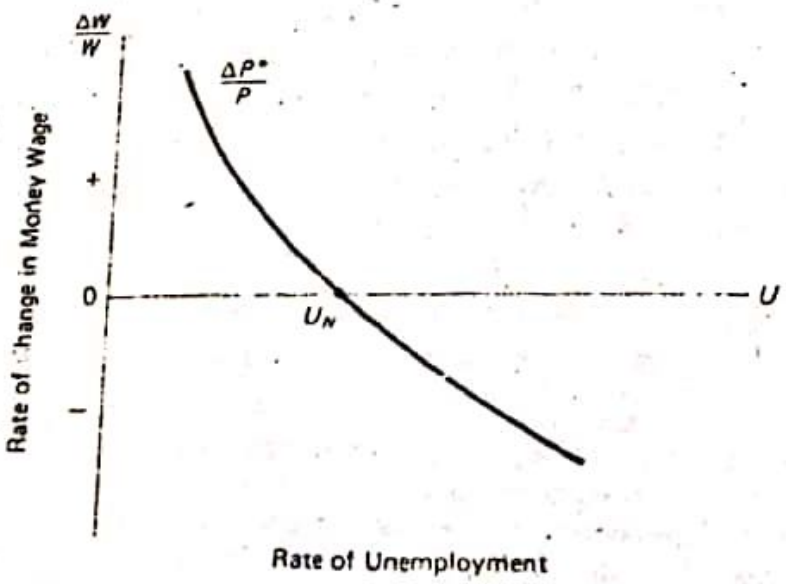

FIGURE 12-12 ***The Short-run Phillips Curve***

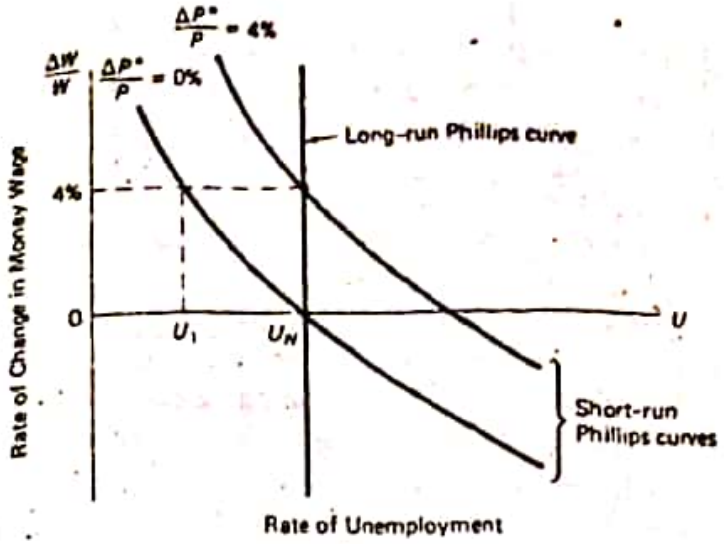

FIGURE 12-13 ***The Long-run Adjustment of the Phillips Curve***

Obviously, it is unreasonable to argue that the tradeoff described in Figure 12-12 is permanent. Workers eventually recognize that the expected real wage will never materialize, and the rate of unemployment returns to the natural rate. For this reason, the Phillips curve in Figure 12-12 has become known as the *short-run Phillips curve*.

The end result of the adjustment process, as worker expectation about the rate of change in the price level $\Delta P^*/P$ becomes equal to the actual change in the price level $\Delta P/P$, is shown in Figure 12-13. The short-run Phillips curve for an expected price increase of 0% in Figure 12-12 is redrawn in Figure 12-13. Initially, the rate of inflation is zero. Suppose that a monetary expansion then occurs that is consistent with an annual rise in the price level of 4%. At first, unemployment declines from U_N to U_1 as we move to the left along the Phillips curve of expected zero price rise. This rate of unemployment is not stable, and as inflationary expectations adjust upward, the rate of unemployment increases until the expected rate of inflation is equal to the actual inflation rate of 4%. This result is represented in Figure 12-13 by the short-run Phillips curve, whose expected rate of price-level increase is 4%. Because worker expectation is now in accord with reality, the money wage is rising at the same rate as the expected rate of inflation, and the rate of unemployment returns to the natural rate U_N.

We can draw several conclusions from the foregoing analysis. First, when expectations adjust fully to the actual rate of price-level change, the rate of unemployment for any rate of inflation is the natural rate. The *long-run Phillips curve* is then a vertical line that passes through U_N, as shown in Figure 12-13, and there is no tradeoff between unemployment and inflation. Second, because the long-run Phillips curve is vertical, a monetary policy that is designed to produce a

constant rate of inflation cannot permanently reduce the rate of unemployment. Expectations will adjust, and unemployment will return the natural rate. Unemployment can be held below the natural rate only by an ever-accelerating rate of inflation, because this produces an actual rate of inflation that is always in excess of the anticipated rate.[17] Of course, the end result of this process would be hyperinflation and the political collapse of any government that attempts to pursue such a policy. Third, if the central bank realizes the drawbacks of its policy of reducing unemployment below the natural rate, then a move on its part to reduce the growth rate of the money supply to a noninflationary rate would produce unemployment in *excess* of the natural rate. And as a corollary to this conclusion, the higher the rate of inflation, the greater the resulting unemployment becomes as the inflation is brought under control.

The conclusions we have drawn here are contingent on the correctness of the Fisher–Friedman–Phelps approach. The key issue in this approach is the extent to which long-run expectations adjust to the actual rate of inflation. If there is no realignment of expectations with reality, then what we have termed the short-run Phillips curve actually becomes the long-run Phillips curve. If expectations adjust completely to reality, then, the long-run curve is vertical. If the adjustment of expectations to reality is less than complete, then the long-run Phillips curve is steeper than the short-run curve, but not vertical. It is extremely complicated to determine empirically whether anticipations of the rate of price increase completely adjust to the actual increase, and a detailed discussion of the subject is beyond the scope of this book. However, we can sketch the evidence that has been developed to date. Early empirical studies primarily produced results indicating that the adjustment of expectations to reality was less than complete.[18] But these results are suspect for several reasons, the primary one being that early studies were not based on an independently determined measure of expected inflation. The results are therefore biased and indicate a less than complete adjustment in expectations. In a more recent study, Parkin, Sumner, and Ward used independently derived expected rates of inflation for retail prices, domestic wholesale prices, and export prices.[19] For each of these measures of expected inflation, their results indicated that the expected rate fully adjusted to the actual rate. All the evidence is not yet in (and in fact may never be, due to complex estimating problems), but the results strongly suggest that the long-run Phillips curve is quite steeply sloped if not actually vertical.

[17] Due to this conclusion, the new view of the Phillips curve has also become known as the *accelerationist hypothesis*.

[18] For a listing of these studies and a discussion in greater detail of the issues involved, see David Laidler and Michael Parkin, "Inflation: A Survey," *The Economic Journal* 85 (December 1975), 741–809.

[19] J.M. Parkin, M.T. Sumner, and R. Ward, "The Effects of Excess Demand, Generalized Expectations, and Wage–Price Controls on Wage Inflation in the U.K.," in Karl Brunner and Allan H. Meltzer (eds.), *The Economics of Price and Wage Controls*, Carnegie-Rochester Conference Series on Public Policy, Vol. 2 (New York: North-Holland Publishing Co., 1976).

12-5 Unemployment and Inflation

Until recently, many economists believed that a simultaneous combination of high unemployment and high inflation was impossible. However, this phenomenon, termed *stagflation*, has occurred in the last few years. Here we examine two possible theoretical reasons for stagflation. Together they probably explain much of what has been observed about this phenomenon.

The first explanation follows directly from our analysis of the Phillips curve. Suppose that a 10% rate of inflation has existed long enough for inflationary expectations to adjust fully to the actual rate. The relevant short-run Phillips curve is illustrated in Figure 12-14, where the rate of unemployment is the natural rate U_N. The rate of increase in money wages at which the short-run Phillips curve intersects the long-run curve (at point A in the figure) is 10%. Now suppose that the monetary authorities reduce the rate of growth of the money supply in an effort to reduce the rate of inflation to 6%. The initial effect of this action is to decrease the aggregate demand for goods and services, so that inventories begin to accumulate. The rate of price increase decelerates as firms attempt to reduce their inventories, and workers are laid off to eliminate new inventory accumulation. In the short run, workers who are laid off expect prices to continue to rise at the 10% rate and are therefore reluctant to accept jobs that promise money-wage increases at less than a rate of 10%. The excess supply of workers does exert some downward pressure on the rate of increase in money wages, but because expectations of future price increases remain at 10%, the rate of unemployment is dictated by a movement to the right from point A to point B on the short-run Phillips curve in Figure 12-14. Unemployment then exceeds the natural, or full-employment, rate by the amount $U_2 - U_N$, and we now have high unemployment *and* inflation.

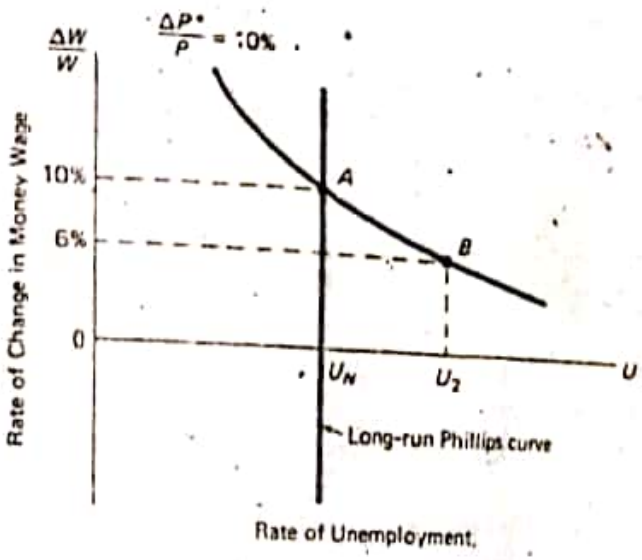

FIGURE 12-14 *The Creation of Stagflation*

The second explanation of stagflation was originally offered in 1931 by Friedrich A. von Hayek, the 1974 cowinner of the Nobel prize in economics.[20] According to Hayek, the monetary expansion that produces inflation temporarily lowers the interest rate below the natural rate in the initial stages, as we saw earlier in this chapter. This temporary decline in the interest rate makes previously unprofitable marginal investment projects appear profitable. These projects are undertaken because this temporary decline in the interest rate is assumed to be sufficiently permanent for these projects to become profitable. Resources are therefore invested in these projects, and when the interest rate returns to its natural rate many projects that are not yet complete appear unprofitable and are abandoned. Workers employed in either the construction or the operation of such projects find themselves suddenly unemployed. In addition to the erroneous allocation of resources in these new investment projects due to false interest-rate signals, the whole spectrum of rational decision making on the part of households and firms becomes increasingly difficult, if not impossible. In the case of hyperinflation, the result can be a general breakdown of the market economy.

12-6 Concluding Remarks

In this chapter we learned that inflation can originate in either the real sector or the monetary sector of the economy. We saw that sustained long-run inflation is possible if excessive growth in the nominal money supply is maintained by the monetary authorities and that cost-push inflation results when imperfections exist in the demand for or the supply of labor. Monopolistic power in the hands of business can cause the price level to rise but cannot be a source of sustained inflation unless the concentration of power continues to increase. Monopolistic labor unions can cause the price level to rise by demanding a real wage in excess of the equilibrium real wage, but this cannot cause sustained inflation unless the government increases the nominal money supply in the pursuit of full employment. We also discussed the Phillips curve, which indicates the relationship between the rate of unemployment and the rate of inflation, in terms of its short- and long-run properties. In the short run the Phillips curve shows that there is a significant tradeoff between unemployment and inflation and that full employment must be accompanied by continuous inflation. The new view of the Phillips curve is that no such tradeoff occurs in the long run, so that the joint policy goals of full employment and price stability are compatible. The phenomenon of high unemployment accompanied by high rates of inflation was then explained in terms of the Phillips curve analysis and the earlier theory of F.A. von Hayek.

[20] Friedrich A. von Hayek, *Prices and Production* (London: Routledge and Kegan Paul, 1931).