

History and Theory of the NAIRU: A Critical Review

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WHAT CAUSES CHANGES IN THE RATES OF INFLATION AND UNEMPLOYMENT? HOW ARE THE PRICE LEVEL AND THE LEVEL OF EMPLOYMENT RELATED? THESE HAVE BEEN KEY QUESTIONS FACING ECONOMISTS FOR AT LEAST FORTY YEARS. DISCUSSIONS ABOUT THEM IN THE PRESS AND ELSEWHERE OFTEN CENTER ON AN APPROACH TO EXPLAINING THE INFLATION-UNEMPLOYMENT RELATIONSHIP THAT DATES BACK TO THE 1960S AND 1970S. ACCORDING TO THIS APPROACH, INFLATION IS CAUSED BY AN EXCESSIVELY TIGHT LABOR MARKET THAT DRIVES UP WAGES AND FORCES FIRMS TO RESPOND BY RAISING PRICES.

An important element of this approach is the concept of a nonaccelerating inflation rate of unemployment, or NAIRU. As its name suggests, the NAIRU is supposed to be an unemployment rate (or range of unemployment rates) that produces a stable rate of inflation: if the unemployment rate is lower than the NAIRU then the inflation rate will tend to rise, and vice versa.

Recently, both the NAIRU and the theory of the inflation-unemployment relationship on which it is based have received a great deal of attention from the press. From December 1995 to December 1996, for example, there were ten articles on this subject in the *Wall Street Journal*, five articles in the *New York Times*, and three in *The International Economy*. One common feature of all these

articles is that they link Federal Reserve monetary policy to the NAIRU. Most of the authors seem to assume that the NAIRU is or should be the Fed's principal guide for conducting monetary policy. According to this view, if the current unemployment rate is below some NAIRU estimate (say, 6 percent) then the Fed should tighten monetary policy to head off a coming increase in the inflation rate.

Despite the extensive press coverage the NAIRU concept has received recently, the theory of the inflation-unemployment relationship that it is part of is quite controversial. Although the NAIRU is alive and well in the media and among economic policymakers, it is no longer very popular among academic economists. It has fallen out of favor partly because its conceptual foundation is

weak and partly because its empirical track record does not inspire confidence. Its survival is due largely to the fact that economists have not been able to reach any consensus about alternative guides for monetary policy.

The purpose of this article is to provide some historical perspective on the “NAIRU theory” and the assumptions behind it. Most of the analysis presented in this article is not original: it has been around for two decades or more. However, the recent resurgence of interest in the NAIRU indicates that there may be a need for a basic review of its origins and a brief explanation of some of the claims surrounding it. Readers interested in additional details should consult the reference list.

The first section of the discussion that follows briefly introduces the Keynesian and classical theories of macroeconomics. Keynesian theory is the macroeconomic theory on which the NAIRU is principally based while classical theory provides the foundation for the monetarist and neoclassical critiques of Keynesian theory that are discussed at length in this article. As we shall see, the concept of a NAIRU grew out of economists’ attempts to reconcile the differences between Keynesian and monetarist theories on the subjects of the causes of price level changes and the relationship between inflation and unemployment. The next section discusses the Phillips curve, a description of the inflation-unemployment relationship that provided the empirical and theoretical starting points for the development of the NAIRU. The third section reviews the monetarist critique of analysis based on the Phillips curve and discusses a number of related questions. The next two sections explain how the NAIRU developed as a response to the monetarist critique of the Phillips curve and raise some basic questions about the NAIRU. The final part of the discussion reviews the concept of rational expectations, a theoretical contribution of neoclassical theory that amplified the monetarist critique of the Phillips curve. This section also discusses some neoclassical contributions that may offer alternatives to the Phillips curve approach to the study of inflation, unemployment, and the effects of monetary policy.

Two Economic Traditions

Classical economic theory developed in the early 1900s, at a time when there was no formal distinction between micro- and macroeconomics. The theory was based on the same basic assumptions that had become widely used to study the behavior of individual households and firms. These included the assumptions that individuals usually act in ways that maximize their

self-interest, that prices are determined in the marketplace, and that markets operate efficiently. According to classical theory, perfect competition is a good approximation of the operation of most real-life markets. The basic assumptions of classical theory are generally understood to imply that government policies have relatively little importance in determining economic outcomes.

Keynesian theory, which developed in the 1930s and 1940s, was the first macroeconomic theory: it was designed specifically to study economywide phenomena, and it was not simply an extension of the conventional economic theory that continued to be used to study the behavior of individual parts and sectors of the economy. Keynesian theory was based on the work of John Maynard Keynes, a British economist who did most of his work in the 1920s and 1930s. One of the basic goals of Keynes’s theory was to explain the persistently high rates of unemployment that appeared across the

world during the Great Depression. Most of this unemployment was generally believed to be “involuntary,” in the sense that the unemployed people were willing to work at the going wage rates but were unable to find jobs. A closely related goal of Keynes was to identify steps that the government could take to alleviate the high levels of unemployment.

Keynesian theory assumes that some important prices are determined or strongly influenced by forces outside the marketplace so that many markets may not be able to “clear” in the sense of successfully reconciling demand with supply. It also assumes that people may not always make the economic decisions that would be best for them. According to Keynesian theory, perfect competition is not a good approximation of the operation of many important real-life markets. The theory implies that government policies can have large, important effects on the economy and that if the policies are carefully devised these effects can be very constructive in nature.¹

Keynes’s ideas and goals placed him in direct conflict with the exponents of the reigning classical theory.

The NAIRU has fallen out of favor among academic economists partly because its conceptual foundation is weak and partly because its empirical track record does not inspire confidence.

1. The monetarist and neoclassical theories developed later—monetarism in the 1950s and neoclassical theory in the 1970s. These theories were developed as alternatives to Keynesian theory, which was then accepted by most contemporary economists. Both theories drew heavily on the classical tradition. As we shall see, the economic theory behind the NAIRU is basically Keynesian in nature, but it has been influenced heavily by monetarist ideas and to a lesser extent by neoclassical ones.

Classical theory predicted that when unemployment was high wages would adjust downward, stimulating more hiring and reducing the unemployment rate. As a result, high unemployment could not last long. It seemed obvious to Keynes (and many others) that the high, persistent levels of unemployment observed during the Depression were inconsistent with this prediction and that classical theory was incapable of explaining them. In 1933 prominent classical theorist A.C. Pigou published *The Theory of Unemployment*; according to Keynes, this book was “the only detailed account of the classical theory of employment” in existence at the time. In his “General Theory” article, Keynes dismisses Pigou’s book as “a non-causative investigation into the functional relationship

which determines what level of real wages will correspond to any given level of employment. . . . [It] is not capable of telling us what determines the *actual* level of employment; and on the problem of involuntary unemployment it has no direct bearing” (1964, 275).

According to Keynes, what prevented labor markets from clearing, and

explained involuntary unemployment, was that when firms’ demand for labor decreased, nominal (money) wages did not fall as fast or as far as classical theory predicted.² “Classical theory,” he comments, “has been accustomed to rest the supposedly self-adjusting character of the economic system on an assumed fluidity of money-wages” (1964, 257). Keynes believed that sluggish labor demand would not push nominal wages downward, at least in the short run. The logic behind this belief was that organized workers had enough market power to resist employers’ attempts to reduce money wage rates. As a result, Keynesian theory is often described as being based on the assumption of “sticky wages.”³ In the classical model, unlike the Keynesian model, money wages and prices are assumed to be perfectly flexible, so labor markets always clear. If temporary unemployment appears because of deficient aggregate demand, then the unemployed workers will bid down nominal wages until they have fallen far enough to eliminate the unemployment.

Keynes also criticized classical theory for failing to provide an integrated analysis of the behavior of different parts of the economy and for making an unwarranted leap from analysis of individual-industry labor markets to analysis of the determinants of aggregate employment.

He writes that “if the classical theory is not allowed to extend by analogy its conclusions in respect of a particular industry to industry as a whole, it is wholly unable to answer the question what effect on employment a reduction in money-wages will have. For it has no method of analysis wherewith to tackle the problem” (1964, 257).

Over time, it became clear that both classical and Keynesian theories suffered from some important deficiencies. Classical theorists needed to integrate their microeconomic theories of individual labor markets into a macroeconomic theory of total employment. They also needed to explain how government policies affected the labor market. The Keynesians needed to move in the opposite direction, integrating their macroeconomic theory with a microeconomic theory of labor markets and formalizing their explanation of wage-setting behavior.

The Phillips Curve

Inflation and Unemployment. In 1958 British economist A.W. Phillips published the results of an empirical analysis of historical data from the U.K. labor market. Phillips’s study was intended to help answer one of the basic questions in macroeconomic theory, which concerns the cause of inflation. He hoped to find empirical support for the Keynesian view that the rate of wage inflation—that is, the rate of increase in nominal (money) wage rates—depended on the tightness of the labor market. Since the level of unemployment was a readily observable indicator of the tightness of the labor market, Phillips’s immediate goal was “to see whether statistical evidence supports the hypothesis that the rate of change of money wage rates in the United Kingdom can be explained by the level of unemployment and the rate of change of unemployment” (1958, 284).

The logic behind Phillips’s theory is very simple. If for some reason the demand for labor were high relative to its supply—as in Atlanta during the Olympics, to use a modern example—then equilibrium wage rates would be expected to rise above current wage levels, and there would be upward pressure on nominal wages as firms bid for additional workers. As additional workers were actually hired, moreover, the unemployment rate would fall. The larger the discrepancy between the quantity of labor demanded and the quantity supplied, the stronger the upward or downward pressure on wage rates. The opposite would be true when there was excess supply of labor and rising unemployment.

Phillips found, as he expected, that from 1861 to 1957 the growth rate of nominal wages was negatively correlated with the rate of unemployment—that is, low unemployment rates tended to be associated with rapidly rising wages while high unemployment rates were associated with slowly rising wages. Phillips also found that the strength of the unemployment versus wage-change relationship seemed to depend on the level of unemployment.

Classical economic theory was based on the assumptions that individuals usually act in ways that maximize their self-interest, that prices are determined in the marketplace, and that markets operate efficiently.

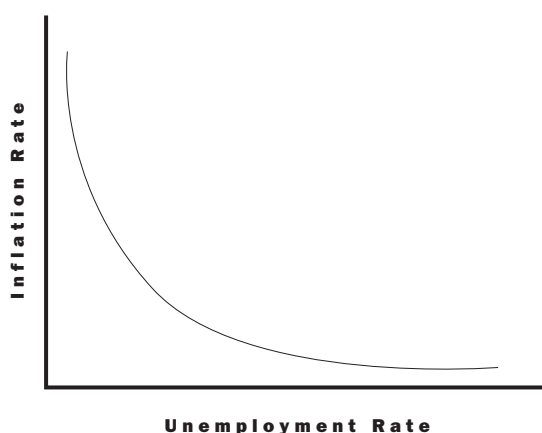
When unemployment was low, decreases in unemployment tended to be associated with big increases in wage inflation while when unemployment was high, decreases in the unemployment rate seemed to produce small increases in wage growth rates (see Chart 1 for a hypothetical Phillips curve). These findings appeared to confirm Keynes's theory of the downward stickiness of nominal wages. Tight labor markets seemed to cause employers to bid wages up rapidly while loose markets (high unemployment) seemed to cause workers to bid wages down relatively slowly.

Phillips's findings have had a profound and lasting effect on economists' ideas about the relationship between inflation and unemployment. What made them so interesting is that they seemed to establish a clear linkage between the state of the labor market and the rate of inflation. By the early 1960s, inflation rates in the United States and western Europe had increased to the point that inflation was coming to be regarded as a serious economic problem. As a result, economists and policymakers were eager for information about its possible causes and potential cures. The Phillips curve appeared to link the real and nominal sides of the economy.⁴

One possible objection to the conclusions that Phillips (and others) drew from his findings is that standard economic theory predicts that what matters to workers is not their nominal wages but their real, or inflation-adjusted, wages.⁵ Phillips did not attempt to measure real wages or study their statistical relationship to unemployment. Under the Keynesian assumption of predetermined or sticky nominal prices, however, changes in expected real and nominal wages would coincide. In addition, while Phillips's statistical evidence involved changes in current nominal wages, the hypothesis that he was trying to test involved changes in *expected* nominal wages. If workers were slow to adjust their price expectations to actual price changes, changes in current nominal wages could be interpreted as changes in expected real wages.

Another problem with Phillips's findings is that they involve wage inflation while economists were principally concerned about explaining price inflation. Since wages are the biggest single component of firms' costs, however, most economists were willing to assume that persistent increases in wage rates would eventually force firms to begin increasing their prices, producing economywide

CHART 1
The Phillips Curve



The now-conventional Phillips curve diagram has the unemployment rate on the horizontal axis and the inflation rate on the vertical axis.

price inflation. For this explanation for inflation to make sense, however, it was necessary to make even more elaborate assumptions about stickiness: wages now had to be assumed to adjust faster than goods prices, at least when wages were rising. (In conventional Keynesian theory, nominal wages were supposed to be slow to fall when a decrease in aggregate demand put downward pressure on prices; the result was a higher-than-equilibrium real wage and involuntary unemployment.)

How was the Phillips curve related to monetary policy? Keynesian theory held that monetary policy could be used to increase or decrease the economy's aggregate demand—the total nominal demand for goods and services of all types—and through it the aggregate level of employment in the economy. The Phillips curve mechanism explained how aggregate demand management could affect the rate of inflation. Thus, economic policymakers began to think in terms of a trade-off between the unemployment rate and inflation rate. Although government aggregate-demand stimulus was no longer cost-free, as it had been in traditional Keynesian theory (which had viewed the price level as constant), it was still possible for the policy authority to reduce the level of employment if it was willing to tolerate the resulting increase in inflation along the Phillips curve. As the next section will show, another reason for the popularity of

2. According to Keynes, the principal source of the observed fluctuations in labor demand was the volatility of aggregate investment. Investment volatility, in turn, was caused by changes in short- and long-term business expectations and variation in interest rates.

3. The discussion will show that the stickiness assumption was also extended to aggregate prices.

4. Phillips was not the first researcher to turn up findings of this general sort. As long ago as 1926 Irving Fisher had found a negative correlation between the rate of goods-price inflation and the level of unemployment.

5. If workers in New York City and rural Mississippi both make \$2,500 per month, the worker in rural Mississippi will have a much higher real wage because the cost of living is lower there.

the Phillips curve is that it was seen by some prominent economists as providing a synthesis of competing theories of inflation.

Cost-Push versus Demand-Pull Inflation. At the time the Phillips curve analysis appeared, economists' interest in understanding the relationship between wages, prices, and economic activity had been growing for some time, and there was also growing interest in studying the effects of government policies on this relationship. Samuelson and Solow (1960) provide a comprehensive review of the debate on these questions that took place after the Second World War. The debate centered on two basic theories of the causes of inflation: demand-pull and cost-push. Both theories can be explained using the aggregate-demand/aggregate-supply model of output and price level determination that was developed during the 1950s and remains popular in textbooks. Demand-pull inflation resulted from increases in the level of aggregate demand that occurred at or near the point of full capacity utilization—that is, at points at which the aggregate supply curve was upward-sloping rather than flat. Cost-push inflation, on the other hand, was caused by upward shifts in the aggregate supply curve. These shifts could allow wages and prices to rise even before full employment was reached.⁶

According to Samuelson and Solow, there were really no purists in this debate. Most economists believed that inflation had both demand-pull and cost-push components, but they differed as to which component predominated. Thus, although demand-pull inflation was associated with Keynesian theory, Keynes himself did not dismiss the cost-push hypothesis. He was “willing to assume that attainment of full employment would make prices and wages flexible upward. . . . Just as wages and prices may be sticky in the face of unemployment and overcapacity, so may they be pushing upward beyond what can be explained in terms of levels and shifts in demand” (1964, 180-81).

Samuelson and Solow believed that in order to reconcile the two sides of this debate it would be necessary for economists to improve their understanding of the behavior of money wages with respect to the level of employment. They saw the Phillips curve as a useful tool for analyzing this behavior. Under some conditions, they explained, “movements along the Phillips curve might be dubbed standard demand-pull, and shifts of the Phillips curve might represent the institutional changes on which cost-push theories rest” (1960, 189).

The Monetarist Challenge to the Keynesian Approach

The Acceleration Hypothesis. One prominent U.S. economist who was skeptical of Keynesian theory in general, and of Phillips curve analysis in particular, was Milton Friedman. Friedman was the champion

of monetarism, a theory that saw inflation as always and everywhere a monetary phenomenon. He was also rather skeptical of the Keynesian view that demand-management policy could have significant effects on output or employment. Beginning in the mid-1960s, Friedman began to challenge some of the conclusions about the inflation-unemployment relationship that economists writing in the 1960s and early 1970s were drawing on the basis of Keynesian theory.

As we have seen, Keynes's explanation for persistent unemployment was that the prevailing level of real wages was not compatible with labor market clearing and instead produced excess supply of labor. This fact raised the question of why lower, market-clearing real wages could not be produced by reductions in nominal wages. One explanation frequently offered was that workers would oppose nominal wage reductions. Friedman (1976) was very skeptical about this and other explanations that Keynesians put forward to explain supposed nominal wage rigidities. He was willing to concede that there might be some situations in which wages and salaries were rigid; the legal minimum wage, he noted, was an example of such a rigidity. He argued, however, that situations like these were the exception rather than the rule. In most industries, he pointed out, relatively few workers earned the minimum wage: what prevented workers in these industries from reducing their wage requests in order to avoid layoffs? And while unions could conceivably be a factor delaying wage adjustment because of their reluctance to accept wage cuts that would benefit unemployed workers at union members' expense, he did not believe that unions were powerful or perverse enough to keep wages from adjusting to full employment levels in the long run.

A second criticism Friedman raised was that researchers had not been able to construct “decent” empirical Phillips curves for the United States or other countries. In later years this problem got worse, and even ardent Keynesians were forced to acknowledge the weakness of the empirical evidence supporting the existence of stable national Phillips curves. In 1980, for example, prominent Keynesian Arthur Okun, commenting on the U.S. case, wrote that “since 1970, the Phillips curve has been an unidentified flying object and has eluded all econometric efforts to nail it down” (1980, 166).

Friedman's third criticism was outlined in the previous section: Phillips's statistical evidence involved nominal wages, but standard economic theory assumes that households and firms base their employment decisions on real wages. Clearly, Phillips and his successors were assuming that changes in current nominal wages were equivalent to changes in expected future real wages. This assumption, Friedman noted, really amounted to two assumptions. The first was that prices, or at least price expectations, were rigid: people did not expect the price level to change and consequently interpreted changes in

their nominal wages as changes in their real wages. The second assumption was that workers would not resist reductions in their real wages that were caused by inflation rather than by reductions in their nominal wages. Only if both assumptions were true could the relationship between the rate of change in nominal wages and the aggregate level of unemployment be stable enough to then offer policymakers a usable menu of options.

A closely related argument made by both Friedman (1968) and Phelps (1967) involved the long-run implications of the Phillips curve. In order to make this argument, they imagined a situation in which a policymaker was trying to use the hypothesized inflation-unemployment trade-off to achieve a lasting reduction in the unemployment rate. Such a policymaker, they argued, would find that while there might indeed be an inflation-unemployment trade-off in the short run, the trade-off would disappear in the long run. In the long run, they asserted, unemployment tended to return to a “natural rate” (NR) that was determined by real economic forces.⁷ Monetary policy, in their view, could do nothing to change the natural rate.

The analysis presented by Friedman and Phelps, which was later summarized by Friedman (1976), involved the relationship between real wages and unexpected inflation. The emphasis on unexpected inflation reflected an attempt on the part of Friedman and Phelps to reconcile the classical principle that labor supply behavior depends on the real wage with Keynes’s observation that workers respond differently to different types of real wage decreases: “Every trade union,” Keynes writes, “will put up some resistance to a cut in money-wages, however small, . . . but no trade union would dream of striking on every occasion of a rise in the cost of living” (1964, 14-15). According to Friedman, this differential response is due to temporary money illusion: it takes time for workers to recognize that the price level has increased, and until they do so they do not realize that their real wage rates have fallen.

Friedman’s discussion can be interpreted as an implicit description of the following hypothetical sequence of events. Suppose the economy starts out in its long-run equilibrium at its normal inflation rate and its natural rate of unemployment. This equilibrium is disturbed when a monetary expansion increases households’

aggregate demand for goods and services at current prices. Demand curves will shift to the right throughout the economy, and the market prices of (output) goods and services will rise. The increased market prices of goods will cause the aggregate demand curve for labor, plotted against the nominal wage, to shift to the right.

If workers realize that the price level has increased, then their aggregate labor supply curve will shift to the left, as depicted in the shift from curve D to curve D¹ in Chart 2. Equilibrium will be restored at a higher nominal wage rate but at unchanged levels of employment, output, and real wages. If workers do not realize that the price level has increased—that is, if the increase in prices is both unperceived and unexpected—then employment and nominal wage rates will increase along the old labor supply curve. Workers will now be providing more labor than they would be willing to provide at the current real wage if they knew what that wage really was. At some point, however,

workers will figure out that the price level has increased, and the aggregate labor supply curve will begin shifting to the left, as depicted in the shift from curve S to S¹ in Chart 2. The shift in the supply curve will drive nominal wages up further. As nominal wages rise, the supply curves for goods and services will shift to the left, driving the price level up further, and so on. Nominal wages will rise faster than prices, however, as workers catch on to the successive price increases. Eventually a new long-run equilibrium is reached at the original unemployment rate (the natural rate) and the original level of real wages—the point L⁰ in Chart 2. Notice that once the process of adjustment to the new long-run equilibrium gets started, prices lead wages upward rather than the reverse.

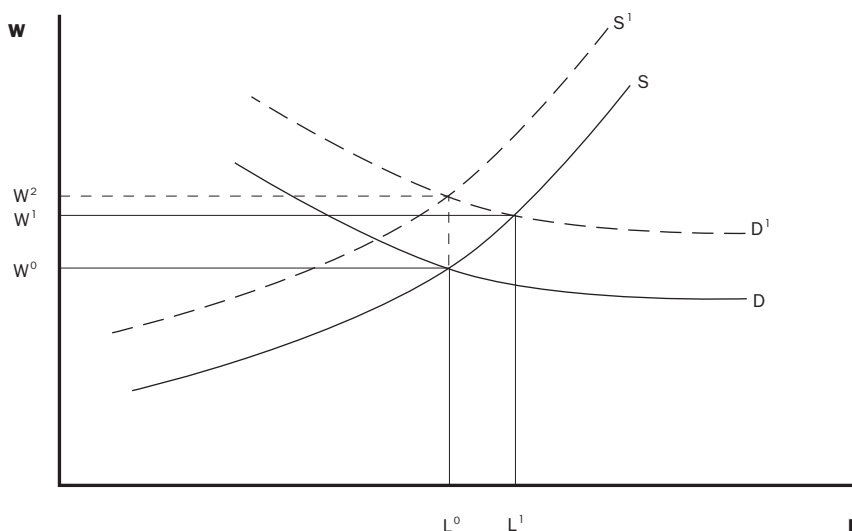
To summarize, Friedman and Phelps argued that unexpected inflation can drive the level of unemployment

Keynesian theory implies that government policies can have large, important effects on the economy and that if the policies are carefully devised these effects can be very constructive in nature.

6. Believers in cost-push inflation often identified unions as one of its main sources. Samuelson and Nordhaus point out, however, that “this view of unions as the clear-cut villain of cost-push inflation does not fit the complex historical facts. Take as an example the depressed year of 1982, when unemployment averaged 9.7 percent of the labor force. During that year, labor costs for union workers rose 7.2 percent, and the cost of nonunion workers rose 6 percent. Both union and nonunion wages rose smartly in spite of high unemployment” (1989, 326).

7. Friedman defines the natural rate of unemployment as the level of unemployment “that would be ground out by the Walrasian system of general equilibrium equations, provided there is imbedded in them the actual structural characteristics of the labor and commodity markets, including market imperfections, stochastic variability in demands and supplies, the cost of gathering information about job vacancies and labor availabilities, the cost of mobility, and so on” (1968, 8).

CHART 2 Effects of Monetary Policy on the Labor Market



Friedman and Phelps argued that unexpected inflation can drive the level of unemployment below the natural rate, but only temporarily.

below the natural rate, but only temporarily. In the long run, the surprise factor will disappear as workers learn that the price level has increased; as a result, the level of employment will go back to the natural rate. Thus, in the long run there will be no inflation-unemployment trade-off. Stated differently, the long-run Phillips curve is vertical.

At this point, it is necessary to make some important distinctions regarding the term *inflation*. A one-time increase in the price level is sometimes called inflation, but it is very different from a situation in which the price level is increasing over time at a constant rate. Both these situations, moreover, are different from one in which the price level is increasing over time at a rate that is also increasing over time (so that the price level is accelerating upward). The inflation that the Keynesian economists who developed Phillips curve analysis had in mind was the type in which the price level increases at a fixed rate. These economists believed that from the point of view of policymakers, the cost of achieving a lower level of unemployment was that the price level would now increase at a higher rate. Inflation would remain constant at this new, higher rate as long as the unemployment rate remained at its new, lower level.

According to Friedman and Phelps, the actual relationship between inflation and unemployment was quite different. In their minds, at least, the difference between their view of this relationship and the Keynesian view involved the way in which workers were assumed to form their expectations. In describing the difference between his view of this process and the view he attributes to Phillips, Friedman quotes Abraham Lincoln's famous assertion that "you can fool all of the people some of the

time, you can fool some of the people all of the time, but you can't fool all of the people all of the time" (1976, 231). To Friedman, Phillips's analysis made sense only if workers could be fooled all the time—only, that is, if a given increase in the price level (beyond some unspecified base inflation rate) always fooled workers to exactly the same extent, regardless of how many times they had been fooled previously. Thus, persistent increases in the price level could hold the labor supply curve fixed in a location to the right of its no-surprises position, producing lower unemployment. Higher inflation rates, moreover, shifted the curve further than lower inflation rates and thus produced lower levels of unemployment.

Friedman and Phelps, in contrast, thought that while it might be possible to fool all the workers some of the time (temporarily), it was not possible to fool all of them all of the time (permanently). Eventually, workers would recognize that the base rate of inflation had increased, at which point the labor supply curve would begin to shift back and the increased inflation rate would gradually lose its power to reduce the unemployment rate. Further declines in unemployment could then be achieved, if at all, only by further increases in the rate of inflation. Thus, "the only way unemployment can be kept below the natural rate is by an ever-accelerating inflation, which always keeps current inflation ahead of anticipated inflation" (Friedman 1976, 227).

The view underlying this "acceleration hypothesis" is that while agents cannot be permanently fooled by inflation at a fixed rate, they can be fooled persistently, if not permanently, by accelerating inflation. One reason to be skeptical about this story is evidence from economies that have experienced hyperinflations (extremely rapid

increases in the aggregate price level): it is not unusual to see hyperinflation and high rates of unemployment go hand-in-hand. It should also be emphasized that nothing in this analysis suggests that any one-time increase in the price level must necessarily be followed by persistent inflation at a fixed rate that will eventually turn into accelerating inflation. The accelerating inflation described by Friedman and Phelps is created by design in order to surprise economic agents. It will not result from forces beyond the control of the policymakers, and it will not be produced by policymakers that implement a stable monetary policy—even if that policy involves a high money growth rate.

The NIRU (aka NAIRU): A Response to the Monetarists. Although the introduction to this article focused on the NAIRU, the analysis presented so far has concentrated on the Phillips curve. The reason for this attention is that the Phillips curve is a key element of the theory of the inflation-unemployment relationship that includes the NAIRU.

As the discussion has shown, during the 1960s Keynesian theorists came to regard the inverse (downward-sloping) empirical relationship between inflation and unemployment—the Phillips curve relationship—as a stable menu of options from which policymakers could choose. The apparent concreteness of this menu helped produce widespread confidence in the potential effectiveness of Keynesian-inspired countercyclical demand management. To Keynesians, the job of macroeconomists was to design demand-management policies that would strike the right balance between the competing problems of unemployment and inflation. Monetarists did not share the Keynesians' faith in the effectiveness of demand management, and during the 1960s and the 1970s there were fierce debates between the two schools. These debates sometimes took the form of disputes about the slope of the Phillips curve. Keynesians believed that the Phillips curve was quite flat, particularly at high unemployment rates. It followed that when unemployment was high, the unemployment rate could be reduced at little cost in terms of increased inflation. Monetarists, on the other hand, believed the curve was quite steep, so expansionary demand management was likely to produce a significant amount of inflation without providing much benefit in terms of lower unemployment. The monetarist challenge to Keynesian ideas about the Phillips curve culminated in the Friedman-Phelps hypothesis that the curve was vertical in the long run.

During the severe recession of 1974-75 both the inflation rate and the unemployment rate reached some

of the highest levels in postwar U.S. history. This experience shook public faith in Keynesianism and played a key role in shaping the subsequent debate about inflation. The warnings of Milton Friedman and other monetarists that attempts to “ride the Phillips curve” might lead to accelerating inflation began to be heeded by more and more people, both inside and outside the ranks of professional economists. The credibility of the monetarist alternative to Keynesian theory was greatly strengthened.

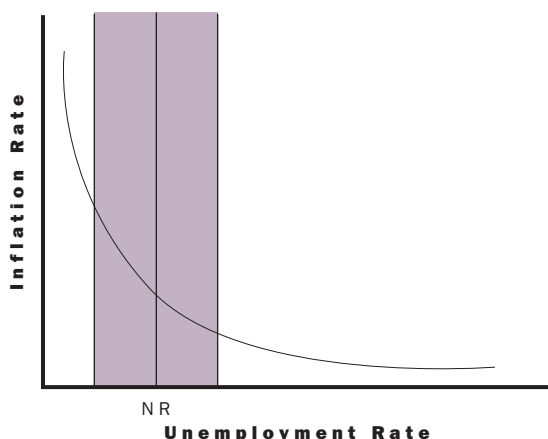
Despite the credibility gains of the monetarists, however, the events of the mid-1970s did not result in the demise of Keynesian macroeconomics or even of analysis based on the Phillips curve. Many economists continued to use the Phillips curve as the basis for forecasting and policy advice. As Okun recalls, “It was hard to cast aside a tool that had traced the United States record so well from 1954 through the late sixties. And it was easy to ignore the Friedman and Phelps attack on the stability of the short-run Phillips curve, and their prophetic warning (issued at a time when the Phillips curve was still performing admirably) that the curve would come unstuck in a prolonged period of excess demand. Unfortunately, most of the profession (including me) took too long to recognize that” (1980, 166).

Some Keynesians reacted to the events of 1974-75 by attempting to reinterpret the Phillips curve in a way that reconciled the Keynesian and monetarist views of the inflation-unemployment relation but preserved considerable scope for activist demand management. To do so was necessary to acknowledge that there might indeed be limits to the exploitability of the Phillips curve relation: in particular, attempts to use it to keep the unemployment rate below a threshold level might indeed result in accelerating inflation. As early as 1975, for example, Keynesians Franco Modigliani and Lucas Papademos asserted that “the existence of NIRU [the noninflationary rate of unemployment] is implied by both the ‘vertical’ and the ‘nonvertical’ schools of the Phillips curve” (1975, 142).⁸

What exactly was the NIRU? In the now-conventional Phillips curve diagram, which has the unemployment rate on the horizontal axis and the inflation rate on the vertical axis, the NIRU was the unemployment rate at which the Keynesians' downward-sloping Phillips curve intersected a vertical line at Friedman's natural rate of unemployment. Thus, the NIRU was equal to the natural rate. But while monetarists believed that the existence of a natural rate implied that there was no useful trade-off between inflation and unemployment, Modigliani and Papademos interpreted the NIRU as a constraint on the

8. The NIRU was later renamed the NAIRU, or nonaccelerating inflation rate of unemployment. This name makes it clear that sufficiently low unemployment rates are believed to be associated with accelerating inflation, not just higher fixed rates of inflation.

CHART 3
The Natural Rate



Keynesians believed that the economy spent most of its time in a range of unemployment rates well to the right of the natural rate and that unemployment rates to the left of the shaded area implied that inflation was likely to accelerate.

ability of policymakers to exploit a trade-off that remained both available and helpful in the short run.

Perhaps the most striking thing about the Modigliani-Papademos argument is that while it incorporated many aspects of Friedman's critique of Keynesian theory, it stood Friedman's principal policy recommendation on its head: Friedman was strongly opposed to activist monetary policy. One of the reasons that was possible was that most expositions of the monetarist view of the inflation-unemployment relationship—including Friedman's—did not seem to resolve the question of the strength or persistence of the short-run effects of monetary policy. After all, Friedman's inflation-acceleration theory did seem to suggest that monetary policy could produce temporary reductions in the level of unemployment—but these reductions could be sustained only at the price of continually increasing inflation rates.

The remaining difference between the Keynesians and the monetarists was actually quite fundamental: it involved the direction of the causal relationship between inflation and unemployment. This difference continued to allow members of the two schools to hold contrasting views about the sensitivity of the unemployment rate to changes in the inflation rate (or vice versa) and thus about whether the short-run Phillips curve trade-off was potentially useful to policymakers.

Monetarists saw the level of unemployment as determined largely through the process of labor market clearing. The economy, in their view, was never far from the full-employment equilibrium of the classical model. Monetarists believed that monetary policy had a direct and powerful influence on the price level and the inflation rate. While the channels through which it obtained

this influence might involve the goods and labor markets, these markets adjusted and cleared so quickly that policy changes had little effect on them. In particular, monetary policy could affect the level of unemployment only marginally and only by producing inflation surprises whose impact would decrease rapidly over time. Since unexpected changes in the inflation rate could produce only small changes in the level of unemployment, the Phillips curve was quite steep even in the short run. The rate of unemployment could never stray far from the natural rate, and continued efforts to keep it below the natural rate would result mostly in accelerating inflation.

Keynesians, on the other hand, continued to believe that the economy could and often did operate at "equilibrium" positions in which aggregate demand was deficient—positions in which there was massive excess supply of labor and large-scale involuntary unemployment. The level of unemployment, they believed, determined the rate of inflation by determining the growth rate of nominal wages (see above). Thus, changes in unemployment caused changes in inflation, rather than the reverse.

It was their belief that the level of aggregate demand could be and often was deficient that allowed Keynesians to believe that policies that influenced its level could play an important role in determining the current level of employment. As long as there was "slack" (unemployed labor and other resources) in the economy, monetary ease, for example, would not start a wage-price spiral because the initial round of goods-price increases it produced (see above) would not place substantial upward pressure on nominal wage rates. Thus, Keynesians believed that the economy spent most of its time in a range of unemployment rates well to the right of the natural rate/NIRU—a range within which the Phillips curve was very flat. If demand stimulus pushed the unemployment rate too low, however, then labor market tightness would put persistent upward pressure on the inflation rate. This was the range where the short-run Phillips curve was steep; it was also the range within which the long-run increases in the inflation rate predicted by Friedman were a serious potential problem. Thus Modigliani and Papademos wrote that "unemployment rates left of the shaded area [the area displaying the current range of NIRU estimates] imply a high probability that inflation will accelerate" (1975, 147) (see Chart 3).

Despite the fundamental differences between the monetarists and the Keynesians, the NIRU was seen by many contemporary economists as helping build a consensus about the nature of the inflation-unemployment relationship. According to James Tobin, the "consensus macroeconomic framework, vintage 1970" held that "the nonagricultural business sector plays a key role in determining the economy's rate of inflation. . . . According to the standard 'augmented Phillips curve' view, rates of

price and wage increase depend partly on their recent trends, partly on expectations of their future movements, and partly on the tightness . . . of markets for products and labor. Variations in aggregate monetary demand, whether the consequences of policies or other events, affect the course of prices and output, and wages and employment, by altering the tightness of labor and product markets, and in no other way. . . . Inflation accelerates at high employment rates because tight markets systematically and repeatedly generate wage and price increases. . . . At the Phelps-Friedman ‘natural rate of unemployment,’ the degrees of resource utilization and market tightness generate no net wage and price pressure up or down and are consistent with accustomed and expected paths, whether stable process or any other inflation rate. The consensus view accepted the notion of a nonaccelerating inflation rate of unemployment (NAIRU) as a practical constraint on policy” (1980, 23).⁹

Most current descriptions of the Phillips curve relationship and the NAIRU are not very different from Tobin’s description. One difference is that most modern descriptions see changes in monetary policy as the principal source of changes in the economy’s aggregate demand—a view that Tobin ascribes to the monetarists. Otherwise, the accounts are similar to Tobin’s in the sense of asserting (1) that the current stance of [monetary] policy can be determined by looking at the unemployment rate and comparing it with its natural rate and (2) that the current level of the unemployment rate provides a good indication of the direction and strength of future changes in the inflation rate: low unemployment indicates that the rate of inflation will increase in the short run and accelerate in the long run.

As Tobin pointed out, the macroeconomic consensus about the nature of the inflation-unemployment relationship did not extend to the question of whether policymakers could or should exploit that relationship. In a recent column in the *Wall Street Journal*, Friedman recounts: “I introduced the concept of the natural rate in 1968 as part of an article on ‘The Role of Monetary Policy.’ . . . The natural rate is a concept that does have a numerical counterpart—but that counterpart is not easy to estimate and will depend on particular circumstances of time and place. More important, an accurate estimate is not necessary for proper monetary policy. I introduced the concept in a section titled ‘What Monetary Policy Cannot Do.’ It was part of an explanation of why, in my opinion, the monetary authority cannot adopt ‘a target for employment or unemployment . . . ; be tight when unemployment is less than the target; be easy when unemployment is higher than the target” (*WSJ*, September 24, 1996).

To summarize, the NAIRU was born out of an attempt by proponents of the Phillips curve to address the monetarist critique of policy prescriptions based on the curve. In the minds of many Keynesians, the NAIRU theory successfully reformulated the natural rate hypothesis as a relatively minor qualification of Keynesian theories about the usefulness of the Phillips curve as a guide to monetary (or fiscal) policy. From the monetarist perspective, however, the NAIRU was simply another name for the natural rate. The NAIRU theory, moreover, was based on a fundamental misunderstanding of the natural rate hypothesis—a hypothesis that demonstrated the ineffectiveness of government demand-management policy.

There is a sense in which it is hard to blame the NAIRU proponents for ignoring monetarist assertions that monetary policy was inherently neutral. After all, monetarists such as Friedman had long argued that activist monetary policy was in fact the principle source of short-run economic fluctuations. The monetarists gave further ground to the Keynesians by maintaining a distinction between the short run and the long run and by speaking of money illusion as a channel that gave policymakers access to a short-run inflation-unemployment trade-off. To the dismay of the leading monetarists, proponents of the NAIRU were quite successful in capitalizing on its appeal as a simple, intuitive guide for giving policy advice.

Some Questions about the NAIRU

There are additional problems with using the NAIRU concept to formulate policy rules that are not directly connected to the Keynesian-monetarist debate. One of these involves the relationship between changes in relative prices and changes in the aggregate price level. Relative price changes signal degrees of relative scarcity in the economy: they reveal how highly the economy values different goods and services and are often associated with changes in the quantities of those goods and services produced or employed. One very important relative price is the real (or relative) wage, which is the purchasing power of the nominal wage in terms of goods and services and can be loosely defined as the average nominal wage divided by the average price level. Changes in real wages reflect changes in the value of labor services relative to the value of other goods and services. They are often associated with changes in the level of employment.

Both conventional monetarist theory and the Keynesian/monetarist synthesis of the 1970s predict that the mechanism by which monetary policy creates inflation involves repeated increases in both nominal and real wages and temporary decreases in the rate of

9. Tobin seems to have been the first writer to actually use the term NAIRU; recall that Modigliani and Papademos used the acronym NIRU (noninflationary rate of unemployment).

unemployment. According to these theories, the changes in nominal wages caused by monetary policy do not result in permanent changes in the level of real wages because the price level eventually adjusts to offset the nominal wage changes.

These macroeconomic theories are often “inverted” to produce rules for conducting monetary policy that are based on current levels of unemployment or current rates of change in nominal wages. The simplest rule of this type is that when the unemployment rate is lower than the NAIRU, monetary policy has become too “easy” and should be tightened to head off the coming inflationary spiral. Unfortunately (or perhaps fortunately), the fact that there is little agreement on the precise value of the NAIRU makes this rule hard to implement. An alternative rule that does not suffer from this problem is to tighten

policy whenever nominal wages begin growing more rapidly than prices so that real wages begin to rise.

As the introduction to this article noted, one of the reasons that the NAIRU has attracted so much attention recently is that the level of unemployment has been low—lower than many NAIRU estimates. As a result, some economists have called on

monetary policymakers to move to tighten policy, and others have suggested that they begin watching nominal wage changes closely and tighten policy as soon as there is any sign that real wages are rising.

Non-Policy-Induced Changes in Real Wages. Do policy rules of this sort make sense, even if we accept the underlying theory of the effects of monetary policy? One fundamental problem with these rules is that they implicitly assume that any change in labor market conditions that produces lower unemployment or higher real wage rates must have resulted from monetary policy.¹⁰ Of course, virtually every economist acknowledges that changes in labor productivity produce persistent increases in the relative price of labor, thus causing real wage rates to change independently of monetary policy changes. Consequently, it is often suggested that policymakers should respond only to increases in nominal wages that result in real wage increases that cannot be attributed to gains in productivity.

Is it reasonable to assume that every increase in real wages that cannot be directly linked to an increase in productivity has been caused by a change in monetary

policy and will eventually be followed by an increase in inflation? Two big problems with this assumption are that labor productivity is notoriously difficult to measure and that productivity data become available only after a considerable time lag. However, even if labor productivity could be measured in a timely and accurate manner, it would not follow that increases in wages that were not associated with productivity gains were necessarily caused by monetary policy. Not all changes in the demand for goods and services come from changes in monetary policy, or even government policy, and some of these changes may affect both the relative price of U.S. labor (that is, the real wage) and the level of U.S. employment. Examples include changes in foreign demand for U.S. exports—particularly exports of goods that are labor- or human capital-intensive—or changes in domestic tastes favoring goods of the same type.

As we shall see, if wages and prices are perfectly flexible then changes in relative prices—including relative wages—should have no effect on the aggregate price level. If wages or prices are sticky, however, then relative wage or price changes may appear to produce aggregate price level changes and may even appear to produce persistent inflation.

Why is the possibility of non-policy-induced changes in the relative price of labor important? Most economists would agree that it makes sense to use monetary policy to resist real wage or unemployment rate changes if these changes are simply a lane on the road to a permanent increase in the rate of inflation. Most economists would also agree that policymakers should not resist real wage or unemployment rate changes that are associated with permanent (or persistent) increases in the relative price of labor—even if these changes appear to produce temporary increases in the inflation rate. Resisting changes of this sort would risk letting monetary policy interfere with the important job of relative price changes, which is to ensure that inputs and outputs continue to be used and produced efficiently.

Unfortunately, it is not always easy to distinguish temporary changes in the inflation rate from permanent ones. As a result, the fact that there may have been many occasions in the past when increases in the relative price of labor produced temporary increases in the inflation rate may reinforce some economists’ present tendency to advocate tightening in response to current increases in nominal and real wages. Thus, real wage changes that are not caused by policy-induced changes in aggregate demand can create a great deal of confusion for policymakers who are trying to use wage growth rates or unemployment rates as guides to monetary policy.

Relative Price Changes and the Aggregate Price Level. The most common method for measuring changes in the aggregate price level involves taking a fixed basket of goods and determining how the money cost of that bas-

Friedman and Phelps argued that unexpected inflation can drive the level of unemployment below the natural rate, but only temporarily; in the long run there will be no inflation-unemployment trade-off.

ket has changed over time. The price index produced by this method is equal to the market value of the basket at a particular point in time divided by the market value of the same basket in a fixed base year—typically, the year in which the basket was chosen. The consumer price index (CPI), which is the most closely watched price index, is constructed in this manner. The following example illustrates the impact of a relative price change—a change in the price of a single good relative to the prices of other goods—on a price index like the CPI.

Imagine a household that consumes (1) directly provided labor services (for example, cleaning services), (2) the services of durable goods (such as personal computers), and (3) food (bread). Now suppose that the demand for directly provided labor services increases—perhaps because foreign tourism in the United States has increased and hotels and condo owners are hiring people to clean the rooms and condos foreign tourists have rented. Standard microeconomic theory predicts that this increase in demand will lead to an increase in the price of these services. Assume, for the moment, that the prices of the two other classes of consumption goods do not change (an assumption that will have to be abandoned later). Thus, both the absolute and relative prices of direct labor services have increased.

How will a change in the price of direct labor services—a relative price change—affect the CPI, which is a measure of the overall price level? The fixed-market-basket method for constructing the CPI amounts to assigning different fixed weights to the prices of the different items in the basket. For the purposes of this example, assume that cleaning services, personal computer services, and bread are the only items in the basket and that their initial prices are \$10 per hour for cleaning services, \$10 for computer services, and \$10 per loaf of bread. Also assume that a typical individual allocates 10 percent of his or her spending to cleaning services, another 10 percent to computer services, and the remaining 80 percent to buying bread. Finally, assume that the initial prices of these items are the same as the ones from the base year. We can then construct the initial value of our hypothetical price index:

$$CPI_{initial} = \frac{0.1(\$10) + 0.1(\$10) + 0.8(\$10)}{0.1(\$10) + 0.1(\$10) + 0.8(\$10)} = \frac{\$10}{\$10} = 1.00.$$

Now suppose that the price of cleaning services doubles but the other two prices remain unchanged. The CPI would then be

$$CPI = \frac{0.1(\$20) + 0.1(\$10) + 0.8(\$10)}{0.1(\$10) + 0.1(\$10) + 0.8(\$10)} = \frac{\$11}{\$10} = 1.10.$$

In this case, the reported inflation rate would be 10 percent.

An important question, however, is whether it is really reasonable to hold the weights of the three goods/services fixed in light of the large increase in the price of one of them. From elementary microeconomics, we know that the price increase is likely to produce a “substitution effect” on spending: people will respond to the relative price increase by substituting out of market-delivered cleaning services, either by accepting slightly messier homes or doing more cleaning themselves. They may also buy additional durable goods (such as carpet-cleaning machines) to help them do their own cleaning. With this likelihood in mind, and ignoring for the moment the possibility of further adjustment in relative prices, let’s imagine the effects of allowing the quantity weights to adjust. Assume that U.S. households change their spending patterns so that they purchase fewer hours of cleaning services (labor), whose weight falls from 0.1 to 0.05, and more durables services, whose weight rises from 0.1 to 0.15). (Note that the government agency that constructs the actual CPI does not make these kinds of adjustments, except quite infrequently—see below.) Our “revised” June CPI would look like this:

$$\begin{aligned} CPI_{(rev)} &= \frac{0.05(\$20) + 0.15(\$10) + 0.8(\$10)}{0.1(\$10) + 0.1(\$10) + 0.8(\$10)} \\ &= \frac{\$10.50}{\$10} = 1.05, \end{aligned}$$

in which case the rate of inflation would now be only 5 percent.

Clearly, the increase in the value of the price index—that is, in the aggregate price level—is smaller when the quantity weights are allowed to adjust to changes in expenditure patterns. In other words, the substitution effect acts to restrain the “inflationary” effects of relative price increases.

10. One noteworthy aspect of Friedman’s explanation of the Phillips curve mechanism was that he was as willing as most other economists to accept the notion that increases in wage rates were essentially equivalent to increases in the price level. In Friedman’s words: “Fisher talked about price changes, Phillips about wage changes, but I believe that for our purposes that is not an important distinction. Both Fisher and Phillips took for granted that wages are a major component of total cost and that prices and wages would tend to move together. So both of them tended to go very readily from rates of wage change to rates of price change, and I shall do as well” (1976, 218). Of course, Friedman may have taken this approach not because he agreed with the assumption that all wage-rate changes necessarily produce proportional price level changes but because he was able to make his point about the natural rate of unemployment without worrying about this distinction.

A second effect of relative price changes on the price level is the often-overlooked “income effect.” An increase in the absolute (dollar) price of cleaning services reduces households’ purchasing power: they are no longer able to afford the quantities of the three goods that they were purchasing initially. This loss of purchasing power will typically cause them to reduce their purchases of all goods—even goods that are not closely related to the goods whose prices have changed. In our example, households are slightly poorer because of the increased price of cleaning services, and they react by reducing their purchases of bread. Bakers may be forced to respond by reducing the price they charge for bread, which we will assume falls to \$9.38 per loaf.

What does the newly revised CPI look like after accounting for the income effect?

$$\begin{aligned} CPI_{(rev^2)} &= \frac{0.05(\$20) + 0.15(\$10) + 0.8(\$9.38)}{0.1(\$10) + 0.1(\$10) + 0.8(\$10)} \\ &= \frac{\$10}{\$10} = 1.00. \end{aligned}$$

Thus, after the substitution and income effects have worked their way through the economy, the increase in the price level caused by an increase in a relative price—in this case, something like a relative wage—is zero.

Unfortunately, the CPI as currently calculated does not capture the substitution effect in a timely fashion: while the quantity weights are periodically changed to reflect changes in spending patterns, this revision happens only once every five years. Income-effect-induced price changes will be captured as soon as they occur, but these often take a long time to work their way through the economy. It may take households some time to realize that their real income has decreased and some additional time to adjust to the decrease; until they do adjust, they may dig into their savings to finance higher-than-normal expenditures. Consequently, relative price or wage increases may produce increases in the measured price level in both the short run and the medium run, even though they may have no long-run price level effects once the income and substitution effects work their way through the economy.

Menu Costs. Ball and Mankiw (1995) have developed a theory that provides a more detailed and specific explanation of the process by which increases in relative prices produce temporary increases in the aggregate price level. Their key postulate is that there are “menu costs”—costs of changing prices—that prevent nominal prices from being fully flexible. Suppose, for example, that veal is a key ingredient in many of the items on a restaurant’s menu and that its market price has gone up by a small amount. The restaurant owner is consequently faced with an uncomfortable choice: increase the prices

of veal-based dishes to reflect the new veal price, which will require an expensive reprinting of all the menus in the restaurant, or simply absorb the price increase.

Changing announced prices may be costly for many firms other than restaurants. The Ball-Mankiw theory predicts that these costs will produce a “range of inaction”—a range of input-price increases small enough that they will not cause producers to increase the prices of outputs. They explain that “when a firm experiences a shock to its desired relative price, it changes its actual price only if the desired adjustment is large enough to warrant paying the menu cost. . . . In this setting, shifts in relative prices *can* affect the price level” (1995, 162). To understand the latter point, imagine a no-menu-cost situation in which the prices of a small number of goods rise substantially but the aggregate price level does not rise because the income effect of these price increases reduces the demand for a large number of other goods and causes their prices to decline slightly. When there are menu costs, however, it may not pay the producers of these other goods to cut their prices in response to small demand decreases. As a result, there may not be a large number of small price decreases to offset the small number of large price increases, and the aggregate price level may rise.

The Ball-Mankiw theory can help explain how a one-time increase in real wage rates or other relative prices can produce a temporary increase in the aggregate price level (as measured by a price index) and how repeated increases in real wages or relative prices can produce a temporary increase in the inflation rate.¹¹ As the authors note, this explanation presumes that the relative price increases are concentrated in particular industries, and thus require large price adjustments, while the resulting income-effect-driven demand decreases are spread across many different industries and consequently require relatively small adjustments. As applied to wage rates, the theory predicts that the increases in real wages that are most likely to result in temporary increases in inflation are increases that are concentrated, at least initially, among workers in particular industries. These wage increases will produce cost increases in these industries that exceed their ranges of inaction and will consequently impel the industries to increase their product prices substantially.

Price Stickiness: The Empirical Evidence. Menu costs are one possible example of a “nominal rigidity”—a source of friction that prevents money prices from adjusting in the perfectly flexible manner assumed by classical theory. Much of Keynesian theory, including the theory behind the NAIRU, is based on the assumption that the economy is afflicted by many other price rigidities of this general type. As a result, one natural strategy for convincing skeptics of the validity of the theory would be to describe the nature and source of these rigidities as pre-

cisely as possible. It would be helpful, for example, to be able to identify the rigidities that are severe enough to prevent nominal wages from adjusting to eliminate a persistent excess supply of labor—the rigidities, that is, that allegedly permit persistent involuntary unemployment. Similarly, it would be helpful to be able to identify the frictions that allegedly make firms slow to adjust their prices to increases in demand and workers slow to adjust their wage demands to increases in prices. This information would make it much easier for skeptics to understand how aggregate demand stimulus could produce significant (if temporary) increases in output and employment.

Given the wealth of NAIRU-based advice that is currently being offered to policymakers, it may seem reasonable to infer that there is plenty of good evidence supporting the claim that nominal rigidities are widespread and substantial. In reality this is not at all the case. In a recent paper, Wynne (1995) reports the results of a systematic search for empirical studies documenting price stickiness. Despite the widespread acceptance of theories based on sticky prices, he was able to find only a small number of studies, including only three that used data from the post-World War II period. Wynne also points out that these studies would not stand up well against some elementary objections to their methodology. For example, the goods and services whose prices are examined in these studies account for a very small fraction of GDP; they also include, in many cases, goods whose prices are known a priori to be relatively inflexible or which “exhibit little or no quality changes over time.” Wynne goes on to point out that “many hi-tech products have remarkably flexible prices” (1995, 7).

What about the assumption that is widely considered absolutely fundamental to Keynesianism—the assumption that nominal wages are sticky downward? Zarnowitz notes that “the average annual money earnings from wages declined in about half of the business contractions of 1860-1914 and in all of those of 1920-38, according to the data compiled in Phelps Brown 1968. . . . In contrast, they kept rising through the period 1945-60, which witnessed four moderate or mild recessions. . . . Data for 1889-1914 from Rees 1961 show that peaks and troughs in annual earnings matched nearly two thirds of the like business cycle turns of the period, but those in hourly earnings fewer than half. . . . The conclusion is that most of the major business downturns and some of the minor ones have historically been associated with declines in nominal wage earnings” (1992, 146).

The NAIRU’s Empirical Record.

As Okun (1980) explains in a passage quoted above, for roughly fifteen years ending in the late 1960s U.S. inflation and unemployment data seemed to line up along a stable Phillips curve. The stagflation of the 1970s destroyed this empirical relationship. During the last twenty years, econometricians have not had much success identifying a stable, reliable relationship between inflation and unemployment.

Of course, econometricians’ inability to construct an empirically reliable Phillips curve makes it impossible for them to produce a reliable estimate of the NAIRU. Recently this problem has become a serious one for economists who think monetary policy should be based on the NAIRU. During the past two years, for example, the U.S. unemployment rate has been quite low—lower than many widely publicized NAIRU estimates. However, the inflation rate has

shown no signs of increasing (to say nothing of accelerating) in the way the NAIRU theory predicts. As Fred Bleakley reports in a recent article in the *Wall Street Journal* (February 1996), the failure of relatively low unemployment rates to produce higher inflation rates has led several prominent economists to revise their estimates of the NAIRU downward. Ex post revisions of this sort are probably very frustrating for policymakers who are seeking a reliable guidepost for monetary policy.

As frustrating as the current situation may be, economists and policymakers definitely prefer it to the 1970s, when inflation rates and unemployment rates were high simultaneously rather than low simultaneously. By the end of the decade even inveterate Keynesians had begun to lose faith in the usefulness of the NAIRU concept. At the close of the 1970s, Tobin warned that “as for the shape of the short-run trade-off [between inflation and unemployment], Murphy’s Law of macroeconomics assures us that it is an *L* with the corner wherever it happens to be. . . . It is possible that there is no NAIRU, no natural rate, except one that floats around with actual

Despite the credibility gains of the monetarists, the events of the mid-1970s did not result in the demise of Keynesian macroeconomics or even of analysis based on the Phillips curve.

11. *The theory does not imply that changes in relative prices can produce permanent price level increases. If the restaurant owner believes that the change in the price level is permanent then it will make sense for him to revise his menu immediately since he will have to revise the menu eventually and the longer he waits the greater his losses will be. Similarly, if relative prices rise gradually over a period of time then the theory predicts that the inflation rate may increase during the same period of time but not that the inflation rate will increase permanently.*

history. It is just as possible that the direction the economy is moving is at least as important a determinant of acceleration and deceleration as its level. These possibilities should give policymakers pause as they embark on yet another application of the orthodox demand-management cure for inflation” (1980, 61-62).¹²

Neoclassical Macroeconomics

The 1970s: Theory and Evidence Collide. Economically, the decade of the 1970s was dominated by major “supply shocks”—principally, the OPEC oil embargo and the resulting increases in world oil prices. Supply shocks were not easily incorporated into Keynesian theory. Historically, Keynesian theorists had

concentrated on studying the effects of changes in aggregate demand and had implicitly assumed the existence of a stable aggregate supply schedule. As a result, the supply shocks of the 1970s caused forecasts based on Keynesian predictions to generate huge errors. As Tobin pointed out, “the inflationary components of the expansions, 1971-73

and 1975-79, were unexpectedly and distressingly large. The disinflationary consequence of the first contraction, 1969-71, was distressingly small. Indeed, money wages ‘exploded’ while unemployment was rising. . . . The major economic events of the decade were the extraordinary changes in world supplies and prices of specific commodities. Their interaction with macroeconomic indicators and events confronted both policymakers and analysts with problems for which they were unprepared. . . . No one foresaw in 1970 the main economic events of the decade or the formidable challenges those surprises would pose for macroeconomics and stabilization policy. We macroeconomists were caught unawares. It was not simply that our models, theoretical and econometric, now had to be applied to novel situations. Worse than that, the shocks of the 1970s required some fundamental rethinking and rebuilding” (1980, 21-23).

Although Tobin acknowledged that Keynesian theory faced problems, he was not at all ready to abandon the Keynesian ship. In his view, the “consensus model” of the early 1970s was in need of extension and refinement rather than replacement. As noted earlier, however, the high inflation rates of 1974-75 pushed many other economists in the direction of the monetarists.

In retrospect, it is clear that the record of 1974-75 posed big problems for both Keynesians and monetarists. While Keynesians could try to explain the high unemployment as a consequence of insufficiently aggressive management of aggregate demand, they could not explain how the inflation rate had become so high when the labor market was clearly the opposite of tight. Monetarists, on the other hand, could blame accelerating inflation on overly aggressive demand management but could not explain how a too-expansionary policy could have produced such high unemployment. To make matters worse, monetarism held that recessions were almost always caused by monetary tightening (see Friedman and Schwartz 1963), but if a major tightening had occurred then the inflation rate should have fallen.

A New (and Old) Approach to Macroeconomics.

The inability of Keynesian and monetarist theories to explain the key macroeconomic events of the 1970s caused these theories to become discredited in the minds of many economists. This widespread disenchantment with traditional macroeconomic theory left the field open for a group of young economists who were attempting to develop a new approach to macroeconomics on the foundation provided by the classical paradigm. The research program of these economists came to be known as neoclassical economics.¹³

The neoclassical attempt to build on classical principles involves formalizing many of the concepts that have been used informally by classical and monetarist economists. Neoclassical economics is based on the classical assumption that individual households and firms make the decisions that maximize their well-being subject to their budget and technological constraints. Neoclassical economists extend this assumption to intertemporal decisions—an extension that forces them to study the interaction between current choices and future choices and to attempt to trace out the consequences of these choices over time. They prefer to conduct these investigations in general equilibrium settings—that is, in formal models that try to take into account the complex and often simultaneous interactions among different economic variables in both the short run and the long run.

A key principle of neoclassical economics is that in order to determine the economic impact of a hypothetical change in government policy—a tax cut or an increase in the money supply growth rate, for example—it is necessary to consider the possibility that individual households and firms may react to government policy changes by changing the ways in which they make their own economic decisions. Neoclassical economists’ effort to describe the nature of these changes in individual “decision rules” focuses on the manner in which the individuals formulate their economic expectations. More specifically, a fundamental and formative assumption of

From the monetarist perspective, the NAIRU theory was based on a fundamental misunderstanding of the natural rate hypothesis—a hypothesis that demonstrated the ineffectiveness of government demand-management policy.

neoclassical economic theory is that the economic expectations of households and firms are formulated in the most accurate possible manner, given the information available to them—including information about changes in government policy. This assumption is known as rational expectations.

As we have seen, the question of how workers formed their expectations about future prices became a key issue in the debate between the Keynesians and monetarists over the inflation-unemployment relationship. The analysis used by the original Keynesians did not include any formal description of the way expectations of this sort were formed. The expectational assumption behind the Friedman-Phelps natural rate hypothesis—a hypothesis that was (as we have also seen) partially incorporated into early-1970s Keynesianism—was “adaptive expectations.” Adaptive expectations is the assumption that people base their expectations about the future values of economic variables on the past values of these variables, emphasizing values from the recent past. In the case of inflation, one specific adaptive expectations assumption that was commonly used in econometric studies was that next year’s rate of inflation was expected to be equal to a weighted average of the values of past inflation rates, with the weight of a particular past inflation rate declining as it receded further into history. As we note below, because adaptive expectational assumptions do not take into account the systematic changes in ways the public forms its expectations that may occur when the government changes policy, results obtained using them will be very different from those obtained using the assumption of rational expectations.

The following two examples illustrate the potential impact of rational expectations on the effects of government policy. First, imagine that the Smith family is considering buying a house in a particular neighborhood. The family wants to make sure the house will bring a good price if they have to sell it in the future. The Smiths will probably use the price information from recent sales of comparable homes to estimate the future resale price of the home they are looking at. Suppose, however, that the Smiths learn that the government has decided to build an interstate highway extension that will, when completed, come within a thousand feet of their prospective home. Will they take this change in government policy into consideration when estimating the future sale price of the home, or will they continue to concentrate exclusively on past sale price information?

For a second example, imagine that during a mild recession the government decides to try to stimulate the

economy by giving temporary tax breaks to families who buy new homes. Suppose, for the sake of argument, that this policy really does succeed in influencing potential home buyers and that the economy actually improves as a result. Now suppose that the government, emboldened by the apparent success of its new policy, makes the decision to use it to combat future recessions. What will happen the next time the economy begins to slow down? Will people remember the tax break that was offered during the previous recession and decide to hold back on their new-home purchases until the government decides to offer another tax break? If they do, then the recession may come sooner and be more severe than it would have been otherwise, and the effects of the tax break policy will be almost exactly the opposite of what the government intended.

These examples illustrate two important things about the ways in which rational, forward-looking individuals are likely to respond to changes in government policy. First, in projecting the consequences of their economic decisions individuals are likely to consider not only

the consequences of similar past decisions but also all the other relevant information that may be available—including information about the effects of government policies. When it comes to predicting inflation, for example, people will not look exclusively at inflation rates from the recent past, as adaptive expectations assumed. Instead, they will also try to make use of any information available to them about the motives and behavior of monetary policymakers. Second, just as people will try to learn from the results of their own past decisions, they will also try to learn from their past observations about the effects of government policy. In particular, people will try to distinguish unsystematic variation in government behavior from systematic changes in government policy. Suppose, for example, that people discover that every time the unemployment rate is above a certain percentage, monetary policymakers react by increasing the money supply in an effort to reduce the rate of unemployment. It will not be long

Real wage changes that are not caused by policy-induced changes in aggregate demand can confuse policymakers who are trying to use wage growth rates or unemployment rates as guides to monetary policy.

12. For a closer look at the question of the estimation and empirical usefulness of the NAIRU, see Staiger, Stock, and Watson (1997) and Chang (1997).
13. For summaries of some of the innovations this research program produced, see Lucas and Sargent (1979) and Miller (1995).

before both employers and employees begin to take into consideration the effects of this policy in their wage and salary negotiations. If the unemployment rate is above the threshold percentage at the time of the negotiations, then the wage and salary levels that emerge from the negotiations may include upward adjustments for expected price increases. As a result, the final negotiated salary may be the same, in real terms, as it would have been if the government had not acted, and the government's actions may not end up having any effect on the level of employment.

How did neoclassical theory view the Phillips curve? To neoclassical economists the Friedman-Phelps critique

of Keynesian notions about the effects of monetary policy was a step in the right direction, but only a rather tentative step. As we have seen, Friedman and Phelps forced Keynesians to accept the natural rate as a long-run constraint on demand-management policy but did not succeed in suppressing their belief in the existence and exploitability of a short-run

Phillips curve relationship. Neoclassical economists, however, argued that even if a statistical relationship between inflation and unemployment did exist in the short run, it might be impossible for the government to exploit the relationship because people might respond to government demand-management policy in ways that would frustrate the goals of the policy.

The first economist to make this point was Robert Lucas, who is generally regarded as the founder of the neoclassical school. The formal model Lucas (1972) developed and analyzed had three basic features that have become characteristic of neoclassical macroeconomic theory. First, the model integrated microeconomics and macroeconomics by studying the impact of the decisions of individual households and firms on the values of economic aggregates. Second, the model was dynamic—that is, it took intertemporal considerations into account, including the expectations of households and firms. Third, the model was stochastic—that is, it accounted for the fact that many decisions had to be made under uncertain circumstances and that the decisions of the households and firms played a role in determining the nature of this uncertainty.

In Lucas's model, individuals are "farmers" who simultaneously provide labor, produce goods, and con-

sume goods. These individuals face fluctuations in prices that are caused partly by changes in "real" economic conditions—good or bad crops—and partly by unsystematic changes in monetary policy. The latter take the form of random deviations from a systematic path of the money supply. Each period, the change in the price of any particular good is caused partly by a change in real economic conditions and partly by a change in monetary policy.

Individuals would like to respond differently to price fluctuations that come from different sources. If the relative prices of the particular goods they produce increase, then they want to work harder and increase their production of these goods, for standard microeconomic reasons. If, however, the increase in the price of the good a particular individual produces is simply part of an increase in the overall price level (that is, in absolute prices)—so that the relative price of this good has not changed—then there is no reason for that individual to increase his production or work effort. Thus, if individuals could distinguish relative price changes from absolute price changes with 100 percent accuracy, then they would never increase their work effort in response to absolute price changes. As a result the Phillips curve for this economy would be vertical, even in the short run.

In Lucas's model, as in most real-life situations, individuals do not possess complete information about the current state of the economy. In particular, individuals are assumed to be unable to observe the current prices of any goods other than the goods they produce. Consequently they cannot tell for certain whether changes in the prices of "their goods" represent absolute or relative price changes. However, individuals do know the statistical properties of the two different types of price fluctuations. They can use this information to calculate the average part of each price change that represents a relative price movement and then respond only to that part of the price change.¹⁴ This is the key place where the assumption of "rational expectations" is used in the model.

Now suppose that, during a particular period, relative prices happen to remain entirely unchanged because there have been no changes in real economic conditions. At the same time, the absolute price level rises by a larger-than-normal amount because there has been a larger-than-normal increase in the money supply. Individuals will have no way of knowing that this particular price change is all absolute; consequently, they will proceed under the assumption that some part of it represents a relative price change. As a result, they will increase their work effort in response to the price increase. The larger the absolute price increase, moreover, the larger their work-effort increase will be. Thus, monetary-policy-induced changes in the price level will have real effects of a type consistent with a Keynesian-looking short-run Phillips curve.¹⁵

Neoclassical economics is based on the classical assumption that individual households and firms make the decisions that maximize their well-being subject to their budget and technological constraints.

Can monetary policymakers use this short-run Phillips curve to increase the levels of employment and output? Suppose that in an effort to do so they increase the average money growth rate by some fixed percentage. If individuals are aware of this change in policy they will realize that prices are now going to increase at a higher average rate. As a result, the fact that the price level increases at a higher rate next period or in subsequent periods will not surprise or confuse them, and the policy-induced increase in the inflation rate will have no effect on work effort. People will still respond to unsystematic price level changes in the same way they did previously, but they will now expect a higher average rate of inflation. The statistical Phillips curve will shift up by the amount of the increase in the average inflation rate, but the Phillips curve facing policymakers will be vertical.

Lucas's 1972 paper had a tremendous impact on the economics profession: it is arguably the most influential single contribution by a macroeconomist in the last fifty years. There are two basic reasons for its significance. The first reason, already noted, is that the paper represented a huge methodological advance in macroeconomic theory, combining as it did general equilibrium theory, dynamic analysis, and rational expectations.¹⁶ The second reason is that he provided a qualitative explanation for two phenomena that were both puzzling and troubling to macroeconomists—the fact that the seemingly reliable Phillips curve of the 1950s and 1960s had begun shifting upward erratically at just about the time that policymakers began to try to use it to guide monetary and fiscal policy and the (closely related) fact that deliberate changes in monetary and fiscal policy did not seem to be having the effects on employment and output that were predicted by Keynesian theory.

What does Lucas's theory predict about the natural rate and the NAIRU? In his model, systematic changes in monetary policy have no effect on the level of employment, and the labor market does not play any special role

in the mechanism by which a monetary expansion produces inflation. As a result, in the context of the model it would not make sense for the government to focus on unemployment rates or wage changes as guides for monetary policy.

Lucas's paper also makes two broader points whose potential applicability extends far beyond the specific features of his model. The first point, discussed earlier, is that theories of the effects of government policy that are based on the assumption that people make systematic forecasting errors are not very sensible: since people have strong economic incentives to correct such errors, the changes in their behavior induced by changes in policy are likely to disappear very quickly as they revise their forecasting schemes. This point had already been made by Friedman and Phelps, but Lucas's analysis reinforced it in an exceptionally stark and rigorous way. The second point, which was an entirely new contribution, is that the existence of statistical relationships between variables of interest to

policymakers is no guarantee that these relationships can be exploited by policymakers, regardless of how reliable the relationships may seem to be. In Lucas's model, the Phillips curve is, by construction, a very reliable statistical relationship—a relationship in which the levels of employment and output fluctuate around long-run averages that can be thought of as the analogues of the natural rate or NAIRU. However, the short-run component of the Phillips curve relationship, which is the only

A fundamental assumption of neoclassical economic theory is that the economic expectations of households and firms are formulated in the most accurate possible manner, given the information available to them.

14. For example, individuals may know that, on average, one-third of the increase in the price of a good represents an increase in the relative price of that good while two-thirds represents an increase in the absolute price level. In this case, if individuals observe that the price of their good has increased by, say, 3 percent, then they will estimate that the relative price of the good has increased by 1 percent and will increase their work effort accordingly.

15. Workers in Lucas's model can be viewed as displaying a type of "money illusion": they supply additional labor in response to expansionary monetary policy because for a time after the policy is implemented they believe, incorrectly, that the purchasing power of their income is higher than it will actually turn out to be. Unlike the analysts who preceded him, however, Lucas provided a rigorous explanation for the source of workers' money illusion. This extra step was crucial because it enabled him to ask (and answer) the question of whether the mechanism generating the money illusion would allow it to be exploited by policymakers. As we shall see, he concluded that it would not.

16. The rational expectations assumption was developed and first used by Muth (1961). However, Lucas (1972) was the first economist to accomplish the conceptually and mathematically challenging task of including rational expectations in a dynamic stochastic general equilibrium model. Sargent and Wallace (1975) illustrated the central importance of rational expectations by inserting this expectational assumption into a simple macroeconomic model of an otherwise-conventional (that is, non-neoclassical) type. The results were similar to those reported by Lucas: the model generated a Phillips curve-type relationship that government policy was powerless to exploit.

component that involves changes in the levels of employment and output, is generated by forces that have nothing to do with the systematic (policy-determined) component of monetary policy. As a result, deliberate, policy-induced changes in the inflation rate have no power to influence the unemployment rate in Lucas's model.¹⁷

Neoclassical Economics in Perspective. In the quarter-century since Lucas published this seminal paper, neoclassical theory has become the dominant school of thought among academic macroeconomists. To be sure, the neoclassical school has not escaped criticism. The rational expectations assumption, in particular, has been criticized as requiring unrealistically high levels of economic knowledge and forecasting ability on the part of households and firms and also because the

econometric restrictions it implies are regularly rejected by the data. As a result, in recent years there has been a renewed interest in the implications of adaptive expectations, especially relatively sophisticated adaptive mechanisms such as least squares learning, Bayesian updating, and genetic algorithms (see, for example, Marcet and Sargent 1989 and

Arifovic 1995). The goal of this research program is to try to better replicate the way in which real-world individuals learn from their mistakes and adjust their expectations to changes in the economic environment.

Neoclassical use of general equilibrium models has been criticized on the grounds that the existing versions of these models are too simplistic and restrictive to capture the complex and diverse behavior of real-world households and firms. A closely related criticism is that neoclassical models simply cannot explain important macroeconomic phenomena. For example, although the "policy ineffectiveness" prediction of the original Lucas article has remained a fundamental part of the neoclassical message, a great many economists continue to believe that monetary policy has substantial real effects, and there is a good deal of empirical evidence supporting this position.¹⁸

In hindsight, it is clear that the significance of neoclassical macroeconomics is not that it has provided anything like a definitive macroeconomic model but instead that it has imposed more rigorous scientific discipline on macroeconomic theorizing. Stated differently, neoclassical macroeconomic theory is at an early stage of develop-

ment, and there are many basic questions to which it has not yet been able to provide definitive answers. However, it has been very successful at identifying the logical and conceptual problems with the Keynesian and monetarist theories that preceded it.

Neoclassical macroeconomics has made a second major contribution to macroeconomic thought—a contribution that is less direct but perhaps equally important. By creating skepticism among economists that monetary or fiscal policy is responsible for business cycle fluctuations, it has forced them to recognize the possibility that the fluctuations may be caused by real forces—that is, by changes in technology, tastes, or resource costs of the type that cause supply and demand curves to shift in conventional microeconomic theory. In recent years, one of the fastest-growing branches of neoclassical macroeconomics has been real business cycle theory, which tries to attribute cyclical fluctuations to random changes in technological productivity. Kydland and Prescott (1982) pioneered in the development of this theory, and Nelson and Plosser (1982) provided empirical evidence that is widely viewed as indicating the importance of real as opposed to nominal factors in driving the business cycle.¹⁹

One basic prediction of real business cycle theory is that the observed changes in real wages and hours worked represent fluctuations in the relative value of labor—a prediction that has been emphasized in real business cycle studies by Hansen (1985) and Prescott (1986). As we have seen, this implication of the theory provides another argument against conducting monetary policy using rules of thumb based on the unemployment rate or the rate of wage inflation. Another interesting implication of neoclassical theory (though not necessarily of real business cycle theory) is that monetary policy and fiscal policy interact so that the effects of changes in monetary policy may depend partly or wholly on the response of fiscal policy. The first neoclassical economists to make this point forcefully were Sargent and Wallace (1981), who constructed a simple model in which the inflationary implications of a change in monetary policy depended critically (and dramatically) on how the government managed its debt. Again, this implication of the theory suggests that any reasonable set of rules for monetary policy guidance must be multidimensional in nature.²⁰

Conclusion

Economic commentators regularly urge the Fed to use the level of unemployment or the rate of change in wages as leading indicators of inflation and as guides to whether they should ease or tighten monetary policy.²¹

The logic behind this approach is based on modern (post-1970s) Keynesian macroeconomics and, more specifically, on the Phillips curve and the NAIRU.

The significance of neoclassical macroeconomics is not that it has provided anything like a definitive macroeconomic model but that it has imposed more rigorous scientific discipline on macroeconomic theorizing.

According to this view, inflation is caused by excessive “aggregate demand,” and changes in aggregate demand show up first in the labor markets. Low levels of unemployment—levels below the natural rate/NAIRU—reflect the fact that excessive aggregate demand has produced a tight labor market. A tight labor market will put upward pressure on wages. Increases in wages will force firms to increase their prices and will consequently produce a higher rate of inflation. Since modern Keynesianism sees the state of monetary policy as the principal determinant of the level of aggregate demand, a tight labor market also reflects excessively expansionary monetary policy and indicates the need for corrective Fed tightening.

This article has attempted to provide some basic information about this NAIRU theory of the causes of inflation and the role of monetary policy. We began by describing the Phillips curve, an apparent empirical relationship between wage increases and unemployment that Keynesian economists used as the basis for a theory of the inflation-unemployment relationship. The theory implies that policymakers could use demand stimulus or restraint to produce lower or higher unemployment at the cost of higher or lower inflation. Monetarist economists, who were deeply skeptical of Keynesian views about the effectiveness of demand management, developed a critique of the Phillips curve that was based on the concept of a “natural” rate of unemployment. According to the monetarists, attempts to use monetary or fiscal policy to keep the unemployment rate below the natural rate might have limited success in the short run but in the long run would produce continually increasing inflation.

The stagflation (simultaneous high inflation and high unemployment) that afflicted the U.S. economy dur-

ing the 1970s shook economists’ faith in the existence of a stable Phillips curve and greatly increased the credibility of the monetarist “acceleration hypothesis.” The proponents of Keynesian theory weathered the monetarist critique by accepting the natural rate—which they rechristened the NAIRU—as a long-run constraint on demand-management policies that, in their view, remained effective in the short run. Although the monetarists were not satisfied with the Keynesians’ response to their critique, the fact that the two schools of macroeconomic thought were working with a common set of theoretical weapons prevented the monetarists from overwhelming the Keynesians’ defenses. As a result, the modified Keynesian theory of the 1970s became the standard theory taught to economics students and used by policymakers. A basic feature of this theory was a simple rule of thumb for monetary policy: tighten policy when the unemployment rate is below the NAIRU or when real wages are rising, and ease policy when the reverse is true. The low unemployment rates observed in the mid-1990s have caused many commentators to urge the Fed to consider using this rule of thumb as a justification for preemptive monetary tightening.

After describing the historical development of the NAIRU theory, the discussion raises some practical questions about the validity of the theory and its usefulness as the basis for policy advice. Perhaps the most important question involved the difficulty of distinguishing policy-induced changes in absolute wages from changes in relative wages associated with real changes in the economy—changes that it would not make sense for monetary policymakers to attempt to oppose. A second question focused on the fact that there is very little empirical evidence supporting the notion of sticky prices on which

17. *In his paper, Lucas imagines a researcher who tries to use a statistical analysis of data from his model to provide advice to policymakers. The researcher runs a linear regression with output or employment as the dependent variable and the inflation rate as the independent variable. He finds that the coefficient estimate for the inflation rate is positive and consequently advises policymakers that using monetary policy to increase the inflation rate is likely to succeed in increasing the levels of employment and output. As we have seen, however, this policy advice is incorrect.*
18. *Strictly speaking, neoclassical theory does not preclude monetary policy from having real effects: it simply rules out real effects that rely on frictionless markets not clearing or on the public being systematically fooled. Thus, although it is arguably fair to describe monetary policy ineffectiveness as a characteristic feature of neoclassical theory, there are an increasing number of neoclassical models in which monetary policy has short-run real effects. Leeper and Gordon (1992) and references therein are examples of key contributors to the rapidly growing “liquidity effects” literature, which uses real business cycle models (see below) to study the short-run effects of changes in monetary policy. There are also a few neoclassical models in which monetary policy has long-run real effects. Examples of the latter type include Wallace (1984), Bhattacharya, Guzman, and Smith (1996), Espinosa and Russell (1997a, 1997b), and Bullard and Russell (1997).*
19. *For a more detailed description of real business cycle theory and a review of the formative developments in the theory see Prescott (1986).*
20. *The following statement by former Federal Reserve Governor Lawrence Lindsey provides a good example of unidimensional reliance on the NAIRU: “The NAIRU is a useful theoretical construct . . . sufficient for making quick ‘on your feet’ estimates of likely economic performance. . . . If I knew with certainty that the NAIRU was 5.837. . . I would have the information I needed to know with certainty that I should tighten” (1996, 10).*
21. *Ironically, experts who specialize in studying the properties of the business cycle classify wages as lagging rather than leading indicators. See Moore (1961) and Zarnowitz (1992).*

Keynesian theory is based, and a third involved the empirical weakness of the Phillips curve relationship that provides the basis for the NAIRU.

The discussion also includes neoclassical economics, a relatively new school of macroeconomic thought that has provided a second, more fundamental challenge to Keynesian thought. We described the fundamental principles of neoclassical theory and went on to explain how Robert Lucas, one of the theory's founders, used these principles to construct a groundbreaking theoretical model whose properties cast doubt on the short-run effectiveness of monetary policy and thus on the usefulness of monetary policy rules based on the NAIRU. Neoclassical theory still has a large number of basic macroeconomic questions to answer. However, it has produced huge logical and methodological improvements in macroeconomic analysis, and it has left the Keynesian and monetarist theories that preceded it largely discred-

ited—including the modern form of Keynesian theory that provides the basis for the NAIRU. Recent developments in neoclassical theory indicate that business cycle fluctuations in employment and output may be caused primarily by real forces—a situation that, if true, increases the danger that monetary policy based on the NAIRU may interfere with the proper functioning of the price system.

Our own view is that proponents of the NAIRU have never provided anything like a satisfactory answer to the neoclassical critique, or even to the questions raised in this article. Given that this is the case, it is hard to give much credence to the commentators who urge the Fed to base its monetary policy on the NAIRU. Unfortunately, neoclassical economists have yet to provide monetary policymakers with reliable policy rules to replace NAIRU-based rules. Until they do, monetary policy decision making will remain a difficult task.

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