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## A Changing Natural Rate of Unemployment: Policy Issues

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*Congressional Research Service*

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## A Changing Natural Rate of Unemployment: Policy Issues

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### Comments

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# CRS Report for Congress

## A Changing Natural Rate of Unemployment: Policy Issues

March 15, 2004

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Prepared for Members and  
Committees of Congress



# A Changing Natural Rate of Unemployment: Policy Issues

## Summary

A concept that is fundamental to our understanding of the economy is that there is an equilibrium, market-clearing rate of unemployment determined by labor market characteristics, policy, and conditions. This rate of unemployment is referred to as the “natural rate” or “full employment rate” of unemployment or the NAIRU (non-accelerating inflation rate of unemployment). Although expansionary fiscal or monetary policy might be able to temporarily push unemployment below the natural rate in exchange for higher inflation, eventually actual unemployment would rise back to the natural rate without inflation falling. This concept is consistent with the view that monetary policy has no long run effect on real variables such as economic growth or unemployment, and affects only prices in the long run. If unemployment did not return to a natural rate, it would imply that monetary policy could permanently affect unemployment.

There are periods of U.S. history when a constant natural rate concept cannot explain the behavior of unemployment and inflation. For example, in the 1970s inflation rose although unemployment was above estimates of the natural rate, and in the 1990s inflation fell although unemployment was below estimates of the natural rate. A more sophisticated theory is needed to explain these periods. Since the natural rate is determined by the characteristics of the labor market, it is possible that changes in the labor market lead to changes in the natural rate over time. For example, an aging workforce, unexpectedly rapid productivity growth, policy changes, and a growing temporary workforce are some of the factors that could have led to a decline in the natural rate in the 1990s. In this view, at any given moment, there is some natural rate of unemployment, below (above) which inflation will rise (fall), but that rate may be different from the natural rate in the past or future because of labor market changes. It is estimated that the natural rate rose during the 1970s and 1980s, and fell back to earlier levels in the 1990s.

Although there is no theoretical drawback to the concept of a changing natural rate, economists have been unsuccessful in empirically predicting when changes would take place. This leaves the theory open to the criticism that rather than offering a meaningful explanation of the empirical record, it does little more than offer post hoc rationalization for contradictory results. Any natural rate estimate must be accompanied by a wide range of uncertainty – some research suggests a natural rate of 5.9%, with a 95% confidence interval of 3.9% to 7.6%. Yet alternative theories to the natural rate have done little better at explaining or predicting economic outcomes. The unpredictability of a changing natural rate suggests that excessive weight should not be placed on the gap between actual unemployment and natural rate estimates in fiscal and monetary policy decisions. The natural rate is probably most useful to policymakers as one of many economic indicators that can predict changes in inflation or the business cycle. Although changes in the natural rate have not been successfully predicted, it would be difficult to make systematic policy decisions without some notion of full employment. This report will not be updated.

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# A Changing Natural Rate of Unemployment: Policy Issues

Decisions to tighten or ease fiscal or monetary policy rely heavily on the economy's position relative to a concept of "full employment," or how much of the economy's labor and capital resources are employed compared to potential resources. Central to determining full employment is the concept of a natural rate of unemployment. When actual unemployment is below (above) the natural rate, it suggests that the economy is operating above (below) full employment and policy should be tightened (eased) to prevent inflation from accelerating (decelerating). Thus, a reliable estimate of the natural rate plays an important role in macroeconomic stabilization policy decisions. This report discusses problems in estimating the natural rate.

## The Natural Rate Concept

In the 1960s, economists Milton Friedman and Edmund Phelps independently developed the concept of a "natural rate" of unemployment or "full employment" rate of unemployment or NAIRU (non-accelerating inflation rate of unemployment.)<sup>1</sup> They posited that there was an equilibrium, market-clearing rate of unemployment determined by labor market characteristics, policy, and conditions. This natural rate will be greater than zero since, at any given point of time, there will always be some people in the process of moving from one job to another, and some people who are in the wrong place at the wrong time for the jobs available.

Although expansionary fiscal or monetary policy may be able to temporarily push unemployment below the natural rate in exchange for higher inflation, eventually actual unemployment would rise back to the natural rate without inflation falling. This concept is consistent with the view that monetary policy has no long run effect on real variables such as economic growth or unemployment, and affects only prices in the long run. If unemployment did not return to a natural rate, it would imply that monetary policy could permanently affect unemployment, and workers suffered from "money illusion" (their wage demands were influenced by nominal instead of real price changes).<sup>2</sup>

In recessions or periods of sluggish growth, unemployment rises above the natural rate and inflation is expected to fall. Thus, estimating the natural rate requires

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<sup>1</sup>Milton Friedman, "The Role of Monetary Policy," *American Economic Review*, March 1968, p. 1; Edmund Phelps, "Money-Wage Dynamics and Labor-Market Equilibrium," *Journal of Political Economy*, vol. 76, part 2, July/Aug. 1968, p. 678.

<sup>2</sup>For more information, see CRS Report RL30391, *Inflation and Unemployment: What Is the Connection?*, by Brian Cashell.

stripping out cyclical factors, including both the increase in unemployment that occurs in recessions and the decrease that occurs when the economy has been temporarily pushed beyond full employment.

## A Changing Natural Rate?

A cursory look at the U.S. experience over the past 30 years seems to belie the existence of a natural rate of unemployment, as seen in Table 1. Over long periods of time, business cycle effects should cancel out and the average unemployment rate should be close to the natural rate. Yet the average unemployment rate by decade has varied significantly, ranging from a low of 4.5% in the 1950s to a high of 7.3% in the 1980s. Regressions for the period 1960-2000 yield a constant natural rate of unemployment of 6.1%, which seems unrealistically high for both the 1990s and the 1950s-1960s.<sup>3</sup> In particular, the experience in the late 1970s – rising inflation although unemployment was above natural rate estimates – and the late 1990s – falling inflation although unemployment was below natural rate estimates – seem at odds with the natural rate concept.

**Table 1: Annual Unemployment Rates, 1950-1999**  
(Percent)

Decade	Average	Low	High
1950-1959	4.5	2.9	6.8
1960-1969	4.8	3.5	6.7
1970-1979	6.2	4.9	8.5
1980-1989	7.3	5.3	9.7
1990-1999	5.8	4.2	7.5

**Source:** Bureau of Labor Statistics

The variance in unemployment over time could suggest that the natural rate concept is incorrect, or it could suggest that the natural rate varies over time. The natural rate is determined by labor market conditions; since labor market conditions change over time, so could the natural rate.<sup>4</sup> If this were the case, the unemployment rate would always return to the natural rate, as the original theory suggests, but at any given point in time, unemployment would be reverting to a unique natural rate. This is the view taken by Federal Reserve Chairman Alan Greenspan in recent hearings:

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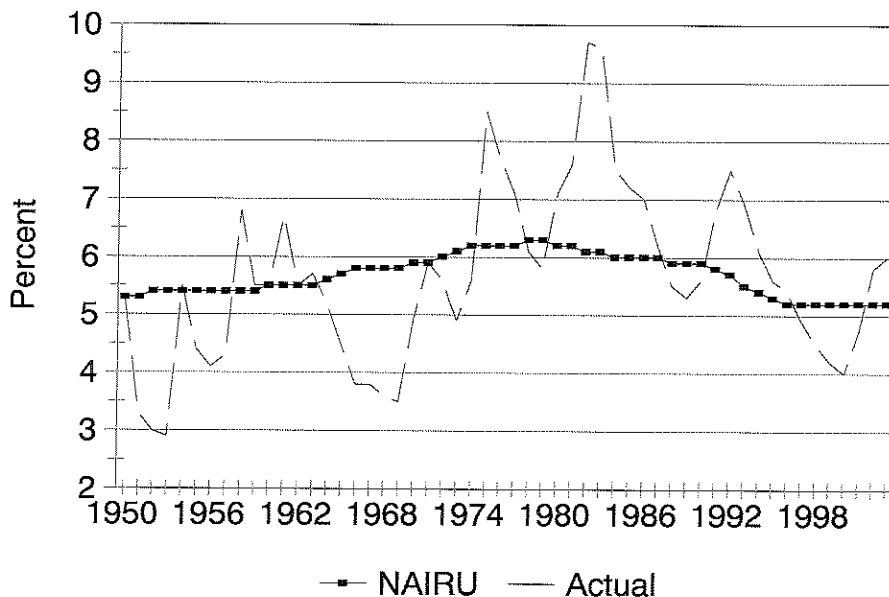
<sup>3</sup>Laurence Ball and Greg Mankiw, "The NAIRU in Theory and Practice," *National Bureau of Economic Research working paper 8940*, May 2002.

<sup>4</sup>Milton Friedman acknowledged this view in his original formulation of the theory: "To avoid misunderstanding, let me emphasize that by using the term "natural" rate of unemployment, I do not mean to suggest that it is immutable or unchangeable. On the contrary, many of the market characteristics that determine its level are man-made and policy-made." From Friedman, *Op Cit.*, p. 9.

Well, [full employment] varied over time. Remember in the early part of the post-World War II period, the general view was that, indeed, 4% was the unemployment rate which was consistent with price stability. It then altered very significantly during the 1970s and the 1980s and it has since come probably almost all the way back down to where it was in the early part of the post-World War II period.<sup>5</sup>

This is the mainstream view in economics today. For example, a natural rate concept underlies the Congressional Budget Office's economic projections, and a new natural rate estimate is calculated each year. CBO's changing estimate of the natural rate is plotted in Figure 1. Figure 1 illustrates that even with a changing natural rate estimate, actual unemployment is still rarely equal to the natural rate.

**Figure 1: Actual Unemployment and CBO's Estimate of the Natural Rate, 1950-2002**



Source: Congressional Budget Office

<sup>5</sup>Alan Greenspan, *Monetary Policy Hearings*, House Financial Services Committee, 108<sup>th</sup> Congress, February 11, 2004.



## Potential Causes of a Falling Natural Rate in the 1990s

From the mainstream perspective, the 1970s and 1980s were a period of a rising natural rate, and the 1990s were a period of a falling natural rate. The 1990s decline caught most economists by surprise.<sup>6</sup> What could have caused the natural rate to fall in the 1990s? A number of theories have been advanced:<sup>7</sup>

**High Productivity Growth.** “Unit labor costs” is a measurement that compares the value of output to the cost of labor input. By definition, whenever productivity increases more rapidly than wages, unit labor costs fall. Lower unit labor costs increase the firm’s profitability, thereby typically increasing the firm’s demand for labor. In the late 1990s, there was a sudden and unexpected rise in the labor productivity growth rate, from 1.4% in 1974-1995 to 2.5% in 1996-2000. It has been hypothesized that because workers cannot easily or instantaneously identify changes in their productivity, they may have been slow to adjust their wage demands to reflect higher productivity growth rates. If this was the case, unemployment and the natural rate would have temporarily fallen in the late 1990s as unit labor costs fell. A similar story can be told about long-term wage contracts, under which wages would not adjust to the change in productivity until a new contract was negotiated. Notice that this decline in the NAIRU would only be temporary: once workers became aware of the increase in their productivity growth rates, other things being equal, they would adjust their wage demands and unit labor costs would rise back to an equilibrium level, removing the incentive for firms to take on more workers.<sup>8</sup>

If this scenario occurred in the late 1990s, labor productivity should have grown more rapidly than real worker compensation. As can be seen in Figure 2, this has been the case. In only two of the last 10 years, 1998 and 2000, has real compensation grown more quickly than productivity, suggesting that workers did not fully incorporate actual productivity growth into their compensation demands in the short term. Compensation has still not caught up to more rapid productivity gains that began several years ago.

Also supportive of this theory is the experience of the 1970s and 1980s. Just as increases in productivity growth may temporarily reduce the NAIRU, decreases in productivity growth may temporarily increase the NAIRU. And indeed, the apparent increase in the natural rate in the 1970s and 1980s coincided with a slowdown in productivity growth. From 1949-1973, labor productivity grew at an average of 2.9% a year; it then slowed to an average of 1.4% from 1974-1995. The unemployment rate at the trough of the 1973-1975 recession was higher than the past,

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<sup>6</sup>For example, a Federal Reserve Bank of Kansas City study forecast a NAIRU of 6.3% in 2000. Stuart Weiner, “New Estimates of the Natural Rate of Unemployment,” *Economic Review*, Federal Reserve Bank of Kansas City, Oct. 1993, p. 53.

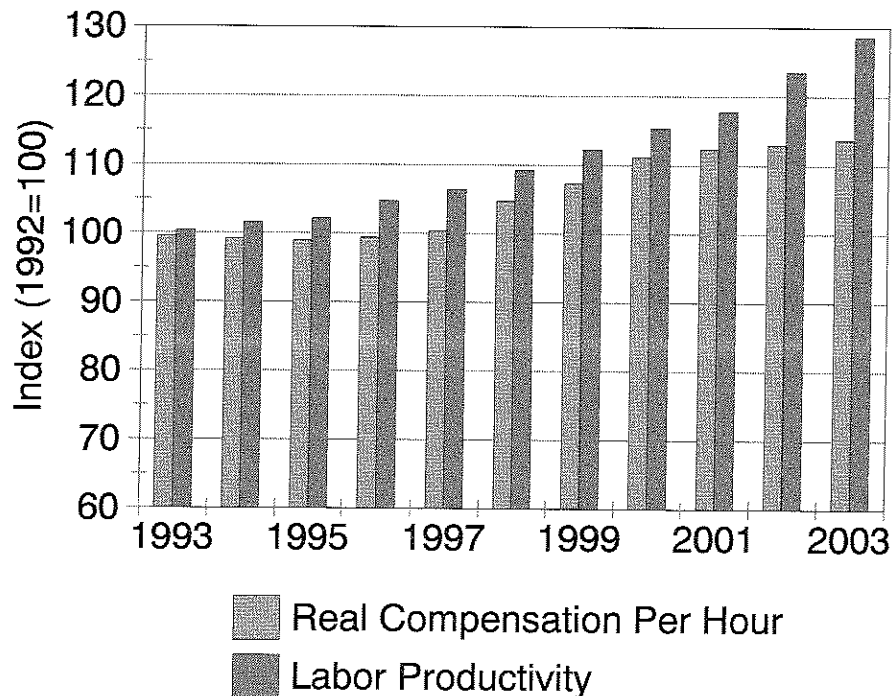
<sup>7</sup>See also Congressional Budget Office, *The Effects of Changes in Labor Markets on the Natural Rate of Unemployment*, April 2002. Interestingly, CBO did not incorporate the changes influencing the natural rate described in this report in its estimate of the natural rate.

<sup>8</sup>*Economic Report of the President*, Feb. 2000, p. 90.

and it remained higher relative to comparable points in past business cycles during the next two expansions and recoveries.

This theory does not seem consistent with the experience during the 2001 recession and subsequent recovery, however. In this period, productivity growth also rose unexpectedly rapidly, yet employment fell for 20 months after the recession had ended, and fell 2.6 million from peak to trough. Perhaps this experience is consistent with the theory if one argues that, several years after the productivity spurt had first begun, by 2001 workers had completely adjusted their wage demands to take the productivity spurt into account. But the data do not support this view: productivity has continued to grow more rapidly than real compensation since 2001. The comparison is not straightforward, however, because weakness in the labor market since 2001 has held down compensation growth.

**Figure 2: Labor Productivity and Real Worker Compensation**



Source: Bureau of Labor Statistics

**Labor Market Policy Changes.** Some policymakers point to changes in labor market policy in the 1990s as a potential cause of the decline in the NAIRU. For example, if welfare reform increased the incentives to seek work, it could have expanded the pool of labor available to employers and lowered the unemployment rate consistent with stable inflation.<sup>9</sup>

<sup>9</sup> One problem with this theory is that only those workers who have actively sought work in the last month are classified as unemployed; otherwise individuals who are not working are classified as “not in the labor force.” Welfare reform may have largely affected individuals  
(continued...)

Whether or not policy changes have affected the NAIRU, it would be difficult to measure the relationship empirically. Policy changes cannot be easily quantified and are not conducive to time series analysis (a one-time policy change gives the statistician only one data observation.) Therefore, it is difficult to say with any degree of confidence that evidence exists proving or denying the hypothesis that policy changes have had a significant influence on the natural rate.

**Demographic Changes.** It has been noted that younger workers consistently have higher unemployment rates than older workers. This could be because older workers have more experience, more “human capital,” and different preferences for employment stability. This suggests that demographic shifts toward an older workforce could lower the overall unemployment rate since the proportion of older, low-unemployment workers in the labor force is greater. There is some evidence of this, as the baby boomers were young workers in the high natural rate decades of the 1970s and 1980s, but have now reached a low unemployment age. The percentage of workers 16-24 years of age, the group with the highest unemployment rate, had fallen from 25% in 1978 to about 16% in 2000.<sup>10</sup> Economist Robert Murphy recalculated the 1998 unemployment rate based on a population demographically similar to the 1979 population. This raised the unemployment rate by 0.6 percentage points – not likely enough to account for the entire change in the natural rate, which may have fallen 0.5-2.0 percentage points over those years.<sup>11</sup> Katz and Krueger estimate that demographic change can account for one quarter of the decline in the NAIRU.<sup>12</sup>

Higher incarceration rates are another demographic factor that could affect the natural rate. Katz and Krueger have also suggested that many young, low-skill individuals who would have been unemployed in the past are now in prison instead and not counted as part of the labor force. Between 1990 and 1999, the incarcerated population grew at an average rate of 5.7% annually, resulting in a doubling of the prison population over that time.<sup>13</sup> As a result, they estimate the NAIRU fell by 0.17 percentage points since the mid 1980s.

Rising disability claimant rates offer another explanation for why the natural rate has fallen. If the disabled are more likely to be unemployed than the rest of the population, more workers claiming disability could push the natural rate down. The

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<sup>9</sup>(...continued)

who were officially classified as “not in the labor force,” leaving the NAIRU unchanged.

<sup>10</sup>Council of Economic Advisors, *Economic Report of the President*, 2000, p.88.

<sup>11</sup>Robert Murphy, “Accounting for the Recent Decline in the NAIRU,” *Business Economics*, April 1999, p.33.

<sup>12</sup>Lawrence Katz and Alan Krueger, “The High Pressure U.S. Labor Market of the 1990s,” *Brookings Papers on Economic Activity 1*, Brookings Institute, (Washington: 1999), p. 1. Phelps and Zoega, using data through 1995, found demographics to have a smaller effect. Edmund Phelps and Gylfi Zoega, “The Rise and Downward Trend of the Natural Rate,” *American Economic Review*, vol. 87, n. 2, May 1997, p. 283.

<sup>13</sup>US Department of Justice, Bureau of Justice Statistics, [<http://www.ojp.usdoj.gov/bjs/correct.htm>]

percentage of the non-elderly population claiming disability rose from 3.1% in 1984 to 5.3% in 2000. Autor and Duggan found that this change explained 0.64 percentage points of the recent fall in unemployment.<sup>14</sup>

Unlike some other factors driving the natural rate, demographics are easily quantified and empirical correlation can be easily measured. Murphy points out that the timing of these explanations does not quite correspond to the fall in unemployment. The demographic shift and the rising incarceration rate were both well underway in the late 1980s, before there was a noticeable decline in the NAIRU.

**Changes in Labor Market Matching.** Economists often think of unemployment as part of a matching process, where unemployment lasts until the right worker finds the right job. In this view, the duration of unemployment depends on how quickly workers can be matched with jobs that well suit their skills and desires. It has been suggested that recent developments in the labor market could have improved the matching process, thereby reducing the duration of unemployment, and in turn, the natural rate of unemployment. These factors include the expansion of temporary employment, greater regional mobility, the role of the Internet in job seeking, and a generally more flexible attitude toward job switching.<sup>15</sup> While these factors may play an important role in determining the natural rate, they are, to varying degrees, unquantifiable and therefore difficult to properly take into account in empirical estimates of the natural rate. The most quantifiable factor, temporary employment, has been estimated to have a modest effect on the natural rate. A Federal Reserve study found that temporary unemployment could explain 0.28 percentage points of the fall in the NAIRU from 1979 to 1993, and Katz and Krueger estimated that it lowered the NAIRU by 0.39 percentage points in the 1990s.<sup>16</sup>

**Back to the Future?** Unemployment rates seen in the late 1990s were similar to the average unemployment rate in the 1950s and 1960s. This suggests that the natural rate today may also be similar to those decades. If so, is this a coincidence or do these eras share something in common? An older population and high productivity growth rates suggest some commonality – the proportion of workers age 16-24 was 17% in 1960, compared to 16% in 2000. Some would argue that welfare reform was a reversal of the expansion of the social safety net that began with the Great Society programs of the late 1960s. On the other hand, other factors, such as the growing role of temporary employment and the Internet in our labor market or rising incarceration and disability rates, suggest that any similarity to the 1950s and 1960s is merely coincidental.

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<sup>14</sup>David Autor and Mark Duggan, "The Rise in Disability Reciprocity and the Decline in Unemployment," *National Bureau of Economic Research working paper 8336*, June 2001.

<sup>15</sup>For more information on regional factors, see Murphy, *Op Cit*.

<sup>16</sup>For more information on the role of temporary employment, see Maria Woo Otoo, "Temporary Employment and the Natural Rate of Unemployment," *Finance and Economics Discussion Paper 66*, Federal Reserve Board, December 1999.

## **The Jobless Recovery – Could the Natural Rate Be Responsible?**

Employment fell for an unprecedented 20 months after the 2001 recession had ended. One possible reason why is that the natural rate was rising during this time. During a period when the natural rate was rising, a prolonged sluggish labor market could result regardless of the state of the business cycle. But because the natural rate is a long-run concept, it is difficult to believe the natural rate could have changed significantly over the past two and a half years. There has not been any major change in labor market policy during that time, and demographic changes are incremental. If the natural rate has changed, it would be part of a longer trend that will not be identifiable in the near term.

There is another reason why the unemployment rate might have continued to rise for so long recently related to the natural rate concept. Even if the natural rate had not changed over the past two and a half years, it is possible that when unemployment reached 3.9% in December 2000, it was further below the natural rate than suspected. Just as the unemployment rate can temporarily rise above its natural rate when growth is too slow, unemployment can temporarily fall below the natural rate when growth is unsustainably fast. In these circumstances, one would expect to see a rising inflation rate as wages are pushed above productivity because too many jobs are chasing too few workers. Few economists believed the natural rate had reached as low as 3.9% in 2000, but many assumed that 3.9% was not too far from the natural rate since there was no significant upward pressure on inflation at that time. In hindsight, if the natural rate has been higher than suspected in recent years, say 6.0% vs. 5.0%, then the prolonged increase in the unemployment rate over the past two and a half years could partly be attributable to the long-term adjustment back towards the natural rate from an unsustainably low level. In this case, one would expect the unemployment rate to fall once the recovery became more robust, but it would fall less than expected. Those who argue that the natural rate was underestimated in the late 1990s point to the fact that the natural rate averaged 6-6.5% in the 1970s and 1980s. To put that figure in perspective, consider that today's unemployment rate would have been considered to be full employment, only attainable near the peak of the business cycle, 20 years ago.

Because the natural rate is a long-run concept, it is too soon to determine which portion, if any, of the recent increase in the unemployment rate is supply-side driven, and which portion is demand-driven. But the inflation rate is one piece of evidence to determine whether inadequate demand or a change in the natural rate is currently driving the rise in unemployment. If the economy is suffering from insufficient demand, the inflation rate should be falling; if the unemployment rate is being driven by changes in the labor market, inflation should be unaffected. The core inflation rate, which strips out volatile food and energy prices, has fallen from 2.6% in 2001 to 2.4% in 2002 to 1.6% in 2003. This indicates that insufficient demand is likely at least part of the story behind the rise in the unemployment rate.

## Alternative Theories

While the natural rate (which changes over time) hypothesis is the mainstream view in economics, the hypothesis is not without its critics. At least four alternative explanations have been offered.

**Phillips Curve Can Be Exploited Indefinitely.** The mainstream position that monetary policy has no long-term effects on real variables, such as unemployment, does not specify how long it takes to get to the long term. One view, which essentially harkens back to pre-NAIRU macroeconomics, argues that the effects of monetary policy are long enough lasting that policymakers can essentially exploit the unemployment-inflation tradeoff (known as the “Phillips Curve”) indefinitely.<sup>17</sup>

This view has a number of shortcomings. First, while it may be true that a higher and higher inflation rate could be traded off with a lower unemployment rate for long periods of time, it is not clear why this would be a desirable policy outcome, particularly since larger and larger increases in inflation would be needed to achieve a given reduction in unemployment as unemployment fell. Second, it has trouble explaining the 1970s, when inflation and unemployment rose simultaneously. Third, the Phillips Curve can only be exploited indefinitely if the inflationary expectations of individuals do not change over time. That is, it assumes that increases in the money supply can continually pump up the economy without individuals ever learning to predict it. Experience from abroad suggests that monetary stimulus ceases to have any effect on the real economy during hyperinflation because expectations do adjust.

**Monetary Policy Changes Cannot Affect Unemployment If It Is Expected.** Another challenge to the natural rate hypothesis comes from the opposite perspective: that any change in monetary policy that is expected or predicted will have no effect on the economy or the unemployment rate. Part of the “rational expectations” movement in the economics profession in the 1970s, this conclusion is reached by assuming that individuals are always rational and well informed, so that changes in the money supply instantly lead to changes in the inflation rate. In this view, rising inflation would not be associated with an unemployment rate below the NAIRU (since the monetary change had no real effect), and falling inflation would not be associated with an unemployment rate above the NAIRU. However, the concept that the unemployment rate would always be at the natural rate (unless unexpected monetary changes occurred) would be consistent with this view.<sup>18</sup>

While this view had a revolutionary effect on academic economics, its empirical relevance – in its purest form – has been limited. There is overwhelming evidence that monetary changes always have affected – and still do affect – real economic variables in the short run, in direct contradiction to the rational expectations theory.

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<sup>17</sup>See James Galbraith, “Time to Ditch the NAIRU,” *Journal of Economic Perspectives*, vol. 11, n. 1, Winter 1997, p. 93.

<sup>18</sup>See Robert Lucas and Thomas Sargent, eds., *Rational Expectations*, University of Minnesota Press (Minneapolis: 1981).

### **Deviations from Natural Rate Caused by Inflation, not Labor Market.**

The natural rate is defined in terms of a relationship between unemployment and inflation. Some economists defending the natural rate concept have argued that recent deviations from it have been caused by inflation-related developments rather than changes in the labor market that have caused the natural rate to change. For example, Robert Gordon has argued that a series of temporary factors held the inflation rate down in the mid-1990s, including low energy, medical, computer, and commodity prices, despite the fall in unemployment below the natural rate.<sup>19</sup> However, most of these prices have risen since. Besides, the shortcoming of this argument is that there will always be some price increases below the increase in the general price level, and some above. It is unlikely that the prices of goods that are falling will not be offset by those that are rising. As the unemployment rate stayed below the estimated NAIRU for at least four years in the late 1990s, the temporary factors argument became less and less convincing. There was a slight increase in inflation toward the end of the last expansion, but not nearly as much as models based on a constant natural rate would have predicted.

Others have argued that low inflation can be explained by a new unwillingness by workers to demand compensation increases because of globalization (e.g., greater foreign competition) and other factors that have made markets more competitive. This argument is hard to prove or disprove empirically, since there is no conclusive way to measure the competitiveness of markets over time. Globalization's influence on wages is thought to be limited since imports are still small relative to GDP, and have increased only gradually.<sup>20</sup> If globalization did reduce the *relative* wages of affected workers, it would only reduce *overall* inflation if it were accommodated by the Federal Reserve, which is unlikely given that one of the Fed's primary goals is price stability. In any case, the data do not support the argument throughout the period – Figure 2 shows that compensation increases were small in the early 1990s, but healthy from 1998-2000, suggesting this factor was not important in the later stages of the expansion.

**Hysteresis.** The natural rate hypothesis suggests that because unemployment always returns to the natural rate, recessions should have no permanent effect on unemployment (or the natural rate). This view was challenged by a group of economists in the 1980s, who argued that serious recessions could raise the natural rate, meaning that the business cycle could have permanent effects on unemployment.<sup>21</sup> This view, called “hysteresis,” sprung from empirical evidence,

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<sup>19</sup>Robert Gordon, “Foundations of the Goldilocks Economy: Supply Shocks and the Time-Varying NAIRU,” *Brookings Papers on Economic Activity* 2, 1998, p.297. Gordon also allows the natural rate to decline in the 1990s in this paper, but most of the favorable performance of inflation is attributed to these temporary factors.

<sup>20</sup>See CRS Report 98-441, *Is Globalization the Force Behind Recent Poor U.S. Wage Performance?* by Craig Elwell.

<sup>21</sup>An early paper on hysteresis is Olivier Blanchard and Lawrence Summers, “Hysteresis and the European Unemployment Problem,” *NBER Macroeconomics Annual* 1, (Cambridge, MA: 1986). A more recent example is Laurence Ball, “Aggregate Demand and Long-Run  
(continued...)

particularly in parts of Western Europe, where the natural rate seemed to jump dramatically following the deep recessions of the 1970s and 1980s.<sup>22</sup> A number of explanations was devised to give it theoretical underpinnings, such as the theory that sustained periods of unemployment (which increased in deep recessions) led to a deterioration in workers' skills that made them less employable. The empirical evidence in the United States is not as strong as Western Europe; nonetheless, it is striking that the rise in the NAIRU coincided with the two deepest recessions (1973-1975, 1980-1982) of the post-war period.

The hysteresis view can be seen more as a complement to the natural rate theory than an alternative. With hysteresis, there is still a natural rate at any given time, and inflation will rise (fall) if unemployment is below (above) it. Hysteresis stipulates that the business cycle is another factor that can change the natural rate. In the purest sense, however, hysteresis does contradict the natural rate view that monetary policy (through its effect on the business cycle) has no permanent effect on the unemployment rate.

## Measuring the Natural Rate in Practice

How the natural rate is theoretically conceptualized and how it is empirically estimated are quite different. Most empirical estimates do not use the conceptual approach discussed in this report: they do not define the natural rate in terms of labor market conditions and then try to estimate how much each condition contributes to changes in the natural rate over time. As discussed above, one reason why this approach would not be fruitful is that many of the factors cannot be easily quantified.

One approach to estimating the natural rate, taken by CBO, for example, is based on the approach described above of explaining changes in the inflation rate econometrically, and ignoring the labor market factors that would change the natural rate.<sup>23</sup> Besides unemployment, CBO lets the inflation rate be influenced by past inflation, productivity growth, food and energy prices, and price controls (for the early 1970s).<sup>24</sup> The notion is that the unemployment-inflation relationship will not hold in the presence of a supply shock, but if shocks are controlled for, a stable unemployment-inflation relationship can be identified. Unfortunately, supply shocks

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<sup>21</sup>(...continued)

Unemployment," *Brookings Papers on Economic Activity*, 2, (Washington: 1999), p.191.

<sup>22</sup>Laubach demonstrates that an economically significant NAIRU cannot be estimated for the major Western European countries. Thomas Laubach, "Measuring the NAIRU: Evidence from Seven Economies," *Review of Economics and Statistics*, vol. 83, n. 2, May 2001, p. 218.

<sup>23</sup>See Congressional Budget Office, *Economic and Budget Outlook*, August 1994, Appendix 2. In essence, CBO controls for demographic factors by using the rate of unemployment for married males in its equations.

<sup>24</sup>Note that productivity is also one of the factors that has been posited as an influence on the natural rate, in which case the regressions do not meet the requirement that the explanatory variables be statistically independent because the variables are jointly determined.



are not always readily identifiable, but productivity and energy prices are two obvious candidates. Changes in monetary policy are not determinants of inflation in this equation. Using past inflation as a determinant of current inflation implies that individuals assume inflation will be the same as in the past, which may not be consistent with rational expectations. Similar models by other authors base expected inflation on survey results, instead of assuming expectations are based on the past.

CBO's model produces a constant NAIRU for married men; it then estimates an overall NAIRU which varies over time because of demographic changes. Although CBO's estimate has a high goodness of fit by measures like the R-squared and t-statistic, a constant NAIRU will diverge from actual experience over short periods of time. For example, it does a poor job explaining why inflation did not rise when unemployment was a percentage point below the CBO NAIRU estimate in the late 1990s.<sup>25</sup>

Gordon uses a similar estimation method and similar control variables to CBO, but allows his estimate of the NAIRU to vary from year to year, unlike CBO's NAIRU for married men.<sup>26</sup> After estimating the causes of inflation, a natural rate can be backed out of the equation in any given year by holding other factors constant. The estimate of the natural rate varies from year to year because it includes the equation's error term. Gordon then limits how much the natural rate can vary to smooth the annual fluctuations out. It should be stressed that Gordon's NAIRU varies only because the actual data vary in ways that Gordon does not attempt to explain. The smoothness of the changes in the NAIRU is imposed by Gordon's model – it is not derived from the data. A critic of the NAIRU concept could argue that rather than proving that there is a varying NAIRU, Gordon has demonstrated that actual unemployment changes unexpectedly to such an extent that the NAIRU concept is not useful.<sup>27</sup>

Barnes and Olivei hypothesize that unemployment is only an important determinant of inflation when unemployment is unusually high or low. They use an approach similar to CBO, with the modification that observations where unemployment is outside of their interval of 4-7.5% are separated from observations within the interval. Their results show that the effect of unemployment on inflation is much larger and statistically significant when unemployment is outside the interval. The drawback to this method is that the observations outside the interval

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<sup>25</sup>It should be noted that these type of macroeconomic "reduced form" econometric equations do not meet many of the theoretical requirements of unbiased statistical estimation. For some of the technical problems with empirically estimating the natural rate, see Hashem Pesaran and Ron Smith, "The Natural Rate and Hypothesis and Its Testable Implications," in Rod Cross, ed., *The Natural Rate of Unemployment*, Cambridge University Press, (Cambridge, UK: 1995), p. 203.

<sup>26</sup>See Robert Gordon, "The Time-Varying NAIRU and Its Implications for Economic Policy," *Journal of Economic Perspectives*, vol. 11, n. 1, Winter 1997, p. 11.

<sup>27</sup>Stock shows that an econometric model with no relationship between unemployment and inflation performs better in the 1990s than a model where the natural rate is allowed to decline. James Stock, "Comments and Discussion," *Brookings Papers on Economic Activity* 2, 1998, p. 339.

are not randomly distributed across the sample: they are mostly limited to the mid 1960s, mid 1970s, and early 1980s. Thus, their method still leaves unanswered the question of why the unemployment-inflation tradeoff only broke down at certain times within the interval, notably the late 1970s and late 1990s. A narrower band would have reduced this problem.<sup>28</sup>

Grant's estimate of the natural rate is fundamentally different than the other three models discussed here, because his natural rate estimate is not based on the empirical relationship between unemployment and inflation. This avoids the problem of controlling for inflation induced by supply shocks, but somewhat changes the meaning of the natural rate. He first estimates output gaps by calculating the difference between actual GDP and trend GDP, which he constructs using various statistical techniques. He then calculates a natural rate of unemployment by regressing unemployment on his output gap measure, and allows the natural rate to vary over time. Like Gordon, this approach can be criticized on the grounds that it does not offer any theoretical explanation for why the natural rate would be changing over time; it only changes because of variation in the actual data. Some of his results are questionable because they show the NAIRU lowest in the 1970s and highest in the 1990s.<sup>29</sup>

## **A Useful Concept for Policymaking?**

The natural rate concept is often accompanied with enough qualifiers that, on the one hand, it becomes difficult to refute empirically, and on the other hand, may arguably limit its practical value. The qualifiers include 1) because of business cycle fluctuations, actual unemployment will rarely if ever equal the natural rate; 2) the natural rate can change unpredictably over time; and 3) the relationship between the natural rate and inflation will not hold when other factors that also influence inflation are present. The third qualifier is more problematic than it may first appear when one considers that the natural rate is defined in terms of its relationship to inflation. Empirically, these qualifiers mean that there is no straightforward test to compare the merits of the argument "a natural rate of unemployment does not exist" to the argument "a natural rate of unemployment exists, but because it changes unpredictably, it cannot be identified until after the fact."

The methods for estimating the NAIRU described above are essentially backward-looking. Because they by and large do not identify the fundamental labor market sources of changes in the natural rate, they cannot predict how the NAIRU will change in the future. This was the case with the apparent fall in the natural rate in the late 1990s, which took most economists by surprise. This is problematic for policymakers: it implies that at any given point, they cannot distinguish whether a movement in unemployment is caused by the business cycle (and should be

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<sup>28</sup>Michelle Barnes and Giovanni Olivei, "Inside and Outside Bounds: Threshold Estimates of the Phillips Curve," *New England Economic Review*, Federal Reserve Bank of Boston, 2003, p. 3.

<sup>29</sup>Alan Grant, "Time-Varying Estimates of the Natural Rate of Unemployment: A Revisitation of Okun's Law," *Quarterly Review of Economics and Finance*, vol. 42, n. 1, Spring 2002, p. 95.

counteracted with stabilization policy) or by a change in the natural rate (and should not be counteracted with policy). If the Fed had relied heavily on NAIRU estimates of the time, it could have unnecessarily tightened monetary policy in the 1990s, cutting short an expansion that never resulted in significantly rising inflation. Likewise, Orphanides and Williams blame much of the stagflation of the 1970s on the Fed's failure to recognize the natural rate had risen, which led it to keep policy too loose.<sup>30</sup>

On the other hand, attempts to systematically identify changing labor market characteristics in order to predict changes in the natural rate beforehand are likely to prove frustrating since, as discussed above, many of the characteristics thought to be important change infrequently (resulting in a dearth of observations for statistical analysis) and are difficult to quantify. For that reason, explanations based on this approach are open to the criticism of *post hoc ergo propter hoc* rationalization (deducing causation by identifying correlation after the fact), and may therefore also fail to forecast changes in the NAIRU accurately.

Staiger, Stock, and Watson argue that while a statistically significant NAIRU can be estimated, the margin of error is too broad for the concept to be of much practical use to policymakers.<sup>31</sup> For example, in the first quarter of 1994, they estimate a NAIRU of 5.9% using the consumer price index (CPI), with a 95% confidence interval of 3.9% to 7.6%.<sup>32</sup> From the perspective of, say, the Federal Reserve, their findings suggest that the Fed could be certain that policy should be tightened only when unemployment was below 3.9% (controlling for the other factors in the estimation) and eased when unemployment was above 7.6%.<sup>33</sup> By way of comparison, unemployment never exceeded 6.3% in the recent recession; if the Fed had based its policy decisions on the criteria of statistical significance, no monetary easing could have been undertaken to counteract the recession (assuming the NAIRU had not greatly changed since 1994). If the core CPI is used, the confidence interval narrows a little, to a range of 4.5% to 6.9%, but the interval is arguably still too wide for meaningful policymaking.

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<sup>30</sup> Athanasios Orphanides and John C. Williams, "The Decline of Activist Stabilization Policy: Natural Rate Misperceptions, Learning, and Expectations," *Federal Reserve Bank of San Francisco*, Working Papers Series. 2003-24, Dec. 2003.

<sup>31</sup> Douglas Staiger, James Stock, and Mark Watson, "The NAIRU, Unemployment, and Monetary Policy," *Journal of Economic Perspectives*, vol. 11, n. 1, Winter 1997, p. 33. They use a model to estimate the NAIRU that is conceptually similar to Gordon's – controlling for similar independent variables and allowing the NAIRU to vary over time, but more smoothly than the raw data would indicate.

<sup>32</sup> A 95% confidence interval is defined as the range of values for which estimates from at least 95 of 100 samples would fall within. Table 1 suggests a broad confidence interval would be expected given the large fluctuations in average unemployment over the decades.

<sup>33</sup> A recent Fed study addresses how to conduct monetary policy with an uncertain NAIRU. See Volker Wieland, "Monetary Policy and Uncertainty about the Natural Rate of Unemployment," *Finance and Economics Discussion Series #22*, Federal Reserve Board of Governors, April 1998.

Despite its shortcomings, the natural rate of unemployment is arguably a concept so deeply ingrained in economic policymaking that it would be difficult to imagine how to formulate policymaking without it. Decisions to tighten or ease monetary policy are fundamentally based on the notion that the economy is above or below full employment, respectively. Full employment, in turn, is primarily determined by comparing the actual unemployment rate to an estimate of the natural rate. As Mankiw and Ball argue,

Few economists would deny that shifts in aggregate demand, such as those driven by monetary policy, push inflation and unemployment in opposite directions, at least in the short run. That is all one needs to believe to accept the NAIRU concept.<sup>34</sup>

The alternative to giving pre-eminence to the natural rate in policymaking decisions would be to demote the natural rate to one among many economic variables in attempting to predict the present and future course of economic activity.<sup>35</sup> Rather than target the (unknown) natural rate of unemployment, policymakers can target sustainable economic growth, using an estimate of the natural rate as one variable to help determine sustainability. Even for strict inflation targeters, who subordinate economic stabilization to price stability, a natural rate would be useful if it (as one of many variables) can help predict the future course of inflation.<sup>36</sup> Based on past experience, it can be argued that other indicators (such as the capacity utilization rate) do a better job predicting future economic activity than the natural rate, particularly since changes in the natural rate are not easily identified.<sup>37</sup> Nevertheless, some of these better predictors are not as comprehensively or well grounded in economic theory as the natural rate, increasing the likelihood that their past predictive capabilities were simply coincidental. Even if the natural rate is relegated to one of many indicators of a fully employed economy, without the concept of the economy moving above or below full employment, it does not seem clear how decisions to change macroeconomic stabilization policy could be made.

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<sup>34</sup>Ball and Mankiw, *Op cit.*, p. 34.

<sup>35</sup>Some argue the NAIRU is not a very good predictor of economic activity. For example, Atkeson and Ohanian demonstrate that from 1984 to 1999, past inflation has been a better predictor of future inflation than a (constant) natural rate of unemployment. Andrew Atkeson, Lee E. Ohanian, "Are Phillips curves useful for forecasting inflation?" Federal Reserve Bank of Minneapolis, *Quarterly Review*, vol. 25, n. 1, Winter 2001, p. 2.

<sup>36</sup>For more information on inflation targeting, see CRS Report 98-16, *The Federal Reserve: Should Its Mandated Goal be Price Stability?*, by Marc Labonte and Gail Makinen; and CRS Report RL3170s, *Price Stability as the Sole Goal of Monetary Policy: The International Experience*, by Marc Labonte and Gail Makinen.

<sup>37</sup>Staiger, Stock, and Watson show that unemployment is a good, but not the best, leading indicator of inflation historically. Staiger, Stock, and Watson, *Op cit.* Fair demonstrates that the predictive power of the natural rate for inflation was low in the 1990s. Ray Fair, "Testing the NAIRU Model for the United States," *Review of Economics and Statistics*, vol. 82, n. 1, Feb. 2000, p. 64.