

# Real Business Cycles

By Mark Rush

Every science possesses its conventional wisdom about its subject. Occasionally, however, the traditional view comes under attack. In most instances, it survives with at most minor modifications; sometimes, though, the conventional wisdom is overturned and replaced with new stylized views or facts about the world.

Economics—and particularly macroeconomics—is no exception to these general statements. In the 1930s, for example, Keynesian views about macroeconomics clashed with the classical view that was then the standard theory of the aggregate economy. The classical theory predicted that the economy was inherently stable and that if excessive unemployment occurred, the economy quickly and automatically would restore itself to full employment. However, these views seemed unable to explain the experience of the Great Depression, and thus macroeconomists turned to the new Keynesian theory. The Keynesian approach asserted that without active government

intervention, the economy could settle into a prolonged state of high unemployment. Thus, contrary to the classical view, the Keynesian model suggested that government intervention in the economy could be beneficial. The Keynesian theory carried the day because it seemed to provide a better explanation of the reality confronting economists in the Great Depression. Having overthrown many of the traditional classical views, the Keynesian approach to macroeconomics became the prevailing orthodoxy.

With some modifications and extensions since its initial victory in the 1930s, Keynesian views have continued to be the conventional wisdom accepted by most macroeconomists. In the last few years, however, new strands of research have emerged to contest some of the most basic beliefs of Keynesian orthodoxy. One of the newest areas of research, the “real business cycle” theories, suggests that many of the conventional views about business cycles are incorrect.

It is too early to determine how much success real business cycle research will enjoy, but it is timely to survey its claims. Thus, the first part of this article summarizes three conventional

---

Mark Rush is an associate professor at the University of Florida. This article was written while the author was a visiting scholar at the Federal Reserve Bank of Kansas City.

beliefs underlining the Keynesian view of the business cycle. The second part traces the development of alternative viewpoints from monetarist critiques to rational expectations and real business cycles. The third part discusses new research on real business cycles that brings traditional views about the business cycle into question. The fourth part presents some criticisms of the real business cycle approach.

### **The traditional view**

Most of the conventional wisdom about business cycles springs from the Keynesian analysis first put forth in the 1930s, though some of it predates that era. This view rests on three postulates that form the bedrock of macroeconomic orthodoxy. First, that business cycles are temporary movements in economic variables, such as real GNP. Second, that business cycles harm a country's economic welfare. And third, that government monetary and fiscal policies can be used to stabilize the economy by eliminating some of the cyclical fluctuations in economic conditions.

#### *The conventional wisdom*

The first postulate, that business cycles are temporary movements in aggregate real variables around their long-run trend, is not the result of the Keynesian revolution. Instead, this view extends back to at least the early part of this century and was widely accepted by classical economists. One important difference between classical and Keynesian economists, however, concerns the duration and amplitude of business cycles. Classical economists generally believed that cycles would be short and mild. Keynesian economists contend that cycles can be long and extreme so that excessive unemployment can last a long time.

The view that business cycles represent tem-

porary movements in economic variables leads to the strongly ingrained conventional classification of cycles into recessions, troughs, expansions, and peaks. An important implication of this approach is that recessions and expansions represent temporary movements away from the long-run trend. During a recession, for example, real GNP falls below its long-run level, but as the economy emerges from the recession, the lost ground is regained as the economy returns to its trend level.

The second postulate of the conventional view asserts that the presence of temporary business-cycle fluctuations in economic aggregates is harmful. In other words, limiting the extent of business-cycle movements will improve the public's welfare. Although this belief may have existed before the Keynesian revolution, it was not emphasized by classical economists possibly due to their belief that cycles would be short and mild. Keynesian economists, believing that cycles will be long and extreme, have made the harmful effects of cycles an important part of their approach. Thus, the existence of business cycles is conventionally believed to have a major adverse effect on the nation's well-being.

The source of the benefit from a reduction in business cycles is rarely made explicit. Rather, it is usually held to be self evident with references to periods such as the Great Depression, when unemployment remained above 20 percent for extended periods of time. However, when forced to make the gains specific, Keynesian economists suggest two possibilities. First, advocates of the Keynesian approach claim that a reduction in the extent of business cycles can save the economy from facing extreme levels of unemployment. Second, the conventional approach suggests that reducing the severity of business cycles may allow the economy to grow more rapidly than otherwise. Faster growth might occur because businesses would not fear that excessive unemployment in the future would rob them of a market

for their products. Thus, assured of having a market, businesses could be motivated to invest in more capital stock in order to produce additional output.

The third postulate underlying the traditional views of business cycles is that activist government policy can be used to smooth cyclical changes in economic variables. The first two postulates listed above are widely accepted by economists. This third tenet, however, though still part of the conventional wisdom, is contested by some economists. Starting with the extreme Keynesian position of the 1950s and extending to the present through monetarist and rational expectations views, there has been dispute about the extent to which monetary policy can be used to reduce the business cycle. Still, the traditional consensus reached in the last 30 or 40 years maintains that both monetary and fiscal policies can be effectively used as countercyclical tools.

### *Importance in practice*

Combining the conventional view that government policy can be used to reduce business cycles with the belief that business cycles harm the economy yields the standard conclusion that it is desirable for government to engage actively in policies designed to reduce the severity of business cycles. This result is perhaps the most pervasive part of the conventional wisdom and shapes virtually all of the public and professional dialogue concerning the government's role in the aggregate economy. The widespread acceptance of this viewpoint has resulted in the enactment of many policies designed to stabilize the economy or smooth the business cycle. For example, the tax cuts in 1964, 1974, and 1981 were designed to promote faster economic growth while the tax surcharge enacted in 1968 attempted to restrain growth. The proper course for monetary policy is also subject to constant discussion. The Federal Reserve is generally thought to have

a major role in reducing aggregate demand when inflationary pressures arise or in stimulating demand when economic growth falters.

Thus, the conventional wisdom that active government intervention in the economy is desirable has had a major effect on the economic policies pursued by the government and, hence, on the government's impact on the nation's welfare.

### **Alternatives to the Keynesian view of the business cycle**

Although the Keynesian approach remains today the conventional wisdom accepted by a majority of economists, since the early 1960s a growing number of economists have become dissatisfied with it and have pursued research into other approaches. These alternatives include the monetarist approach, prominent since the 1960s, the natural rate and rational expectations theories developed in the 1970s, and the more recent real business cycle theories.

Research into these alternatives has resulted from two sources of dissatisfaction with the Keynesian conventional wisdom. First, some economists have suggested that the theoretical foundations of Keynesian economics are too weak to be taken seriously. In particular, Keynesian theory relies on the assumption that some nominal wages and prices are "sticky" and do not respond to excess supplies or demands. Thus, for example, in the Keynesian view, wages may not fall sufficiently to eliminate excessive unemployment. However, critics of the Keynesian approach point out that microeconomic theories of firm and consumer behavior have been unable to rationalize the presence of sticky nominal wages or prices.

Second, the behavior of the U.S. economy during the 1970s led other economists to reject the Keynesian approach. In the beginning of the 1970s, economists were confronted by the

existence of “stagflation,” a situation of high unemployment combined with a rising inflation rate. Then, in the mid-1970s, inflation rose dramatically due to OPEC-created supply shocks that pushed up the price of oil. For many economists, standard Keynesian models which emphasized the aggregate demand for goods and services did not provide an adequate explanation of stagflation or of the impact of supply factors such as oil prices on economic activity.

In the early 1960s, opposition to the orthodox Keynesian view centered around the monetarist approach shaped by Milton Friedman and Karl Brunner. These economists contended that changes in the money supply were more potent than Keynesian economists believed. Monetarists also asserted that long and variable lags in both monetary and fiscal policy made active government intervention in the economy undesirable. Therefore, these economists attacked the use of government policies because they believed such policies, while effective, created undesirable outcomes.

In 1968, a major challenge to the standard Keynesian approach occurred when Milton Friedman and Edmund Phelps independently wrote about the natural rate of unemployment. This theory suggested that monetary policy might temporarily change the unemployment rate but that the unemployment rate would eventually return to its long-run level, the so-called natural rate of unemployment. This approach directly challenged the conventional Keynesian wisdom that monetary policy could permanently alter the unemployment rate, and so cast doubt upon the efficacy of monetary policy.

In the early 1970s, the natural rate theories were modified by Robert Lucas and Robert Barro. These economists agreed with the earlier natural rate theories that changes in the money supply could affect real variables, such as the unemployment rate, only when these money supply changes were unexpected. That is, expected changes in

the money supply would have no effect on real variables. In addition, these economists assumed that the public’s expectations about changes in the money supply are formed rationally. As a result, they concluded that monetary policy changes would always be expected and so would be unable to affect real variables. Thus, the traditional conclusion that both monetary and fiscal policies could be used to affect the nation’s economy faced another challenge.

Finally, around 1980, a group of economists using a theoretical approach similar to that of the rational expectations economists developed the real business cycle approach. This school rejects entirely two of the three conventional Keynesian views about business cycles. In particular, real business cycle theorists believe that most of the economy’s fluctuations are permanent rather than temporary in nature and they question the desirability of government policy designed to affect aggregate economic conditions. In addition, real cycle theorists doubt that the historical record provides much evidence about the ability of monetary policy to reduce the severity of business cycles, although they concur with the conventional wisdom that fiscal policies can affect real economic variables.

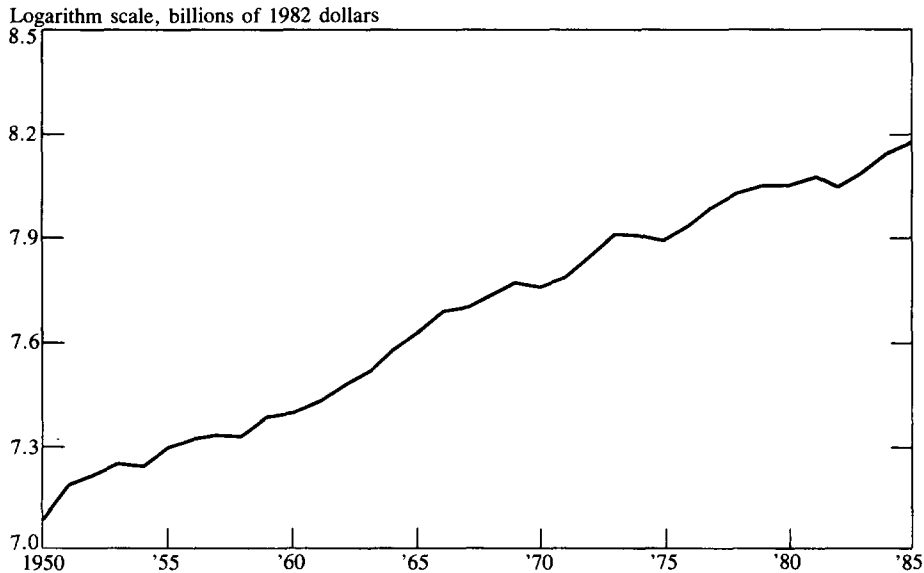
## **Real business cycle views**

### *The nature of the business cycle*

The idea that business cycles represent temporary movements around long-term trends may be the most strongly enshrined belief held by macroeconomists. Real business cycle advocates, however, dispute this claim. They contend that most fluctuations in variables such as real GNP are permanent rather than temporary.

The most basic economic difference between the traditional view and the real business cycle view results from the difference in the factors the two approaches see as responsible for changes

**CHART 1**  
**Real GNP: 1950-85**



in economic activity. Keynesian economists stress changes in aggregate demand as the primary source of economic fluctuations. Specifically, Keynesian economists emphasize random, temporary fluctuations in private investment and consumption spending as the primary cause of business cycles. These demand-side fluctuations can be offset—or, through error, augmented—by temporary changes in government policies that affect the demand for output.

Real cycle theorists generally emphasize aggregate supply as the cause of economic fluctuations. In the view of most real cycle theorists, changes in technology or economywide supply shocks—such as the OPEC-created oil shocks of the 1970s—are the major causes of fluctuations in economic activity. Changes in technology are generally permanent, and supply shocks may also be permanent. Thus, real cycle advocates see no compelling theoretical reason why business cycle

movements must be temporary rather than permanent.

The traditional approach, with its emphasis on temporary cycles, would appear to be supported by the data shown in Chart 1, which plots the logarithm of real GNP against time. Periods when GNP is temporarily above its trend appear to be followed by periods when it is temporarily below trend. Thus, the conventional analysis suggests that when GNP is above its trend, it will fall back; if it is below trend, it will rise so that fluctuations in GNP are temporary.<sup>1</sup>

<sup>1</sup> Following traditional methods by detrending the data using a regression of the logarithm of GNP on a constant and a time trend, the residuals from this procedure—which are the difference between actual and trend GNP—are significantly correlated, with a regression coefficient of 0.73. Thus, if last period's GNP was \$100 billion above its trend, on average this period GNP would be only \$73 billion above the trend. This suggests that any increase of GNP above its trend is temporary, as in succeeding periods GNP tends to fall back to the trend.

But, recent empirical research by Nelson and Plosser questions the validity of this traditional view.<sup>2</sup> Their research suggests that important economic variables, such as real GNP, exhibit very few temporary fluctuations. Instead, based on their examination of historical movements in GNP, Nelson and Plosser argue that most changes in GNP are permanent in the sense that there is no tendency for changes in GNP in one direction or the other to be automatically offset. Thus, if output is higher in one quarter, there is no reason to think that there will be a tendency for output to fall back to its trend in future quarters.

The motivation for this line of research lies in the idea that GNP evolves as a statistical process known as a "random walk." A random walk for GNP can be written as

$$(1) \text{GNP}_t = a + 1.0\text{GNP}_{t-1} + u_t$$

where the  $t$  and  $t-1$  subscripts identify different periods and GNP is measured in logarithms. From this equation, GNP in period  $t$  equals  $a$ , representing the yearly average growth in GNP, plus the previous period's GNP plus  $u_t$ , a term designed to capture random changes in GNP.

The random walk specification concludes that one-time fluctuations in  $u_t$  add permanently to the level of GNP. That is, an event that increases GNP this period will cause next period's GNP to be higher by an equal amount. The key element in this process is the magnitude of the coefficient on the previous period's GNP. For GNP to follow a random walk process, this coefficient must be equal to one. If this coefficient is less than one, any event that increases this period's GNP will increase next period's GNP by a smaller amount so that GNP movements can be described

as temporary.<sup>3</sup> On the basis of statistical tests, Nelson and Plosser cannot reject the hypothesis that the coefficient on last period's GNP is equal to one. Thus, their research supports the view that GNP follows a random walk.

It may seem difficult to believe that a random walk can capture the phenomenon of "cycles" that seem so apparent in Chart 1. However, data generated from a random walk do give the appearance of cycles. The data series shown in Chart 2 was artificially constructed using the random walk model in Equation (1).<sup>4</sup> Note the strong similarities in the behavior of actual GNP in Chart 1 and the constructed series in Chart 2. Both series grow steadily over time and there is the appearance of temporary business cycles. Looking more closely at Chart 2, between periods 17 and 23 is what appears to be a classic sort of temporary business cycle. In these periods there is an expansion in economic activity that eventually reaches its peak, followed by a contraction in economic activity that eventually reaches a trough, and then another expansion. Yet, data in Figure 2 were artificially constructed from a random walk specification. Hence, the appearance of a temporary "business cycle" in these data is purely spurious. Thus, it may not be easy to dismiss Nelson and Plosser's result that GNP behaves largely as a random walk, with only small temporary fluctuations.

The next section points out how the conclusion that most fluctuations in GNP are permanent has helped shape the views of real cycle advocates about the desirability of government economic policy. This result also has major consequences for the beliefs held by real cycle proponents about the effectiveness of monetary policy.

<sup>2</sup> For evidence on this point, see Charles R. Nelson and Charles I. Plosser, "Trends and Random Walks in Macroeconomic Time Series: Some Evidence and Implications," *Journal of Monetary Economics*, September 1982, pp. 139-160.

<sup>3</sup> This feature of a random walk is explained more fully in the accompanying example titled Box 1.

<sup>4</sup> To generate these data,  $a$  was set equal to 0.032 and the variance of  $u_t$  to 0.036. These approximate the trend growth rate and variance of the actual, real-world series of GNP. Then 30 random values for  $u_t$  were selected and equation (1) was used to obtain the numbers plotted in Chart 2.

## Box 1

### The Permanent Nature of Fluctuations in a Random Walk

The significant feature of the random walk specification is that random fluctuations in  $u_t$  add permanently to GNP. To illustrate this, suppose that  $u_t$  initially equals zero every year and that  $a$  equals 0.032, the average annual growth rate of real GNP in the United States since 1950. Then, starting with the logarithm of the actual value of real GNP in 1950, the random walk specification for GNP leads to constant growth in GNP at an annual rate of 3.2 percent per year. The solid line in Chart 3 illustrates this case.

A random movement in GNP is included by examining a second situation in which  $u_t$  does not equal zero for all the years. Let  $u_t$  in 1964 (and in only 1964) equal \$80 billion.\* Thus, as the dotted line in Chart 3 shows, GNP immediately jumps higher in 1964 because of the positive value for  $u_t$ .

Now consider how GNP in 1965 is affected by the change in 1964. The random walk process specifies that the logarithm of GNP for 1965 equals the logarithm of GNP in 1964 plus  $u_t$  for 1965. In 1965,  $u_t$  is zero but the logarithm of GNP in 1964 is larger than previously. Thus, the logarithm of GNP in 1965 is higher than in the first example—and by the same amount as in 1964. This process continues for 1966, 1967, and so on, so that the random, temporary increase in GNP during 1964 causes GNP to be permanently higher throughout the entire future, as shown by the dotted line.

The crucial feature of the random walk specification that leads to this permanence is that the coefficient on the past value of GNP equals one. If the coefficient is less than one—say 0.75—the random fluctuation in  $u_t$  leads to temporary changes in GNP.

If the coefficient on past GNP is 0.75, GNP in any period can be written as:

$$\text{GNP}_t = a + 0.75 \text{GNP}_{t-1} + u_t$$

In this case, the one-time increase in  $u_t$  for 1964 continues to raise GNP by \$80 billion. From the new formula in 1965, however, only 75 percent of GNP from 1964, or \$60 billion, of the initial \$80 billion increase feeds through into 1965. This continues so that only 75 percent of the \$60 billion, or \$45 billion, affects GNP in 1966, and so on. Thus, when the coefficient on past GNP is less than one, random fluctuations lead to temporary changes in GNP, not permanent changes.

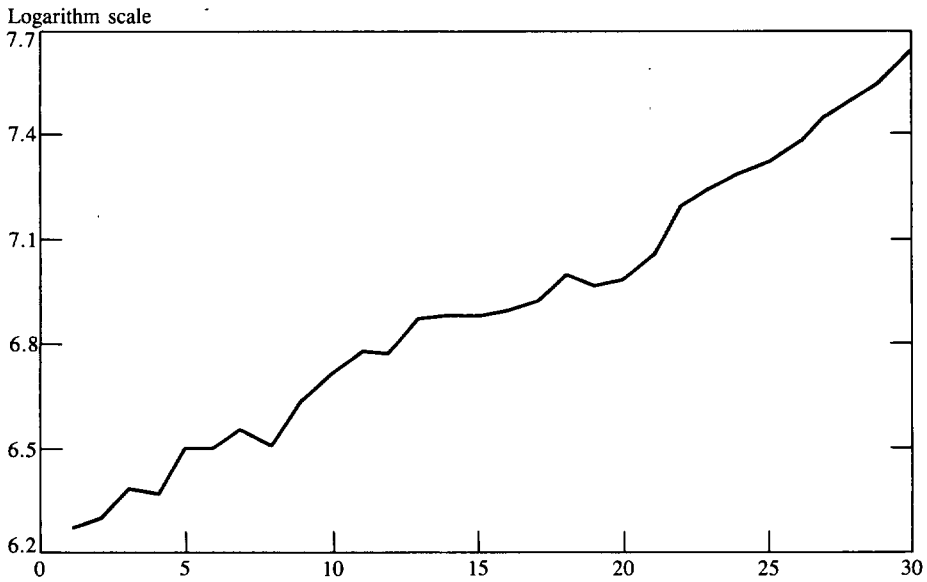
\*In terms of the logarithm scale, this value for  $u_t$  makes GNP in 1964 0.10 higher than it was in the first case.

### *The welfare costs of business fluctuations*

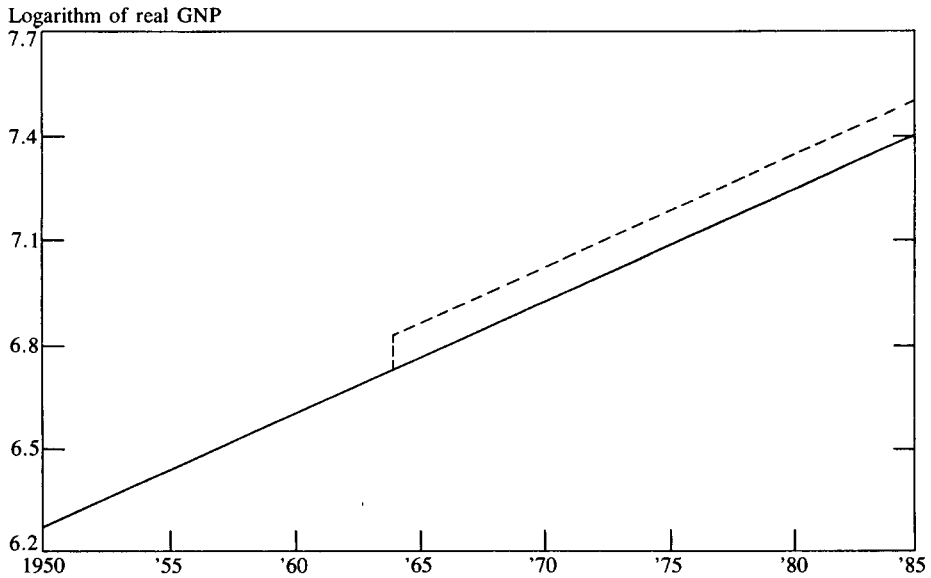
Real cycle theorists question the second postulate of the conventional wisdom, which asserts that business cycles harm the economy.

In particular, they advance the view that business fluctuations are a natural part of the nation's economy and are not necessarily harmful. Real cycle advocates believe that the inevitability of fluctuations in economic activity has led the

**CHART 2**  
**The evolution of a random walk**



**CHART 3**  
**The permanent nature of random fluctuations in a random walk**





private sector to develop and adopt ways of efficiently coping with these fluctuations. As a result, real cycle economists doubt whether the government should employ activist countercyclical policies.

Real business cycle theorists are especially critical of the microeconomic structure of markets underlying conventional Keynesian macroeconomic theory. The Keynesian approach emphasizes sticky wages that prevent the labor market from reaching the standard microeconomic equilibrium where the quantity of labor demanded equals the quantity supplied. In the Keynesian theory, the amount of labor supplied exceeds the amount demanded, with the difference between the supply and demand equal to involuntary unemployment. Involuntary unemployment involves a situation where unemployed workers are willing to work for lower wages than those that are currently prevailing and firms are willing to hire the workers if the firms can pay lower wages. However, the Keynesian approach assumes that sticky wages frustrate both workers and firms by preventing the necessary decline in wage rates. Because both workers and firms are harmed, the nation's welfare is unambiguously lowered.

This sort of harmful inefficiency obviously suggests a role for government policy whenever fluctuations in output increase involuntary unemployment. Thus, to combat a recession, it is useful to have a stimulative fiscal policy that raises the demand for output and hence increases the demand for the labor necessary to produce the output. These policies reduce the amount of involuntary unemployment and thereby raise the nation's well-being.

The welfare-enhancing role for the government in the sticky wage Keynesian theories contrasts sharply with results obtained by real business cycle proponents. Real business cycle macroeconomic models are based on conventional microeconomic models in which quantities are

determined by supply and demand in a competitive framework.<sup>5</sup> Fluctuations in output do not necessarily harm society, but simply represent the adjustment of markets to changes in tastes or conditions of production. Moreover, in the absence of externalities and public goods, conventional microeconomic theory also demonstrates that a competitive equilibrium is one in which it is impossible to rearrange matters so as to improve one person's lot without harming someone else. In real cycle models, all fluctuations in aggregate output represent this sort of optimal equilibrium. As a result, government policies designed to alter economic conditions cannot be justified on strictly economic grounds. Any change induced by the government must harm some people, so a value judgment as to the desirability of the change is required.

The use of competitive equilibrium analysis is the fundamental theoretical difference between real business cycle advocates and traditional Keynesians.<sup>6</sup> The theories presented by real cycle theorists are intimately related to their view that fluctuations are an inevitable part of the economy. If changes in economic activity are inescapable, real cycle proponents believe that the public will deal with the fluctuations so as to exhaust all mutually perceived opportunities for gains from trade. As a result, real cycle advocates see little role for activist government policies.

---

<sup>5</sup> For examples see Fynn E. Kydland and Edward C. Prescott, "Time to Build and Aggregate Fluctuations," *Econometrica*, November 1982, pp. 1345-1370, or John Long and Charles I. Plosser, "Real Business Cycles," *Journal of Political Economy*, February 1983, pp. 39-69, or Edward C. Prescott, "Theory Ahead of Business Cycle Measurement," *Quarterly Review*, Federal Reserve Bank of Minneapolis, Fall 1986, pp. 9-22.

<sup>6</sup> See Robert J. Barro, "Second Thoughts on Keynesian Economics," *American Economic Review*, May 1979, pp. 54-69, or Peter Howitt, "Conversations with Economists: A Review Essay," *Journal of Monetary Economics*, July 1986, pp. 103-118.

### *The effectiveness of government stabilization policies*

The third postulate of the conventional Keynesian wisdom suggests that both fiscal and monetary policies are able to affect the economy's real equilibrium. Real business cycle proponents partially agree. They do not dispute the ability of the government to use fiscal policy to alter real variables, although they would question the desirability of this policy.<sup>7</sup> In contrast to Keynesians, however, real cycle advocates deny that monetary policy actions have any significant effect on aggregate output and employment.<sup>8</sup>

Empirical studies of the U.S. economy seem to be the primary reason real business cycle proponents have concluded that changes in the money supply have no effect on real variables. Three separate types of evidence lead to this conclusion. The first is the work by Nelson and Plosser discussed above. This research concludes that most fluctuations in GNP are permanent. Most economists, including real business cycle proponents, accept the natural rate view that monetary policy cannot cause permanent changes in real variables. If monetary policy cannot have permanent effects on real GNP and most changes in GNP are permanent, the conclusion must be drawn that monetary policy does not have a large influence on real GNP.

<sup>7</sup> See Robert J. Barro, "Output Effects of Government Purchases," *Journal of Political Economy*, December 1981, pp. 1086-1121, or Robert J. Barro, *Macroeconomics*, John Wiley and Company, New York, second edition, 1987, for a discussion of the role of fiscal policy.

<sup>8</sup> In fact, Bennett McCallum has written "...that the distinguishing characteristic of real business cycle models is a denial that monetary policy actions have any significant impact on aggregate output and employment magnitudes." See Bennett McCallum, "On 'Real' and 'Sticky-Price' Theories of the Business Cycle," *Journal of Money, Credit and Banking*, November 1986, pp. 397-414.

The second type of study often referenced by real cycle advocates uses vector autoregressions or VAR's.<sup>9</sup> Most of the recent research using vector autoregressions concludes that changes in the money supply have no effect on real variables, such as real GNP and employment.<sup>10</sup> This conclusion is reached in two stages. First, if money is included in a VAR with a set of real variables and without an interest rate, money frequently emerges as a significant factor helping determine the real variables. However, if a nominal interest rate is also included among the variables in the VAR, changes in the growth rate of the money supply drop out as a significant factor explaining changes in the real variables.

<sup>9</sup> Given the large number of papers that use the VAR methodology, it likely has been even more influential in shaping the views of real business cycle theorists than Nelson and Plosser's article. Vector autoregressions involve estimating a system of equations in which each equation includes many lags of the dependent variable as well as lags of all the other variables in the system. For example, a typical VAR might include real GNP, a nominal interest rate, and the growth rate of the money supply. This system has three variables, so three equations would be estimated: one with real GNP as the dependent variable, one with the nominal interest rate, and one with the growth rate of the money supply. Each equation would include lags of the dependent variable as well as the other two variables so that, for example, the real GNP equation would have as regressors lagged values of real GNP, lagged values of the interest rate, and lagged values of the monetary growth rate.

Once the equations are estimated, there are two ways to measure the importance of a particular variable, say the growth rate of the money supply, in determining another variable, say real GNP. The first uses a standard F-test to calculate the statistical significance of the lagged monetary growth rate regressors in the estimated real GNP equation. The second procedure, called innovation accounting, determines the extent to which unpredicted changes in the monetary growth rate influence future values of real GNP.

<sup>10</sup> For examples and a complete exposition of vector autoregression methods, see Christopher A. Sims, "Macroeconomics and Reality," *Econometrica*, 1980, pp. 1-47, Christopher A. Sims, "Comparison of Interwar and Postwar Business Cycles: Monetarism Reconsidered," *American Economic Review*, March 1980, pp. 250-257, or Robert Litterman and Laurence Weiss, "Money, Real Interest Rates, and Output: A Re-interpretation of Postwar U.S. Data," *Econometrica*, 1985, pp. 129-156.

Real cycle advocates interpret these results as implying that changes in the money supply have no direct effect on real variables. Instead, changes in the interest rate are directly related to changes in the real variables. Therefore, while changes in the money supply may seem to affect real variables, it is only because money is related to the interest rate. In other words, any correlation between the money supply and such variables as real GNP is the result of omitting an important variable, the interest rate.

The third type of empirical study which leads real cycle proponents to doubt the efficacy of monetary policy also focuses on the correlation between GNP and the money supply. These studies suggest that any observed correlation between the money supply and real output is the result of reverse causation, wherein changes in real GNP cause changes in the money supply.<sup>11</sup> For example, some models have the feature that one component of the money supply—checking accounts—is an input into the production process created when financial institutions make loans. Thus, when GNP expands, checking accounts also expand as firms increase their demand for loans and money; when GNP contracts, so do checking accounts. These studies show that the component of M1 most highly correlated with GNP is checking accounts rather than currency or base money. Thus, it is argued that instead of money growth causing GNP to expand, GNP growth causes an increase in the money supply.

The net result of these three lines of research has led real business cycle proponents to the conclusion that policy-created changes in the money supply have no effect on real variables. Any relationship between money and real GNP is the result

<sup>11</sup> See Robert G. King and Charles Plosser, "Money, Credit, and Prices in a Real Business Cycle," *American Economic Review*, June 1984, pp. 363-380, and Robert G. King and Bharat Trehan, "Money: Endogeneity and Neutrality," *Journal of Monetary Economics*, November 1984, pp. 385-394.

of reverse causation and/or the omission of an important relevant variable, the interest rate.

### **Critiques of real business cycle theories**

Real business cycle theories have raised empirical and theoretical challenges to the conventional view of business cycles and the role of government stabilization policy. At the same time, real cycle theories have stimulated additional research, some of which is critical of the real cycle approach.

Much of the empirical support for the real view of business cycles is provided by Nelson and Plosser's work on the temporary versus permanent nature of the business cycle. However, this work has not gone unchallenged. Bennett McCallum has argued that Nelson and Plosser may have dramatically underestimated the extent of traditional, temporary changes in economic activity.<sup>12</sup> McCallum has strongly emphasized that Nelson and Plosser's empirical tests cannot distinguish between a random walk process, in which the lagged value of GNP affects the current value with a coefficient of one, and a process in which the coefficient is slightly less than one. McCallum points out that Nelson and Plosser's characterization of "small" temporary changes versus "large" permanent changes depends crucially on GNP evolving precisely as a random walk. McCallum shows that if the coefficient on the lagged value of GNP is only slightly less than one—say 0.98—Nelson and Plosser may underestimate the importance of temporary changes and overestimate the significance of permanent changes or very long-lasting changes by a factor of 25.

A second prominent real business cycle study by Kydland and Prescott has also been criticized. Kydland and Prescott develop an empirical ver-

<sup>12</sup> See McCallum, "On 'Real' and 'Sticky-Price' Theories," pp. 403-408.

sion of a real business cycle model in which technology shocks generate business cycle changes.<sup>13</sup> They demonstrate that with appropriate choice of the size of these technological fluctuations, their real cycle model reproduces important empirical regularities in postwar U.S. economic activity.

Critics of this model have focused on three issues. First, McCallum has noted that while Kydland and Prescott build a model in which money plays no role, they do not demonstrate that the addition of monetary variables would not improve the performance of the model.<sup>14</sup> Second, Kydland and Prescott choose the size of their technology shocks arbitrarily so as to generate output behavior that is close to actual experience. But, as McCallum notes, there is little knowledge of the actual magnitude of technology shocks. If actual technology changes are smaller than Kydland and Prescott assume, their model may not provide as good a description of the economy's behavior.<sup>15</sup> Third, Kydland and Prescott did not subject their model to standard statistical testing procedures. When other researchers tested their model, the model's theoretical restrictions were not supported.<sup>16</sup> Kydland and Prescott's model is fairly simple, so it is not surprising that it might be rejected. A more complicated real cycle model might not be as easy to reject, though one of the attractions of the real cycle approach is its simplicity.

The real cycle view that business fluctuations may not harm the economy has also been criticized. These criticisms center around the use of competitive equilibrium analysis in real cycle

research. Opponents of the real cycle ideas generally assert that use of competitive analysis is inappropriate because it ignores important aspects of reality that create inefficiencies. They argue that in the presence of the standard sort of assumed inefficiency, namely sticky wages or prices, standard competitive equilibrium analysis is incorrect.

Finally, the real cycle idea that monetary policy cannot affect real variables has also been attacked from two directions. First, several studies confirm a role for the money supply in determining real variables. These papers range from work that supports the rational expectations contention that only unexpected changes in the money supply can affect real output to research supporting the traditional view that all changes in the money supply, both expected and unexpected, influence real variables.<sup>17</sup> Although these studies were not designed to refute the real cycle view that all changes in the money supply are neutral, they implicitly provide evidence denying the real cycle assessment.

Second, a new line of research has emerged that attempts to confront directly real cycle views about the role of money. For instance, some studies have tested and rejected the proposition that the positive correlation between growth in the money supply and real GNP is explained by endogenous money responding to changes in real GNP. Other work has examined and rejected the hypothesis that unexpected changes in the base money supply have no effect on real variables.<sup>18</sup>

<sup>13</sup> Kydland and Prescott, "Time to Build and Aggregate Fluctuations."

<sup>14</sup> See McCallum, p. 400.

<sup>15</sup> See McCallum, p. 400.

<sup>16</sup> See Sumru Altug, "Gestation Lags and the Business Cycle: An Empirical Investigation," unpublished manuscript, University of Minnesota, 1985.

<sup>17</sup> See Robert J. Barro, "Unanticipated Money Growth and Unemployment in the United States," *American Economic Review*, March 1977, pp. 101-115, and Stephen G. Cecchetti, "Testing Short-run Neutrality," *Journal of Monetary Economics*, May 1986, pp. 409-424.

<sup>18</sup> See John F. Boschen and Leonard O. Mills, "Tests of the Relationship Between Money and Output in the Real Business Cycle Model," unpublished paper, Tulane University, August 1986, and Mark Rush, "Unexpected Money and Unemployment: 1920 to 1983," *Journal of Money, Credit and Banking*, August 1986, pp. 259-274.

Thus, these studies raise doubt about the real cycle view that monetary policy cannot affect real variables such as real GNP or unemployment.

### **Conclusion**

The new views put forth by proponents of real business cycles profoundly attack the conventional wisdom that business cycles represent temporary changes in economic activity, that business cycles

are harmful to the nation's well-being, and that activist government policy can be used to counter these cycles. At present, it is not clear which—if any—of these challenging new views will be upheld because they still require extensive additional testing and refinement before judgment can be passed. It is clear, however, that if any of these ideas are eventually upheld, the traditional view held by most macroeconomists will be subject to major change.