Economic Brief

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Monetary Policy with Unknown Natural Rates

By Thomas A. Lubik and Jessie Romero

The "unemployment gap" is an important factor in monetary policy decisions. But the size of the gap depends on the natural rate of unemployment, which is inherently unobservable. The uncertainty surrounding estimates of the natural rate, and the costs of mismeasuring it, may recommend a policy rule that responds to the rate of change in the actual unemployment rate rather than to the implied unemployment gap.

The Federal Reserve Act states that the objectives of monetary policy are to "promote effectively the goals of maximum employment, stable prices, and moderate long-term interest rates." It is unclear, however, how policymakers should weigh the objectives, and the tradeoffs between them, when making policy decisions. The Act does not explicitly define maximum employment, leaving it to policymakers to determine the level that is consistent with a stable and healthy economy. Such vagueness naturally invites debate about the proper course of monetary policy, particularly when emerging from a recession: Should policymakers be more concerned with the possible inflationary effects of expansive monetary policy or with the still-elevated unemployment rate? Put another way, should policy respond to the level of the unemployment rate or to how quickly it is changing?

Currently, inflation appears to be well-contained. Inflation expectations are at moderate levels, and despite a recent increase in commodity prices, most forecasters expect inflation to subside to about 1.5 percent over the course of the year. But some observers believe that inflationary pressures are close at hand, a belief that was supported by a rapid drop in the unemployment rate, from 9.8 percent to 8.8 percent, between November 2010 and March 2011. The decline included two consecutive months where the rate dropped four-tenths of a percentage point, a historically unprecedented fall compared to similar periods after other recessions. According to this view, the rapid rate of change in the unemployment rate would call for a tightening of monetary policy to forestall inflation.

On the other hand, the unemployment rate is still so elevated that even a full-percentage-point drop would barely put a dent in the nearly 14 million Americans still looking for work. The level of unemployment thus would warrant maintaining the current policy course. The unemployment rate rose to 9.1 percent in May 2011, renewing calls to not only continue current policy, but also to take new action.

The increase in April and May has somewhat put aside the question of whether policymakers should focus on growth rates or on levels, but as the economy continues to recover, the

question will undoubtedly arise again. Focusing on the growth-rates-versus-levels question, however, obscures a deeper issue. Finding the "right" answer depends on knowing something that is inherently unknowable: the natural rate of unemployment.

A New Keynesian View

Both arguments are based on a "New Keynesian" view of the economy. New Keynesian models, which are widely used in modern macroeconomic analysis, have at their core a relationship between prices and measures of economic activity. Firms set prices based on their costs of production, such as the cost of labor (wages). If demand increases, the demand for labor and other resources also rises, and firms would like to pass those costs on to consumers. In the New Keynesian model, firms also set their current prices based on their expectations of future inflation. Since a firm may not be able to change its prices for a while, if it expects inflation to increase, it will set its current price higher to offset the effects of future inflation.

The idea that prices are hard to change is an example of what economists call "nominal rigidities." Nominal rigidities in wages and prices are important elements in New Keynesian models and allow economists to explain the "non-neutrality" of money. If prices and wages adjust instantaneously, changes in the money supply shouldn't have any effect on real variables, such as employment or output. But if prices are difficult to change, then a firm may respond to a change in the money supply by changing its production or employment levels. In New Keynesian models, changes in the money supply can lead to changes in real economic activity, and, conversely, changes in real economic activity can lead to inflation.[1]

A key insight of modern macroeconomic theory, and the key to inflation dynamics in New Keynesian models, is the idea that movements in real quantities matter for inflation dynamics only to the extent that they depart from their potential or natural levels. The potential level of output is the level an economy could achieve if product and factor markets were perfectly competitive. But in practice, a more realistic measure is the natural level of output, which assumes that markets are imperfectly competitive. The natural rate of unemployment is then the rate consistent with output being at its natural level. The rate is not zero because there are "frictions" in labor markets: It takes time for workers and firms to find each other, so at any given moment there are a certain number of unemployed workers looking for jobs and firms looking for workers.

The difference between the actual and natural levels of unemployment is called the "unemployment gap," a measure of the degree of slack in the economy. If inflation is driven by real marginal costs, then a large and positive unemployment gap keeps wages lower and constrains inflationary pressures. This logic seems to support the argument that the Federal Reserve should continue to pursue expansionary monetary policy: The high unemployment rate means that there is a large unemployment gap dampening the inflationary effects of the Fed's quantitative easing programs. But the size of the unemployment gap depends on the level of the natural rate—and that level is impossible to observe .

Estimating the Natural Rate

The natural rate of unemployment is not an objective fact; economists cannot simply measure it. It is a theoretical or empirical construct that has to be inferred from observable data. A variety of theoretical and statistical models have been used to estimate the natural rate, and there is considerable debate about the precision of those methods.[2] A comparison of 12 different natural rate estimates at six points between 1960 and 2000 shows that the range of estimates averages 2.14 percentage points. The widest of the six ranges was 3.6 percentage points in 1980.[3]

Broadly, there are two competing approaches to computing the natural rate. One approach is almost purely statistical and tends to treat the natural rate as a slow-moving trend. It is predicated on the idea that there is a normal average growth path to which the economy returns over the course of the business cycle. This is commensurate with a natural unemployment rate that is determined purely by structural

factors, such as the availability and generosity of unemployment benefits and the efficiency with which employers and job seekers find each other. Under this approach, the natural rate is typically measured as a linear trend (in the case of GDP) or as the smooth trend component from the Hodrick-Prescott (HP) filter, named for Robert Hodrick and Edward C. Prescott, the economists who developed it.

An alternative statistical approach is to extract the natural rate as an "unobserved component" from a regression analysis that looks for the best predictor of inflation movements as explained by the unemployment or output gap. The resulting natural rate is invariably fairly smooth, as movements in inflation are captured by movements in the gap of similar magnitude.

One commonly cited statistical estimate is the "non-accelerating inflation rate of unemployment," or NAIRU, calculated by the Congressional Budget Office (CBO). The NAIRU is the level of unemployment consistent with stable inflation. It is calculated by backing out an unemployment rate from other economic variables based on a Phillips-curve relationship between inflation and unemployment. The CBO views the NAIRU as a stable long-run trend. Its estimate has declined by only 1 percentage point since 1980, from 6.2 percent to 5.2 percent, and the CBO currently projects the NAIRU to remain at 5.2 percent for the next decade.[4]

The HP filter suggests more variation in the natural rate. The HP-filtered rate declined nearly 3 percentage points between 1980 and 2000, from 7.4 percent to 4.6 percent, and this method currently puts the natural rate at 6.6 percent.

The competing approach to calculating the natural rate assumes that the natural rate is subject to the same shocks that affect business cycles, causing the rate to vary considerably over time. In this view, the natural rate is the hypothetical outcome of an idealized economy in the absence of any nominal rigidities, such as price or wage stickiness. These rigidities prevent the economy from attaining a desirable equilibrium and thus impose a deadweight loss, which monetary policymakers should strive to avoid. This estimated natural rate is still buffeted by unavoidable real shocks, such as cyclical changes in productivity or oil price movements, and is less smooth than purely statistical measures.

A theoretical model developed by one of the authors of this brief (Lubik)[5] estimates the natural rate from a New Keynesian model with search and matching frictions in the labor market. Natural unemployment is generated as employers search for workers and unemployed people search for jobs. Not every searcher finds a partner in the matching process, which generates equilibrium unemployment. Using this model, the natural rate of unemployment in the first quarter of 2011 was estimated to be 7.9 percent, which is considerably higher than the rates estimated by other methods. This is mainly accounted for by a substantial drop in productivity during the Great Recession. (A drop in productivity lowers the natural rate of output, which raises the natural rate of unemployment.) This estimate of the natural rate also implies that the unemployment gap is much smaller than commonly believed. The figure on page 4 compares the model's natural rate with the CBO rate and the actual unemployment rate.

Policy Choices with Unknowns

The wide variations in natural rates described above occur even when economists are calculating the rates "ex post," with the luxury of examining the data after the fact. Policymakers face the additional challenge of making their calculations in real time.

This challenge is illustrated by the stagflation of the 1970s, according to Athanasios Orphanides, formerly of the Federal Reserve Board of Governors and now governor of the Central Bank of Cyprus. Economists studying the era ex post have concluded that the Fed should have implemented much tighter policy than it did. In a 2002 paper, Orphanides evaluates the decisions using Greenbook data that were available to the Federal Open Market Committee (FOMC) in real time, and concludes that policymakers actually

were setting policy that would have corresponded to a forward-looking Taylor rule, based on the available data.[7] But the real-time estimates of the natural rate of unemployment were more than a full percentage point lower than what economists now believe the natural rate was. FOMC members thus set policy that attempted to address a non-existent unemployment gap, leading to high inflation.

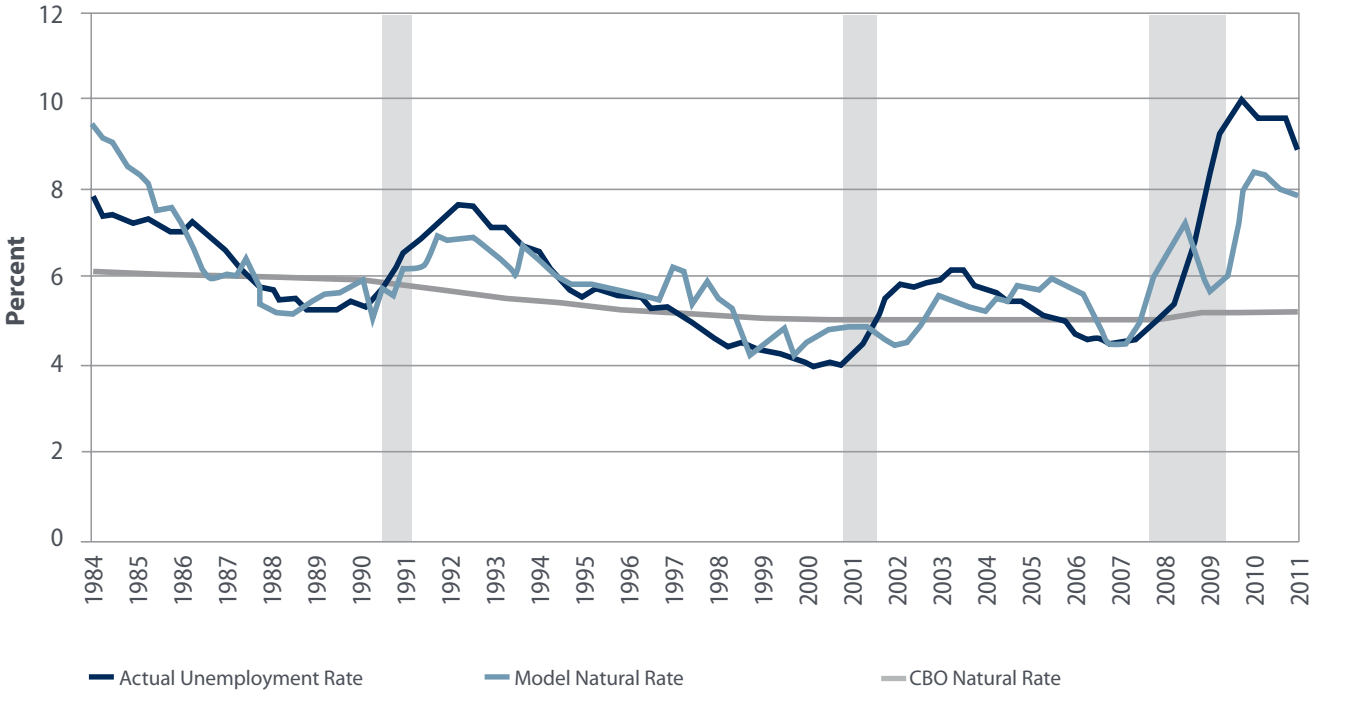
Policy rules designed to account for mismeasurement of the natural rate may not lead to better outcomes; given that the natural rate itself is unknown, the degree of mismeasurement is also unknown. In another 2002 paper, Orphanides and John Williams of the San Francisco Fed compare the performance of policy rules that are designed to accommodate varying degrees of natural rate mismeasurement. They find that the costs of underestimating the uncertainty are much higher than the costs of overestimating it. In other words, policymakers are better off assuming a high degree of inaccuracy in their calculations.

To protect against such errors, Orphanides and Williams suggest a difference rule that responds to changes in inflation and observable economic activity instead of responding to deviations from target variable levels. In their model, this rule mathematically eliminates the error that is introduced by incorrectly specifying the level of the unknowable natural rate. Such a rule may not be "optimal"—it may not deliver the best performance—in an environment where policymakers have precise knowledge about the degree of natural rate mismeasurement, but it ensures against major mistakes when such knowledge is absent.

Has the Natural Rate Risen?

Some economists believe there is evidence that the natural rate of unemployment has risen following the 2007–09 recession, citing the continued high unemployment rate and very low exit rates from unemployment.[8] The persistence of long-term unemployment also suggests that the natural rate may have increased. On average, the longer a worker

Actual and Natural Unemployment Rates



Note: Data are quarterly; 2011 data are first quarter only. Shaded areas denote recessions.
Sources: Bureau of Labor Statistics, Haver Analytics, Lubik's calculations

is unemployed, the less likely it is that he or she will find work, as Lubik explains in an essay with fellow Richmond Fed economist Andreas Hornstein.[9] Long-term unemployed workers may effectively become unemployable and leave the labor force, making the pool of potential hires smaller than it appears from the raw unemployment numbers alone. The natural rate of unemployment may thus be higher, and the unemployment gap narrower, limiting its dampening effect on inflation.

Many observers are understandably apprehensive that tightening monetary policy too soon or too quickly could put the brakes on the already slow recovery. Fed policymakers also remain concerned about the millions of Americans still looking for work. But in the long run, monetary policy is likely to have the most effect on employment and economic growth by maintaining its commitment to price stability. Whether or not the natural rate has risen, the uncertainty surrounding its measurement—and the costs of mismeasuring it—may recommend a policy rule that responds to the rate of change in the unemployment rate, rather than to its absolute level and the implied unemployment gap. ■

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Endnotes

[1] For further explanation, see Andreas Hornstein, "Introduction to the New Keynesian Phillips Curve," Federal Reserve Bank of Richmond *Economic Quarterly*, Fall 2008, pp. 301-309.

[2] For a discussion, see Douglas Staiger, James H. Stock, and Mark Watson, "How Precise Are Estimates of the Natural Rate of Unemployment?" in *Reducing Inflation: Motivation and Strategy*, edited by Christina D. Romer and David H. Romer, University of Chicago Press, 1997.

[3] Athanasios Orphanides and John C. Williams, "Robust Monetary Policy Rules with Unknown Natural Rates," *Brookings Papers on Economic Activity*, 2002, vol. 2, pp. 63-118.

[4] See Table 2-1 in "Budget and Economic Outlook: Fiscal Years 2011 to 2021," Congressional Budget Office, January 2011, available at http://www.cbo.gov/ftpdocs/120xx/doc12039/SummaryforWeb.pdf. For a discussion of the CBO's method, see Robert Arnold, "CBO's Method for Estimating Potential Output: An Update," Congressional Budget Office, 2001, available at http://cbo.gov/ftpdocs/30xx/doc3020/PotentialOutput.pdf.

[5] See Thomas A. Lubik, "Estimating a Search and Matching Model of the Aggregate Labor Market," Federal Reserve Bank of Richmond *Economic Quarterly*, Spring 2009, vol. 95, no. 2, pp. 101-120, and Michael U. Krause, David Lopez-Salido, and Thomas A. Lubik, "Inflation Dynamics with Search Frictions: A Structural Econometric Analysis," *Journal of Monetary Economics*, July 2008, vol. 55, no. 5, pp. 892-916.

[6] See Athanasios Orphanides, "Monetary Policy Rules and the Great Inflation," *American Economic Review*, May 2002, vol. 92, no. 2, pp. 115-120.

[7] The Taylor rule was developed by Stanford economist John Taylor in 1993. Although FOMC members in the 1970s would not have had the Taylor rule to guide their decision making, it has been a useful tool for economists to evaluate the policies of previous eras. For example, see John P. Judd and Glenn D. Rudebusch, "Taylor's Rule and the Fed: 1970–1997," Federal Reserve Bank of San Francisco *Economic Review*, 1998, no. 3, pp. 3-16.

[8] See Renee Courtois, "The New Normal? Economists ponder whether the natural rate of unemployment has risen," *Region Focus*, First Quarter 2010, pp. 12-16.

[9] Andreas Hornstein and Thomas A. Lubik, "The Rise in Long-Term Unemployment: Potential Causes and Implications," Richmond Reserve Bank of Richmond *2010 Annual Report*, pp. 4-23.