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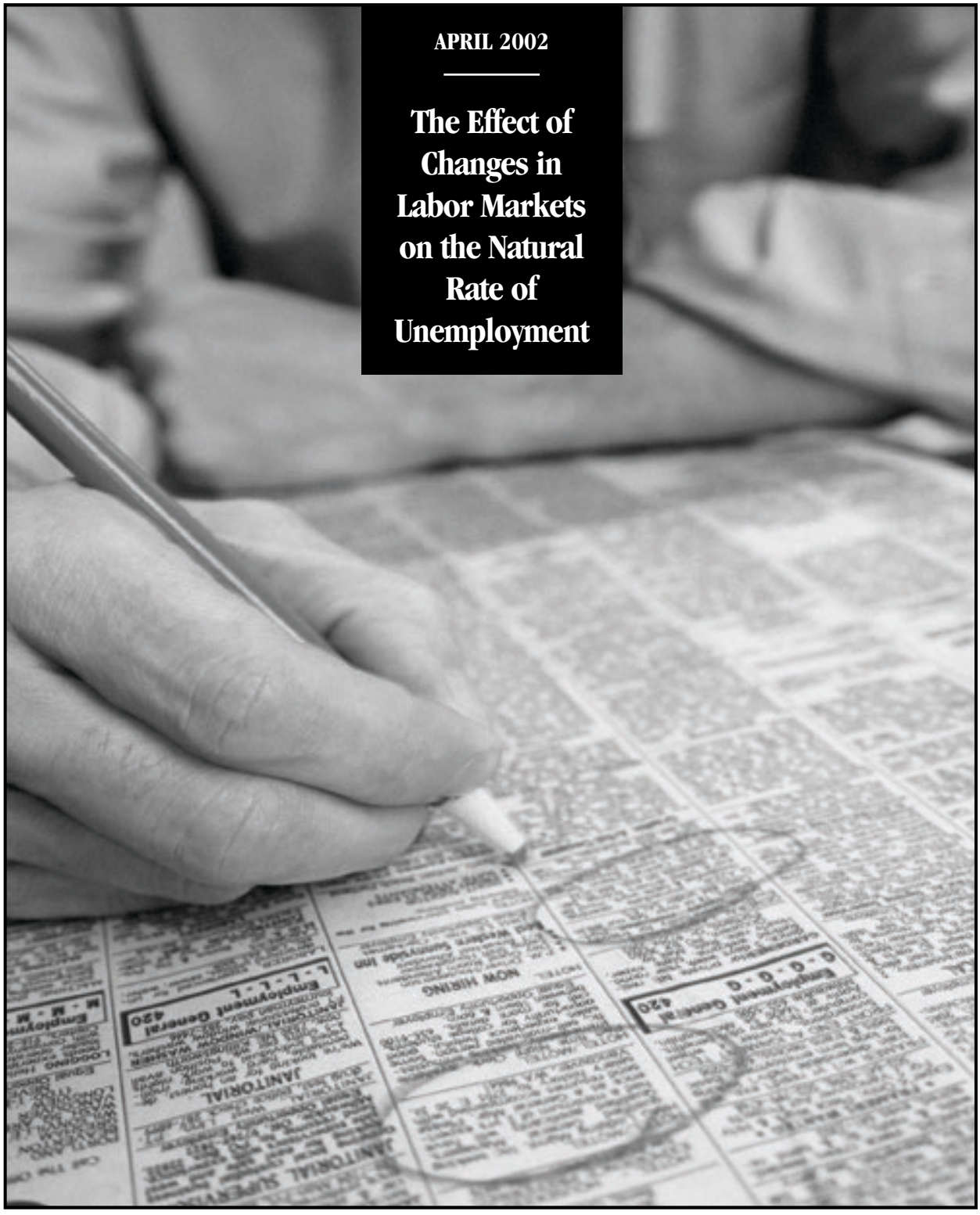
The Effect of Changes in Labor Markets on the Natural Rate of Unemployment



THE EFFECT OF CHANGES IN LABOR MARKETS ON THE NATURAL RATE OF UNEMPLOYMENT

April 2002

The Congress of the United States
Congressional Budget Office

NOTES

All years referred to in the text and figures are calendar years, unless otherwise indicated.

The figures in this report use shaded vertical bars to indicate periods of recession. The bars extend from the peak to the trough of each recession.

PREFACE

The Congressional Budget Office (CBO) is required to project the unemployment rate over a 10-year period. Such projections are closely linked to the concept of the natural rate of unemployment, the level of unemployment that would occur if aggregate demand for goods and services was in balance with aggregate supply.

This paper summarizes and assesses recent research on the ways in which changes in the composition of the labor force and in the operation of labor markets may have affected the natural rate of unemployment. In particular, the experience of the late 1990s—when supply seemed to keep up with rapidly growing demand even though labor markets were tight, and the unemployment rate fell well below previous estimates of the natural rate—led many observers to speculate that the natural rate may have fallen substantially over the past two decades. This paper finds that several factors, most notably shifting demographics and the expansion of the temporary-help industry, have combined to reduce the natural rate significantly since the mid-1980s. Some other factors, such as higher levels of skill and Internet job searching, may also have played a role in reducing the natural rate, but those factors have not been incorporated into CBO's projections for the next 10 years because they cannot now be quantified.

David Brauer of CBO's Macroeconomic Analysis Division prepared this paper under the supervision of Robert Dennis and John Peterson. The manuscript benefited from suggestions by Arlene Holen, Deborah Lucas, Kim Kowalewski, Bob Arnold, Christopher Williams, Frank Russek, Kathy Ruffing, Ralph Smith, Bruce Vavrichek, and Paul Cullinan, all of CBO, as well as by Robert J. Gordon of Northwestern University and June O'Neill of Baruch College at the City University of New York. John McMurray provided research assistance.

Christine Bogusz edited the paper, and Christian Spoor proofread it. Linda Lewis Harris prepared the report for publication, and Annette Kalicki produced the electronic versions for CBO's Web site (www.cbo.gov).

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SUMMARY AND INTRODUCTION

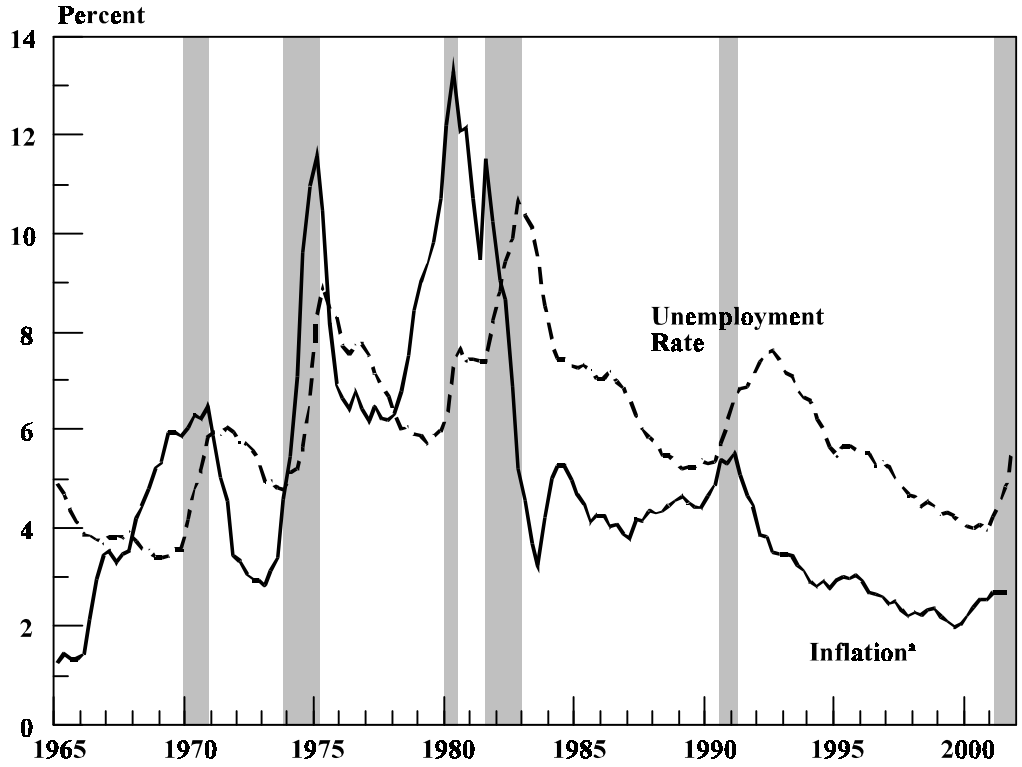
To project the unemployment rate over a 10-year horizon, the Congressional Budget Office (CBO) must abstract from the booms and busts of the business cycle and estimate the rate of unemployment that is likely to prevail, on average. Such an estimate is closely linked to the concept of the "natural" rate of unemployment. That term has been used in various ways by economists, but the natural rate is essentially an estimate of the level of unemployment that would result if aggregate demand for goods and services was in balance with aggregate supply. The concept of a natural rate of unemployment is connected to a number of questions that deal with policy and forecasting, as well as 10-year projections. For example, if the unemployment rate is reduced by policy actions, will real wage growth or price growth increase as a result? If so, at what critical point will the acceleration be triggered, and how big will the response be?

In debates over those questions and others, analysts have referred to that critically important rate of unemployment in various ways. Some analysts use terms such as the natural rate, the equilibrium rate of unemployment, and the non-accelerating inflation rate of unemployment (NAIRU) interchangeably; others make careful distinctions between those terms. Analysts also disagree about whether there is a relatively stable critical rate and, if so, whether it can be estimated reliably. Because of those fundamental disagreements, analysts' estimates of that rate vary widely.

The debate about the natural rate has intensified in recent years. Some observers have claimed that increased globalization could boost domestic unemployment for certain groups of workers, raising the natural rate. But unemployment has dropped sharply. Moreover, prices have generally not shot up as unemployment has declined. When the unemployment rate fell below 5 percent in 1997, many economists expected inflation to reaccelerate; instead, inflation continued to fall through the middle of 1999 (see Figure 1). An unanticipated pickup in the growth of productivity at that time helped keep inflation from rising; other factors, such as falling prices for commodities and imports, may also have played an important role. However, changes in labor markets, such as the rise in the use of the Internet for job searches, may have contributed, too.

This paper summarizes the recent research on how changes in labor markets over the past two decades may have affected the unemployment rate. Those changes involve ongoing shifts in the composition and characteristics of the labor force as well as in the structure and operation of labor markets. Theory and qualitative evidence suggest that the natural rate of unemployment has declined over the past two decades and that some of the factors causing that decline may continue to grow in importance over the next decade. One factor—the aging of the adult population—has been widely discussed and quantified, and it has been incorporated directly in CBO's projections for many years. Other factors have only recently been

FIGURE 1. THE UNEMPLOYMENT RATE AND CORE INFLATION



SOURCE: Department of Labor, Bureau of Labor Statistics.

a. The year-over-year percentage change in the consumer price index for all urban consumers, excluding the food and energy sectors, applying the current methodology to historical price data since 1978 (CPI-U-RS).

examined. The expanded role of the temporary-help industry has probably reduced the natural rate, but the effects of Internet job searching and higher levels of skill are difficult—if not impossible—to quantify. Nonetheless, CBO estimates that, on balance, changes in labor markets have reduced the natural rate of unemployment from 6.0 percent to 5.2 percent since the mid-1980s. Although the unemployment rate rose sharply immediately after the September 11 terrorist attacks, the natural rate is unlikely to be affected to any significant and lasting degree.

EXPLANATION OF TERMS

The unemployment rate is the number of unemployed people as a percentage of the civilian labor force, which consists of all employed and unemployed people ages 16 and higher. The Bureau of Labor Statistics classifies people as *employed* if they performed any work for pay or profit during the reference week (the week including the 12th day of the month) or held a job but were temporarily absent because of illness, vacation, inclement weather, a labor dispute, or personal reasons. To be

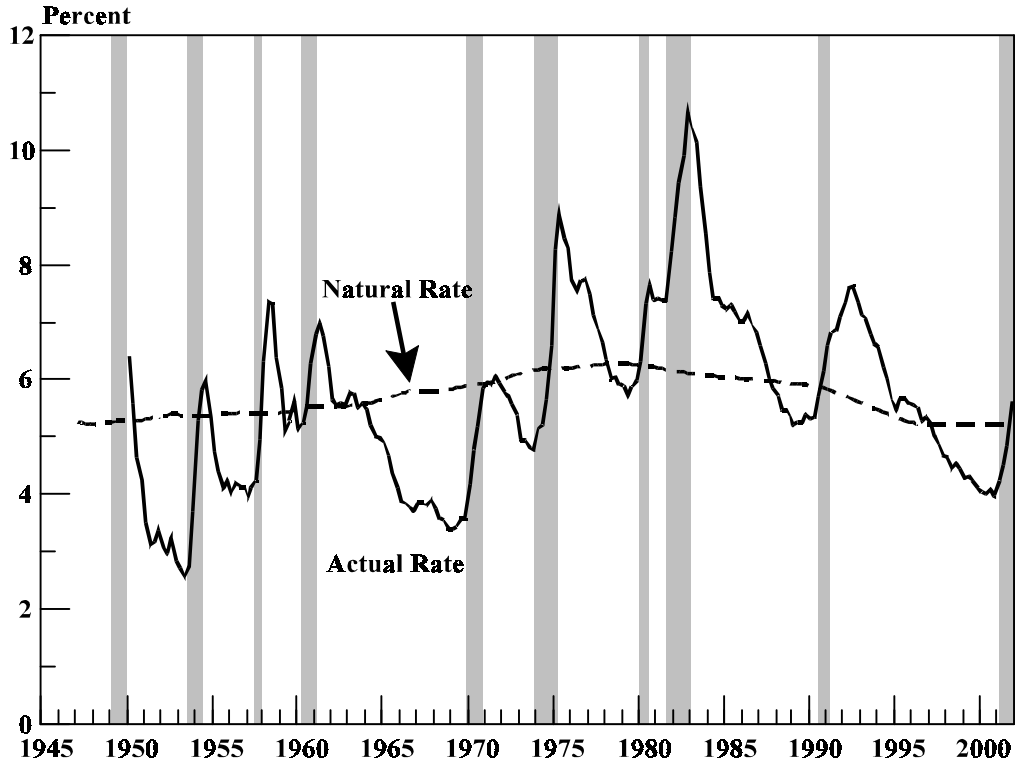
counted as *unemployed*, people must not have been employed during the reference week, must have been available to work during that week, and must have either made some specific effort to find work during the previous four weeks or been laid off from their job and expecting to be recalled. People without jobs who fail to meet those conditions are classified as *not in the labor force*.

The overall concept of the natural rate of unemployment comprises a number of other concepts. **Frictional** unemployment stems from the normal turnover of jobs and workers (the turnover that is independent of the effects of business cycles) and from the fact that it takes time for unemployed workers to find and accept a suitable job offer. A related concept, **structural** unemployment, refers to the unemployment caused by mismatches between available workers' skills and those necessary to fill vacant positions. Structural unemployment includes geographic mismatches, so its level is influenced by regional disparities in labor market conditions and by the degree of worker mobility.

Frictional and structural unemployment together determine the **equilibrium** rate of unemployment. That rate is theoretically the lowest unemployment rate that would prevail if labor markets functioned smoothly, with flexible wage rates allowing the supply of and the demand for labor to balance. In practice, however, several factors tend to keep wages from falling when supply exceeds demand, thereby slowing the economy's adjustment to equilibrium. Those factors include minimum wages set by law, the presence of unions, social conventions, and wage-setting practices by employers that are aimed at boosting workers' morale and effort, minimizing turnover costs, or otherwise stimulating greater output. The unemployment arising from those so-called institutional factors, together with the equilibrium rate of unemployment, is termed the **natural** rate of unemployment. The natural rate represents all sources of unemployment *except the unemployment associated with fluctuations in aggregate demand*. **Cyclical** unemployment represents the difference between the estimated natural rate and the actual unemployment rate. Near the end of an economic boom, the actual rate will tend to be lower than the natural rate; in a recession, it will tend to be higher. The bulk of the variation in the actual unemployment rate is attributable to cyclical unemployment (see Figure 2). Finally, the **NAIRU** is generally considered to be equivalent to the natural rate in the long run (see Box 1 on pages 6 and 7).

In broad terms, the natural rate of unemployment is determined by any factor —demographic, economic, or institutional—other than the business cycle that influences the number of people searching for work, the number of vacant positions, and the rate at which vacancies are filled. Several factors affect the flow into frictional or structural unemployment and thus the natural rate. The age distribution of the population is particularly important because it affects the number of new entrants into the labor force. The simultaneous creation and destruction of jobs also contributes to frictional unemployment because workers displaced from existing jobs will

FIGURE 2. THE NATURAL AND ACTUAL RATES OF UNEMPLOYMENT



SOURCES: Congressional Budget Office; Department of Labor, Bureau of Labor Statistics.

often be unemployed until they can find new ones, even as newly created vacancies remain unfilled for a time. That creation and destruction can occur through establishments' opening, closing, expanding, contracting, or restructuring (even if the total number of positions at an establishment is unchanged, newly created jobs may require a set of skills different from those that they replace). The same effect results from vacancies that are created when workers quit voluntarily or are dismissed because of their performance.

In addition to those factors, the natural rate of unemployment depends on the rate at which job seekers are matched with, and are willing to accept, vacant positions. The greater the mismatch, in terms of either skills or geography, between vacant positions and unemployed workers, the longer the matching process will take and, consequently, the higher the natural rate will be. In contrast, technological or institutional changes that improve the efficiency of job searches will shorten the search process and thus reduce the natural rate.

Any factors affecting the likelihood that a job seeker will choose to accept a particular offer will also influence the natural rate. When a job offer is made, a worker must choose between accepting its terms or rejecting the offer and remaining unemployed while continuing to search in the hope of eventually obtaining a better offer. For example, higher unemployment insurance benefits will tend to motivate workers to continue to search longer before accepting a job offer, thus increasing the natural rate.[1]

CHANGES IN THE LABOR FORCE

The characteristics of the workforce exert considerable influence on the natural rate of unemployment. Younger and less-skilled workers change jobs more frequently than their older and more-skilled counterparts do and are consequently more likely to become unemployed. The less-skilled may also take longer to find a new job when unemployed. Since the late 1970s, however, the population's age mix has shifted from younger workers to older workers; that increase in the average age of the adult population has reduced the natural rate by about 0.4 percentage points. Expansion of the nation's incarcerated population has lowered it by a further 0.1 to 0.2 percentage points by removing some of the least-skilled people from the labor force. Changes in policies that govern payments for disability may also have reduced the natural rate by inducing unskilled workers to leave the labor force. Recent changes in the administration of welfare programs appear to have increased labor force participation and reduced unemployment among single mothers, but quantitative effects are difficult to assess. In addition, more-educated workers, with their higher skill levels, are less likely to become unemployed. Expansion of employer-provided training might in principle have reduced the natural rate, but economists lack the data necessary to assess that effect fully.

1. That effect is not necessarily undesirable from a social welfare perspective if the extra search time ultimately results in a better, more durable match (which could itself at least partially offset the direct effect on the unemployment rate of greater search time). The unemployment insurance (UI) system can also influence the measured unemployment rate through its effect on workers' decisions about whether to search for work or drop out of the labor force. Higher benefits will encourage some jobless workers who might otherwise have dropped out of the labor force to instead search for work at least enough to retain eligibility for UI benefits. In the early 1980s, the ratio of UI recipients to unemployed job losers (those people theoretically eligible for UI benefits provided other criteria are satisfied) fell sharply; that ratio has since drifted upward for reasons not fully understood by economists. Unemployment insurance, a federal/state system, has not undergone fundamental changes at the federal level over the past two decades; it is not discussed further in this paper.

BOX 1.
THE NATURAL RATE, THE NAIRU, AND CBO'S ESTIMATING PROCEDURES

The natural rate of unemployment is associated with the NAIRU, or nonaccelerating inflation rate of unemployment. The NAIRU model is built on the theory that there is an overall national unemployment rate at which hourly compensation growth tends to neither increase nor decrease. In some versions of the model, changes in compensation growth directly affect price inflation. In other versions, an unemployment rate below the NAIRU primarily indicates a high level of aggregate demand, which generates upward pressure on inflation even without a direct link between compensation and prices.[1] Some analysts reject the premise of the NAIRU model—namely, that one can infer short-run inflationary pressures from the unemployment rate—and instead emphasize the importance of monetary policy in determining inflation. CBO does not adhere strictly to the NAIRU model in forecasting near-term inflation but uses it as one indicator among many. In its projections of inflation over 10 years, CBO does not use the NAIRU at all.

Analysts who stress the link between compensation and prices argue that it is possible to estimate a critical rate of unemployment (the NAIRU) and use that estimate to predict changes in the growth of real hourly compensation. If the actual rate of unemployment falls below the estimated NAIRU for a significant period of time, the rate of growth of compensation will tend to increase, rising faster than the sum of price inflation and the trend rate of productivity growth. The reason is that the relative scarcity of labor will force employers to bid up the rate of wage growth to attract and retain workers with the desired skills. Conversely, if the unemployment rate rises above the NAIRU, employers will be less willing to bid up wages, and workers will be more willing to accept lower wage offers. It is unclear exactly how far and for how long the actual unemployment rate must deviate from the NAIRU in order to obtain those effects.

CBO uses standard procedures to estimate the NAIRU and then uses those estimates as a guide for evaluating near-term pressures on compensation growth and inflation and for

1. *Economic Report of the President* (February 1997), pp. 45-50; and Flint Brayton, John M. Roberts, and John C. Williams, *What's Happened to the Phillips Curve?* Finance and Economics Discussion Series, Paper No. 1999-49 (Washington, D.C.: Board of Governors of the Federal Reserve System, September 1999).

Age and Sex

Shifts in the age distribution of the population played a significant role in lowering the natural rate over the past two decades. Younger workers traditionally experience spells of unemployment while looking for their first job or while shuttling between participation in the labor force and other activities, such as attending school or receiving support from their parents. Younger workers are also more likely than older workers to change jobs, generating additional periods of unemployment (see Figure 3).

Since the late 1970s, the share of younger workers as a percentage of the total labor force has declined significantly (see Figure 4). Several studies have found

BOX 1.
CONTINUED

projecting the unemployment rate over a 10-year horizon.[2] The historical estimate of the NAIRU derives from an econometric estimate of a Phillips curve, which is an equation that relates the change in inflation to the unemployment rate and other variables, including changes in productivity trends, oil price shocks, and wage and price controls in effect in the early 1970s. Specifically, CBO estimates a NAIRU for married men—a group with very high and stable labor force attachment during the normal working years and with a low average unemployment rate. It then estimates a NAIRU for specific age/sex groups on the basis of the observed relationship between each group's unemployment rate and that of married men. The overall NAIRU is derived from the group-specific rates, so demographic shifts are directly factored into CBO's estimates.

The NAIRU is only one of several indicators that CBO uses to forecast inflation in the short run. CBO also considers information about productivity, sectoral price pressures, unusual developments in labor markets, and (occasionally) inflation-measurement issues.[3] For example, an apparent shift to higher productivity growth in the late 1990s, changes in medical costs, and unusually low energy prices and declining import prices in 1998 and 1999 help to explain the very low inflation seen in those years. The analysis of labor market developments in this paper is just one of the ways in which CBO seeks to evaluate the usefulness of, and improve the value of, its estimate of the NAIRU.

CBO assumes the natural rate is synonymous with the NAIRU over a 10-year horizon, therefore projecting that the actual unemployment rate will average out to the NAIRU during the projection period. That practice also assumes that the influence of transitory factors on inflation is neutral, on average, throughout the 10-year span.

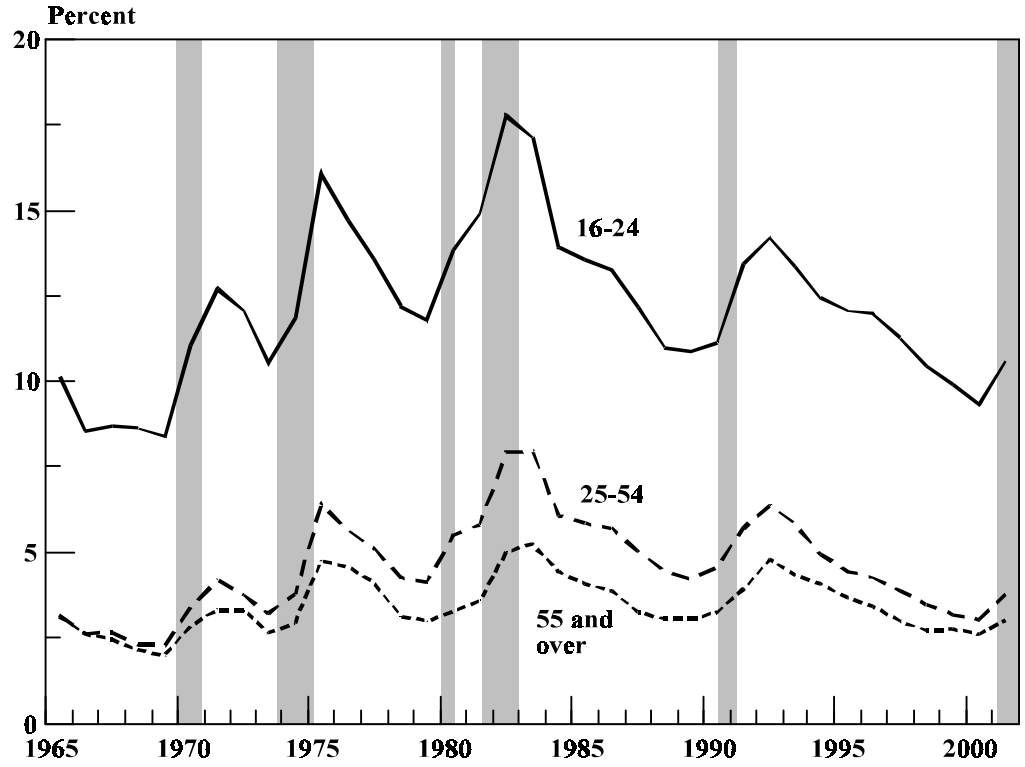
2. For a more detailed description of the procedure used to estimate the NAIRU and the way the NAIRU is used in estimating potential output, see Congressional Budget Office, *CBO's Method for Estimating Potential Output: An Update* (August 2001).

3. For further discussion, see Congressional Budget Office, *The Budget and Economic Outlook: Fiscal Years 2001-2010* (January 2000), pp. 29-33.

that shifts in the population's age mix toward older workers accounted for a decline in unemployment of 0.3 to 0.5 percentage points between the mid-1980s and the late 1990s. (Those shifts have already been incorporated in CBO's estimate of the natural rate of unemployment.)[2] Calculations based on the Census Bureau's most

2. Lawrence F. Katz and Alan B. Krueger, "The High-Pressure Labor Market of the 1990s," *Brookings Papers on Economic Activity*, vol. 1 (1999); Robert J. Shimer, "Why Is the U.S. Unemployment Rate So Much Lower?" in Ben Bernanke and Julio Rotemberg, eds., *NBER Macroeconomics Annual*, vol. 13 (Cambridge, Mass.: MIT Press, 1998), pp. 11-61; and Robert Horn and Philip Heap, "The Age-Adjusted Unemployment Rate: An Alternative Measure," *Challenge*, vol. 42, no. 1 (January-February 1999), pp. 110-115.

FIGURE 3. THE UNEMPLOYMENT RATE BY AGE GROUP



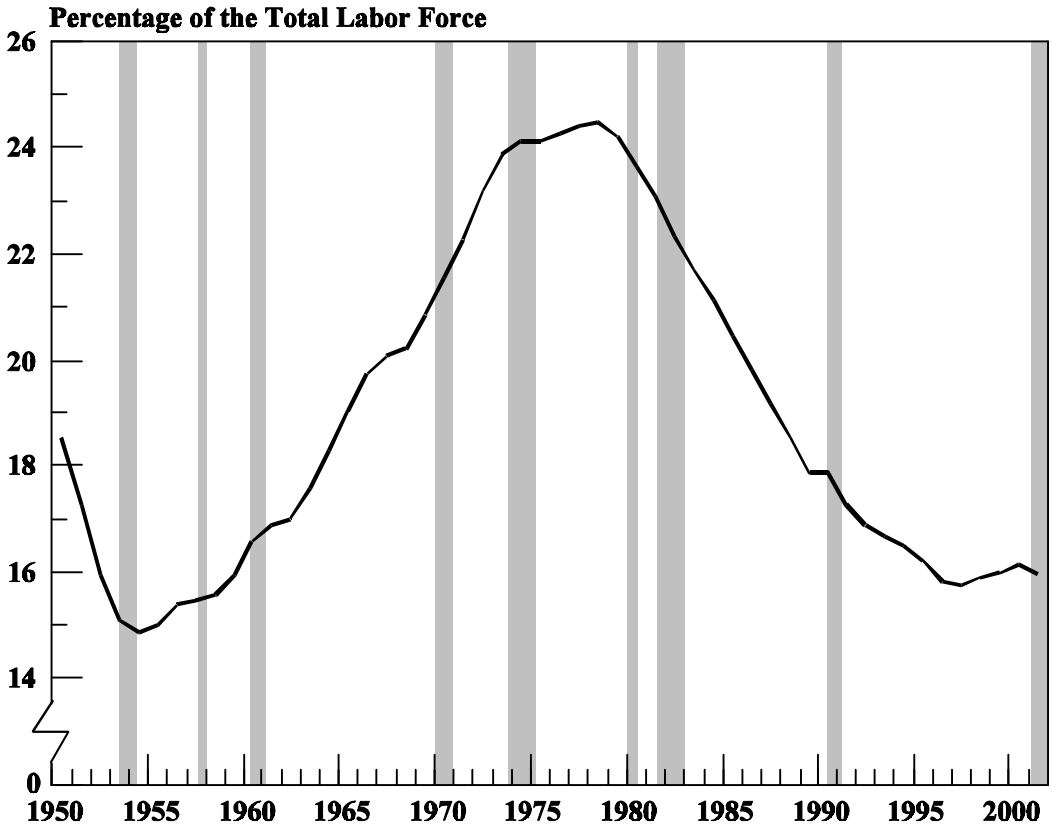
SOURCE: Department of Labor, Bureau of Labor Statistics.

recent population projections by age imply that the natural rate should decline by roughly another 0.1 percentage point over the next decade.[3]

Changes in the composition of the labor force by sex played an important part in explaining the increase in the natural rate of unemployment during the 1960s and 1970s, but they have had little effect on the rate since then. Between 1959 and 1979, women's share of the labor force climbed from 33 percent to 42 percent. During that span, the average unemployment rate among women was 6.4 percent, compared with 4.9 percent for men. The higher unemployment rate among women reflected their entry into, and frequent movement in and out of, the labor force. Reentry often entailed a period of unemployment while women looked for work, which caused the natural rate to rise.

3. Bureau of the Census, *Population Projections of the United States by Age, Sex, Race, Hispanic Origin, and Nativity: 1999 to 2100* (February 2000). Those projections do not reflect results of the 2000 census. Updated projections by age and sex, which incorporate data from the 2000 census, are expected to be available later this year. The updated projections are unlikely to significantly alter the conclusions in this report.

FIGURE 4. PEOPLE AGES 16 TO 24 IN THE LABOR FORCE AS A SHARE OF THE TOTAL LABOR FORCE



SOURCE: Department of Labor, Bureau of Labor Statistics.

Women's share of the labor force has continued to grow since the early 1980s, albeit at a slower pace than during the previous two decades, but unemployment rates for men and women have been about equal, on average. Women's relative status in the labor market has steadily improved over time, and the wage gap between men and women has substantially narrowed, for three reasons.[4] First, demand in traditionally female occupations, such as teaching and nursing, has risen relative to that in traditionally male occupations, such as mechanics and machine operation. Second, women have increasingly entered more highly skilled occupations. And third, women's average educational attainment has increased relative to that of men. Although women are still more likely than men to temporarily leave the labor force in midcareer, those interruptions are less frequent and typically shorter than in the

4. June O'Neill and Solomon Polachek, "Why the Gender Gap in Wages Narrowed in the 1980s," *Journal of Labor Economics*, vol. 11, no. 1, part 1 (January 1993), pp. 205-228.

past. As a result, women today experience fewer short spells of unemployment than they did in earlier decades.[5]

Percentage Incarcerated in Prisons

Over the past two decades, the percentage of the population incarcerated in jails and prisons has nearly quadrupled (from about half a million in 1980 to 1.9 million in 2000), and the removal of those people from the labor force has helped to reduce the natural rate of unemployment.[6] Young males, presumably with skills and job qualifications that are well below average, account for most of the increase in the prison population. Under reasonable assumptions about what their labor force attachment and unemployment rates would have been had they remained out of prison, the overall unemployment rate for men would have been about 0.3 percentage points higher.[7] Because men account for slightly more than half of the labor force, that figure suggests that greater incarceration rates have reduced the unemployment rate by between 0.1 and 0.2 percentage points. CBO does not project changes in the prison population, so it assumes that there will be no further effect on the natural rate during the 10-year projection period.

Policies Affecting Welfare and Disability

In 1996, the Congress adopted far-reaching changes in welfare policy through its passage of the Personal Responsibility and Work Opportunity Reconciliation Act. The law was broadly intended to replace the traditional welfare entitlement with work requirements and other changes designed to encourage welfare recipients to seek employment. A number of states had already begun to implement welfare reforms toward that same end several years before 1996.

When the reforms were implemented, some observers feared that they would lead to a sharp increase in unemployment. They believed that a large number of women with limited skills and, in many cases, difficulties with child care and transportation arrangements would be forced to enter the paid labor force but would have difficulty finding and retaining a job. In addition, the new work requirements cre-

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5. Katharine G. Abraham and Robert Shimer, *Changes in Unemployment Duration and Labor Force Attachment*, Working Paper No. 8513 (Cambridge, Mass.: National Bureau of Economic Research, October 2001).

6. Statistics are from the Bureau of Justice Statistics. Inmates of jails and prisons are excluded from the population for purposes of calculating the unemployment rate and other statistics about the labor force.

7. Katz and Krueger, "The High-Pressure Labor Market of the 1990s."

ated an incentive for people without a job to claim that they were searching for work, which would tend to raise the measured unemployment rate.

Nonetheless, the first few years of welfare reform coincided with declines not only in the overall unemployment rate but also specifically among female heads of households—the group most directly affected by that reform. One explanation is that the welfare changes gave recipients a strong incentive to intensify their job search and to accept an offer rather than remain unemployed or out of the labor force.[8] The decline in unemployment among single mothers also stems from the exceptionally tight labor markets of the late 1990s. The 1993 expansion of the earned income tax credit is another factor that probably increased the labor force participation and employment of single mothers.[9] Disentangling those effects is difficult, which is why economists have not yet reached any firm conclusion about the lasting impact of welfare reform on the rate of unemployment. It may be possible to estimate the effects more accurately several years from now, when unemployment data reflecting a recession and a recovery should be available.

Disability policy can also influence the unemployment rate because, for some people, income from disability benefits provides an attractive alternative to either unemployment or low-wage employment. Following the adoption of the Disability Benefits Reform Act of 1984, which loosened federal restrictions on eligibility for disability benefits, the number of people receiving federal disability payments rose substantially. In 2000, 4.8 percent of the population ages 18 to 64 received disability-related income from Social Security, Supplemental Security Income (SSI), or both; that figure was just 2.9 percent of the population in 1984 (see Figure 5). Among men, the rise in the number receiving disability income was concentrated among the less skilled, a group that has experienced an adverse shift in demand over the past two decades and whose increased use of disability benefits cannot be explained by worsening health status.[10]

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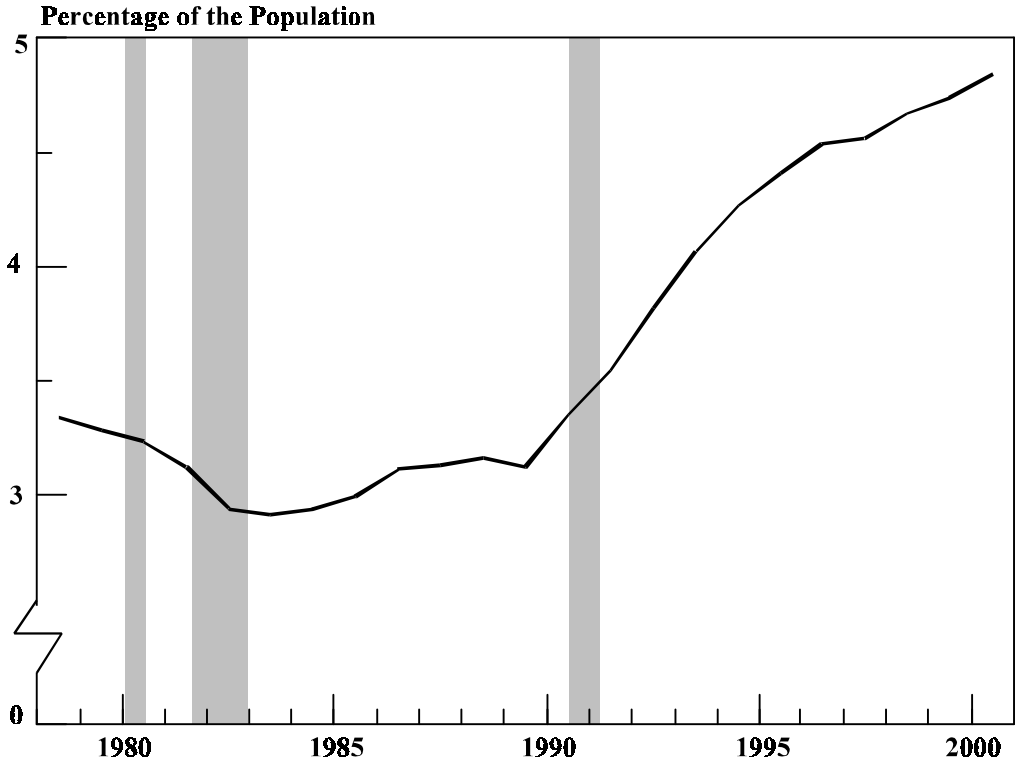
8. June E. O'Neill and M. Anne Hill, *Gaining Ground: Women, Welfare Reform, and Work* (Dallas, Texas: National Center for Policy Analysis, February 2002).

9. The 1993 reforms substantially increased the value of the tax credit, especially for families with two or more children. Several studies found that those reforms significantly boosted the labor force participation and employment of single mothers. See Nada Eissa and Jeffrey B. Liebman, "Labor Supply Response to the Earned Income Tax Credit," *Quarterly Journal of Economics*, vol. 111, no. 2 (May 1996), pp. 605-657; and Dan T. Rosenbaum and Bruce D. Meyer, "Welfare, the Earned Income Tax Credit, and the Labor Supply of Single Mothers," *Quarterly Journal of Economics*, vol. 116, no. 3 (August 2001), pp. 1063-1114.

10. David H. Autor and Mark G. Duggan, *The Rise in Disability Recipiency and the Decline in Unemployment*," Working Paper No. 8336 (Cambridge, Mass.: National Bureau of Economic Research, June 2001). Earlier work documented a link between the availability of disability income and the decline in labor force participation of older men from 1948 to 1976. See Donald O. Parsons, "The Decline in Male Labor Force Participation," *Journal of Political Economy*, vol. 88, no. 1 (February 1980), pp. 117-134.

FIGURE 5. PEOPLE AGES 18 TO 64 RECEIVING FEDERAL DISABILITY BENEFITS AS A SHARE OF THE POPULATION



SOURCE: Social Security Administration.

NOTE: Data points are year-end values. The value for 2000 is preliminary.

Greater availability of disability income could be expected to reduce the labor force participation rate for workers (generally the less skilled) who would have above-average unemployment rates if they were part of the labor force. As a result of inducing those workers to leave the labor force, the natural rate of unemployment would be expected to decline, although the magnitude of such an effect is unclear. Studies of workers whose applications for disability insurance were rejected and of beneficiaries whose benefits were terminated suggest that applicants for and recipients of SSI and disability-related Social Security would have low labor force participation rates even without those programs. That conclusion implies that an increase in the number of claims for disability insurance might not have a large effect on the measured unemployment rate.[11]

11. John Bound, "Health and Earnings of Rejected Disability Applicants," *American Economic Review*, vol. 79, no. 3 (June 1989), pp. 482-503.

Educational Attainment, Skills, and Training

Over the past two decades, the educational attainment of the labor force has increased, on average, suggesting that the skill level of the population is also rising. Because more-educated workers tend to have lower unemployment rates than less-educated workers do, such an increase in skills may have contributed to a reduction in the natural rate of unemployment. In 2000, the unemployment rate for workers ages 25 and older with less than a high school diploma averaged 6.4 percent, compared with rates of 3.5 percent for workers with a high school diploma but no college education, 2.7 percent for workers who had attended college but did not complete a bachelor's degree, and a relatively minuscule 1.7 percent for workers with at least a bachelor's degree.

Increased proficiency in the skills valued by employers—whether that increase stems from education, employer-provided training, or other sources—could reduce the natural rate of unemployment. The link between higher skill levels and lower unemployment is clearest when skills are firm-specific. Because firm-specific training is of little or no value outside a firm, employers will typically subsidize it by paying workers their regular wages while accepting diminished output during the training period. Once employers have made that investment, they will seek to protect it through practices and policies aimed at minimizing turnover. At the same time, workers with such firm-specific skills will be less likely to leave for another job in which those skills will not be rewarded. That implicit contract is one of the most important explanations for long-tenure jobs; consequently, more firm-specific training might be associated with reduced turnover of employees and thus a lower natural rate of unemployment.

Analysts have only limited information on changes over time in the incidence of employer-provided training. Much training, especially of the firm-specific type, occurs informally through observation and interaction with more-experienced workers and is therefore virtually impossible to quantify. The information that is available, however, points to at least a modest increase in training. In a 1991 supplement to the Current Population Survey, 42 percent of workers indicated that they had received some form of training since being hired for their current job, up from 36 percent in a similar survey conducted in 1983. Most of that increase was in formal company-provided training (from 12 percent in 1983 to 17 percent in 1991), and the additional recipients were largely older and better-educated workers. Separately, the incidence of formal company-provided training appears to be associated with the rate of technological change within establishments, so more-rapid technological change in general may have induced more companies to provide training.[12] Like-

12. Ann P. Bartel and Nachum Sicherman, "Technological Change and the Skill Acquisition of Young Workers," *Journal of Labor Economics*, vol. 16, no. 4 (October 1998), pp. 718-755.

wise, the fraction of occupations in which training is necessary has grown. But the absence of historically consistent data on the provision of training makes drawing broader conclusions difficult.

Education and general training could also reduce the natural rate of unemployment, although the link is more complex than in the case of firm-specific training. On the one hand, higher educational attainment connoting higher skill and learning capacity makes workers able to qualify for or adapt to a wider range of jobs. Educated workers may also be more skilled in the job search process. Moreover, employers are more likely to invest in firm-specific training when their workers have already demonstrated general skills.

On the other hand, two factors could limit the impact of increased educational attainment on the natural rate. First, the increase in education may not be associated with a proportional increase in skill. Some economists maintain that the value of a college degree may have risen because it is increasingly used by prospective employers to screen candidates, regardless of the actual skills a prospective employee obtained while in college. Such screening would diminish the impact of rising educational attainment on the natural rate of unemployment. Second, the effect of any genuine increase in skill on the natural rate might be limited if skill enhancement raised a typical worker's *reservation wage*—the lowest wage rate needed to persuade a person to accept an offer of employment rather than continue to search—in tandem with the boost to that worker's productive capacity. Skill enhancement would increase the average worker's opportunity cost of continuing to search but also his or her expected reward from holding out for a better job offer.

CHANGES IN THE OPERATION OF LABOR MARKETS

Changes in the structure and operation of labor markets and in demand for workers with different skills can also affect the natural rate of unemployment. Those changes could involve the process by which unemployed workers search for jobs, the degree to which unemployed workers possess the skills desired by employers with vacancies, or the way in which the economy adjusts to shifts in demand for workers. One such change—the expanded use of temporary labor—has probably reduced the natural rate by between 0.2 and 0.4 percentage points over the past two decades. Growth in the use of the Internet to search for jobs may have affected the natural rate to a similar—or even greater—extent, but it is difficult to know for sure. In addition, greater synchronization of labor market conditions among geographic regions may have reduced the natural rate. Moreover, decreased job stability and an associated rise in the rate of simultaneous job creation and destruction may have boosted the natural rate, although the evidence remains inconclusive. A more rapid rate of technological change may also have worked to push up the natural rate, but the magnitude of that effect is impossible to quantify. Institutional changes, such as

weakened unions, a declining relative minimum wage, and forms of compensation that are generally more flexible may have helped to lower the natural rate by making it easier for companies to adjust to changing demand. However, estimates of the size of those effects are few and tend to vary widely.

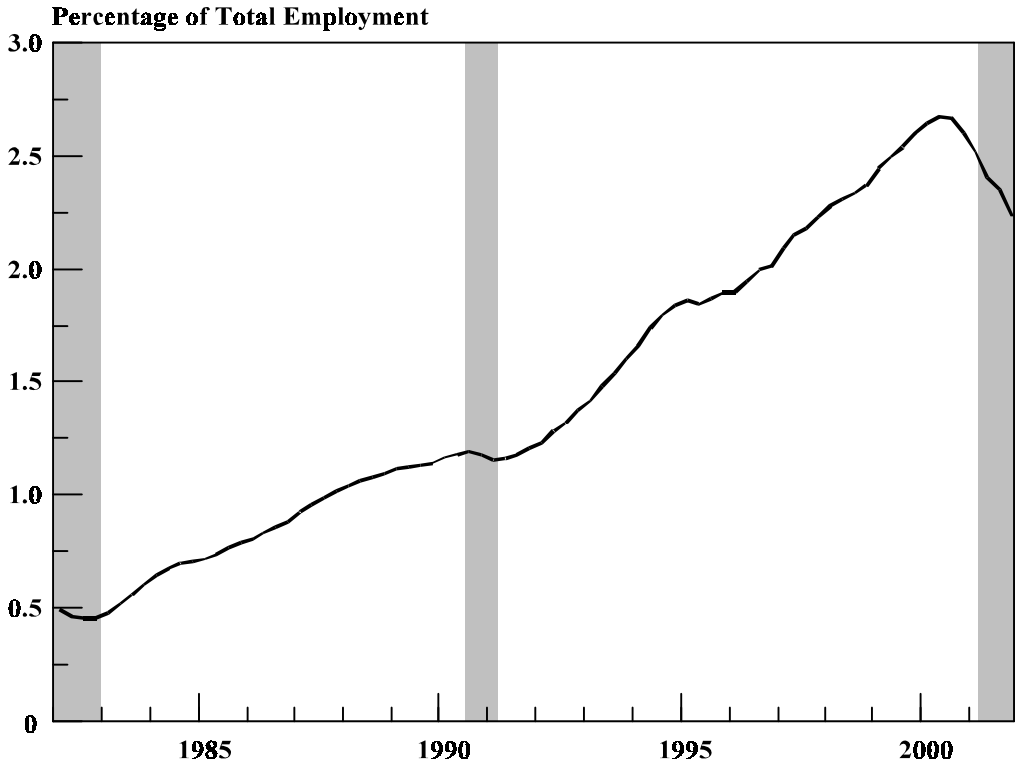
Use of Temporary Labor

The rapid growth of the temporary-help industry has in all likelihood significantly lowered rates of frictional and structural unemployment and thus the natural rate. In 1982, slightly more than 400,000 people (about 0.5 percent of total payroll employment) worked in the temporary-help industry. Employment in that industry reached its peak level of 3.5 million (2.7 percent of total employment) in mid-2000, but it declined by more than 600,000 people through the end of 2001 as the economy slipped into recession (see Figure 6). Until that recent drop, the impact of the temporary-help industry's expansion appears to have been substantial. Two studies that examined variation between states or metropolitan areas in the use of temporary workers concluded that the industry's expansion between the mid-1980s and late 1990s could account for a decline in the natural rate of 0.2 to 0.4 percentage points.[13]

From the perspective of employers, one important function of temporary-help agencies is to manage short-term fluctuations in demand. In economic booms, employers can often fill vacancies more quickly by using temporary-help agencies than by hiring directly. Even if the marginal cost of an additional hour worked was the same for temporary employees as it would be for workers hired directly as permanent staff members, employers would still save on recruiting and other one-time hiring costs as well as firing costs once demand returned to normal. Furthermore, especially in recent years, some employers have begun to take on workers from temporary-help agencies with the idea that the workers who performed well would be hired permanently. Although some workers prefer temporary employment, many more use temporary-help agencies to try various types of work or to take advantage of the agencies' screening function with the hope of landing a permanent job instead of remaining unemployed while searching.

13. Maria W. Otoo, *Temporary Employment and the Natural Rate of Unemployment*, Finance and Economics Discussion Series, Paper No. 1999-66 (Washington, D.C.: Board of Governors of the Federal Reserve System, December 1999); and Katz and Krueger, "The High-Pressure Labor Market of the 1990s."

FIGURE 6. EMPLOYMENT IN THE TEMPORARY-HELP INDUSTRY AS A SHARE OF TOTAL EMPLOYMENT



SOURCE: Department of Labor, Bureau of Labor Statistics.

NOTE: The data in this figure reflect employment in help supply services (Standard Industry Classification 7363), which primarily consists of temporary-help agencies. It includes all workers on an agency's payroll, regardless of the industry to which they are currently assigned.

Internet Job Searches

People's use of the Internet to search for a job has grown rapidly over the past several years.[14] The Internet may have reduced frictional unemployment directly by improving the efficiency of job searches and therefore shortening the search period, but it is difficult to assess the magnitude of any such reduction. Furthermore, the Internet may have lowered the natural rate by making it easier for currently employed workers to search for a new job, increasing the probability that workers will change employers without experiencing a spell of unemployment between jobs. Finally, because Internet searching provides job seekers with more-complete infor-

14. For example, Monster.com—a leading Internet firm in the field of employment listings—reported having over 1 million job postings and approximately 2.7 million subscribers to its free newsletter in January 2002. The company arose from a merger between two firms that began Internet operations in the early to mid-1990s.

mation about employers they are considering, it may improve the quality of matches and thus reduce the probability of a subsequent quit or performance-based dismissal.

Increased job searching through the Internet could have far-reaching implications for labor markets.[15] One recent study found that 15 percent of workers who were unemployed in December 1998 looked for work via the Internet.[16] In general, Internet job searches by the unemployed appeared to supplement, rather than replace, more traditional forms of searching, such as reading classified ads or networking. In addition, 7 percent of employed workers in 1998 used the Internet to investigate other job opportunities. In a follow-up to that study, the same authors tracked the subsequent labor force status of many of the people who had been unemployed in December 1998. They found that those who used the Internet to search for a job experienced considerably shorter spells of unemployment between jobs: a median duration of one to two months, compared with three to four months for people who did not use the Internet.[17]

Taken together, those results translate to a decline of roughly 0.3 to 0.4 percentage points from a baseline natural rate of unemployment of 5 percent (which is close to the current estimated rate) relative to the early 1990s, before Internet searching became widely practicable.[18] Moreover, that estimated reduction may be too small, for two reasons: Internet job searching has probably continued to increase in importance since the data for those studies was collected, and that estimate does not take into account spells of unemployment that may have been averted as a result of Internet searching while people were still employed. However, those results came from a period of exceptionally tight labor markets, when demand for workers greatly exceeded supply. It is unclear whether Internet job searching would be equally productive relative to other search methods under less favorable labor market conditions.

Synchronization Among Regions

Macroeconomic conditions were considerably more synchronized among regions during the economic expansion of the 1990s than during the previous two expan-

15. David H. Autor, "Wiring the Labor Market," *Journal of Economic Perspectives*, vol. 15, no. 1 (Winter 2001), pp. 25-40.

16. Peter Kuhn and Mikal Skuterud, "Job Search Methods: Internet vs. Traditional," *Monthly Labor Review*, vol. 123, no. 10 (October 2000), pp. 3-11.

17. Peter Kuhn and Mikal Skuterud, "Does Internet Job Search Reduce Unemployed Workers' Jobless Duration?" (paper presented at the Society of Labor Economists conference, Austin, Texas, April 2001).

18. CBO's current estimate for the natural rate of unemployment is 5.2 percent; the Administration's is 4.9 percent.

sions (especially that of the 1980s), and that synchronization may have contributed to a reduction in the natural rate. In 1979, when the economy was at a stage of the business cycle comparable to where it stood in 2000, unemployment rates by Census division ranged from 4.0 percent (West North Central) to 7.0 percent (Middle Atlantic). Similarly, in 1989, they ranged from 3.8 percent (New England) to 6.8 percent (West South Central). But in 2000, the range was 2.8 percent (New England) to just 4.8 percent (Pacific), and the highest unemployment rate in any state in the continental United States was 5.7 percent (in Mississippi).[19]

In general, any regional variation in employment conditions implies that while some areas are outperforming the national average, others are performing more poorly. Starting from a situation in which the supply of and demand for workers are balanced in all regions, if demand falls in one region, unemployment there will rise. If demand rises in another region at the same time, the unemployment rate in that region will fall. However, that decline may not be proportional to the increase elsewhere because the skills demanded by employers do not match those of available workers or because relative wages do not adjust by enough to restore equilibrium. As a result, for a given set of aggregate demand conditions, as the degree of synchronization increases, the national unemployment rate decreases.

Several factors may have contributed to the increased synchronization seen over the past decade. First, a number of states and regions have reduced their dependence on a single industry or cluster of industries, making those areas more like the rest of the nation and less vulnerable to industry-specific shocks. For example, the Texas economy is considerably less dependent on oil and gas today than it was a generation ago; similarly, the economy of western Pennsylvania no longer relies so heavily on the steel industry. Second, changes in the operation of financial markets—in particular, the removal of restrictions on interstate banking—may also have bolstered synchronization by permitting capital to flow more easily across state lines. Third, Internet job searching probably contributes to synchronization by facilitating the movement of information about job opportunities across broader geographic areas. If employment conditions slacken in one area, the most mobile workers there—typically young, well-educated, childless people—can seek employment in another area where conditions are more favorable. That easier movement of information and people tends to equalize labor market conditions.

All of those factors should imply a lessening in the degree of geographic mismatch between people seeking jobs and available positions, which would reduce structural unemployment. However, if the greater degree of synchronization seen during the latest expansion reflects the absence of region-specific shocks rather than

19. Even in December 2001, nine months after the economy entered recession, the variation among regions remained quite narrow, with a seasonally adjusted low of 4.2 percent in the West North Central region and a high of 6.4 percent in the Pacific region. State unemployment rates ranged from 3.1 percent, in North Dakota, to 7.8 percent, in Oregon.

improved efficiency or more diverse regional economies, the effect on unemployment might not be permanent.

Job Stability

Some observers have suggested that over the past several decades, employment has become increasingly unstable, with fewer long-tenure jobs than in the past. If so, such increased instability would imply greater turnover of workers and a higher natural rate of unemployment.

The evidence on instability is mixed, however, with different data sets and measures yielding different results. Data from one simple measure of instability—median tenure—suggest little change in tenure overall but some shifts within particular demographic categories.[20] Between 1987 and 1998—years that seem to reflect similar points in the business cycle—overall median tenure rose marginally, from 3.4 years to 3.6 years, although that increase could be explained at least in part by the aging of the workforce. Job tenure declined significantly among men ages 35 and over, but it rose among women.

Evidence from some studies points to reduced job stability during the economic expansion of the 1990s, compared with previous expansions, after data are adjusted for changes in the age mix of the labor force. But it is not entirely clear what portion of that reduction results from voluntary quits and what portion stems from involuntary layoffs or dismissals. For example, most defined-benefit pension plans reward workers with long tenure, effectively penalizing those who frequently change employers. But employers' ongoing shift from defined-benefit plans to defined-contribution pensions has reduced the cost to workers of changing jobs and has therefore quite likely encouraged greater voluntary turnover. Although voluntary job changes often do not entail a spell of unemployment, they do create vacancies that must be filled. To the extent that any decline in job stability comes from involuntary displacement, it is unclear whether that reduction is part of an ongoing trend or whether it simply reflects the short-term effect of a wave of corporate restructuring that took place during the early to mid-1990s.[21]

Changes in the mix of industries and occupations may also have contributed to changes in job stability. In principle, one possible source of increased instability is the declining share of jobs in manufacturing, a sector in which average tenure in the

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20. This measure is based on a series of special supplements to the Census Bureau's Current Population Survey that focus on employee tenure.

21. See the October 1999 special issue of the *Journal of Labor Economics*; and David Neumark, *Changes in Job Stability and Job Security: A Collective Effort to Untangle, Reconcile, and Interpret the Evidence*, Working Paper No. 7472 (Cambridge, Mass.: National Bureau of Economic Research, January 2000).

past was significantly higher than in the economy as a whole. Between 1987 and 1998, the share of jobs in that sector fell by about 4 percentage points, whereas the share of jobs in services—a sector with below-average tenure—increased by 6 percentage points. The implications of that shift may not be as important as the numbers seem to imply, however, because the difference in average tenure between sectors has diminished over the past several decades. At the same time, shifts in the occupational mix appear to have had little effect on job stability. The share of jobs held by skilled and semiskilled blue-collar workers—a group with high tenure—fell by about 2.5 percentage points over that period. But that of managers and professionals—another group with high tenure—rose by 5 percentage points over the same span.

A phenomenon closely related to job stability is "churning," the flow of workers into and out of jobs with no lasting effect on total employment at any establishment. Churning can arise from workers' quitting and subsequently being replaced or from simultaneous hiring and firing within an establishment. A greater degree of churning theoretically means higher frictional and structural unemployment while vacancies remain unfilled and workers who have quit or been terminated search for their next job. One recent study that examined churning using a unique data set covering Maryland establishments between 1985 and 1994 found it to be considerably higher in nonmanufacturing sectors than in the manufacturing sector but "high and pervasive" across all sectors of the state's economy.[22] The authors did not find any clear trend in the degree of churning. Their findings may be of limited usefulness in establishing a link between churning and a higher rate of unemployment, however, because the data do not include information on whether workers affected by churning actually experienced spells of unemployment and because the data may not be representative of the national economy.[23]

Technological Change

Some observers have suggested that the rapid rate of technological advance over the past several decades may have, at least for a time, increased the natural rate of unemployment by creating mismatches between the skills of available workers and those desired by employers. A large volume of literature focuses on the effect of technological change on relative wages and the wage distribution. That research

22. Simon Burgess, Julia Lane, and David Stevens, "Job Flows, Worker Flows, and Churning," *Journal of Labor Economics*, vol. 18, no. 3 (July 2000), pp. 473-502.

23. Sometime soon, the Bureau of Labor Statistics plans to release data from a new monthly Job Openings and Labor Turnover Survey (JOLTS), which will focus on turnover and on the availability of unfilled jobs. That survey will cover 16,000 establishments, and its design will be comparable to that of the bureau's monthly establishment survey (including government). JOLTS will contain information on total hires and separations as well as the number of job openings. Unfortunately, no historical data will be available.

was motivated by the observed widening of the wage distribution in general and by the growing wage premium for people with college degrees in particular. Clearly, growth in the demand for skilled workers (relative to that for unskilled workers) has exceeded growth in the relative supply of those workers since at least the late 1970s.[24] Early studies identified technological change that favors skilled workers as a likely contributor to growing wage inequality, mainly by showing that other factors (such as trade, immigration, weaker unions, and the minimum wage) could not fully explain it.[25] More recently, studies have found direct links between changes in the wage distribution and specific aspects of technological change.[26]

Technological change could increase the natural rate of unemployment if it raised demand for workers at higher skill levels and lowered demand for unskilled workers. Higher unemployment might result to the extent that labor market institutions such as unions, the minimum wage, and established relative pay scales within establishments prevented the relative wages of the unskilled from falling in tandem with the decline in demand. But it is unclear whether that has actually occurred. In fact, technological change may reduce the natural rate in the long run by encouraging more workers to obtain training.[27] Moreover, the nature of technological change itself may have begun to shift, which could also tend to reduce the natural rate. Some forms of new technology have made very unskilled workers—a group with limited job opportunities—more able to work as retail clerks or in fast-food restaurants. It is too soon to gauge the magnitude of that shift, but it could at least offset, it not reverse, any past tendency for technological change to boost unemployment.

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24. Lawrence F. Katz and Kevin M. Murphy, "Changes in Relative Wages, 1963-1987: Supply and Demand Factors," *Quarterly Journal of Economics*, vol. 107, no. 1 (February 1992), pp. 35-78; and Frank Levy and Richard J. Murnane, "U.S. Earnings Levels and Earnings Inequality: A Review of Recent Trends and Proposed Explanations," *Journal of Economic Literature*, vol. 30, no. 3 (September 1992), pp. 1333-1381.

25. John Bound and George Johnson, "Changes in the Structure of Wages in the 1980s: An Evaluation of Alternative Explanations," *American Economic Review*, vol. 82, no. 3 (June 1992), pp. 371-392.

26. David Autor, Lawrence F. Katz, and Alan B. Krueger, "Computing Inequality: Have Computers Changed the Labor Market?" *Quarterly Journal of Economics*, vol. 113, no. 4 (November 1998), pp. 1169-1213; and Steven G. Allen, "Technology and the Wage Structure," *Journal of Labor Economics*, vol. 19, no. 2 (April 2001), pp. 440-483.

27. Stephan Danninger and Jacob Mincer, "Technology, Unemployment, and Inflation," in Solomon W. Polachek, ed., *Worker Well-Being*, vol. 19, *Research in Labor Economics* (Amsterdam: Elsevier Science, 2000), pp. 1-28.

Institutional Changes

As noted above, institutions such as unions, internal pay scales, the minimum wage, and various practices and social conventions that restrict wage flexibility may hold wages for some occupations in some locations above their equilibrium level. Those institutions could increase unemployment in two ways—by reducing the number of workers demanded and by inducing greater labor force participation (which means more spells of unemployment).

At least some of those forces appear to have diminished in importance in recent decades, however, which may have helped to reduce the natural rate of unemployment. Union membership as a share of total wage and salary employment fell from 20 percent in 1983 (the first year in which measures consistent with those used today became available) to 13.5 percent by 2001 (see Figure 7).[28] In addition, over the past two decades, the federal minimum wage has declined relative to wages economywide (see Figure 8), largely because it remained constant in nominal terms between 1981 and 1990. During the 1970s, as inflation accelerated, the federal minimum wage was adjusted frequently; between 1975 and 1981, the ratio of the minimum wage to average hourly earnings of production and nonsupervisory workers averaged 46 percent. That ratio fell as low as 34 percent before the minimum wage was again raised in 1990. Since then (with three subsequent increases in the minimum wage), the ratio has ranged from 36 percent to 41 percent.

One study estimates that a 10 percent increase in the minimum wage (relative to an economywide average) raises the natural rate of unemployment by about half a percentage point.[29] That finding implies that reductions in the relative minimum wage may have lowered the natural rate by more than a percentage point between the late 1970s and the late 1980s. Other research, however, suggests that the impact of the minimum wage on employment is slight, in part because only a small fraction of the labor force is affected by changes to the minimum wage.[30] In late 2001, about 1 percent of private-sector workers earned the minimum wage ($5.15 per hour), and another 6 percent earned between $5.15 and $6.65 per hour.[31] Nonetheless, future legislation raising the minimum wage could boost the natural rate during CBO's 10-year projection period. In contrast, the absence of such legislation could reduce the

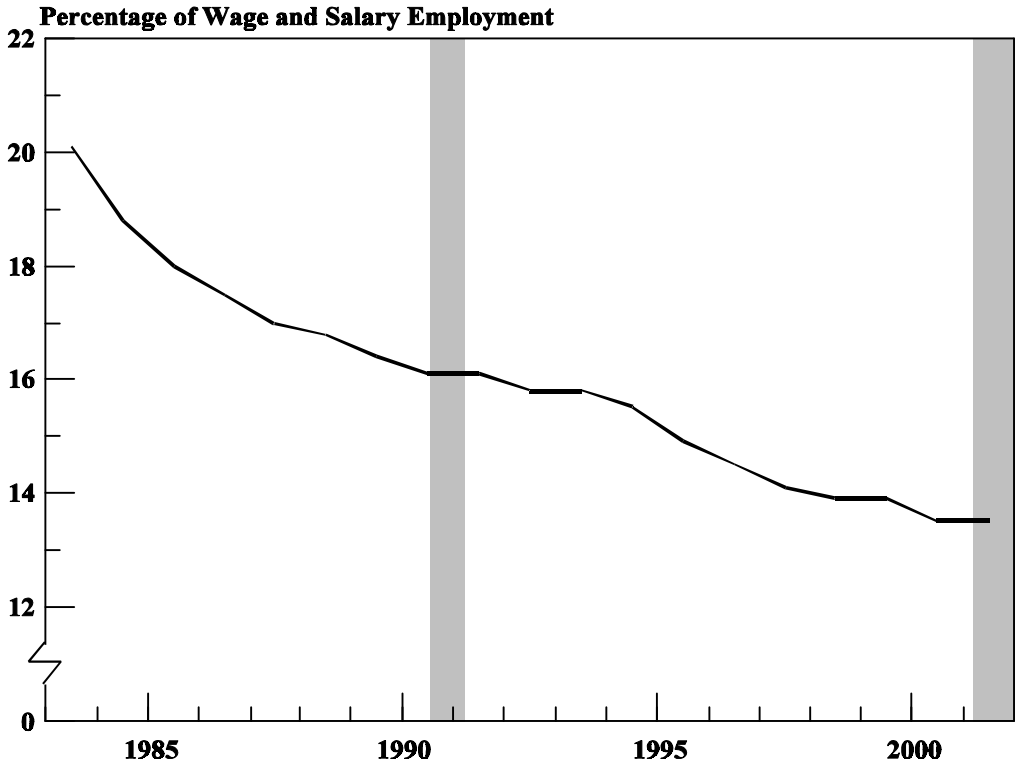
28. Older measures of union membership rates indicate that membership peaked in the 1950s and began to drop sharply in the mid-1970s.

29. Peter Tulip, *Do Minimum Wages Raise the NAIRU?* Finance and Economics Discussion Series, Paper No. 2000-38 (Washington, D.C.: Board of Governors of the Federal Reserve System, August 2000).

30. David Card and Alan B. Krueger, *Myth and Measurement: The New Economics of the Minimum Wage* (Princeton, N.J.: Princeton University Press, 1995).

31. Based on unpublished tabulations provided to CBO by the Bureau of Labor Statistics.

FIGURE 7. UNION MEMBERSHIP AS A SHARE OF WAGE AND SALARY EMPLOYMENT



SOURCE: Department of Labor, Bureau of Labor Statistics.

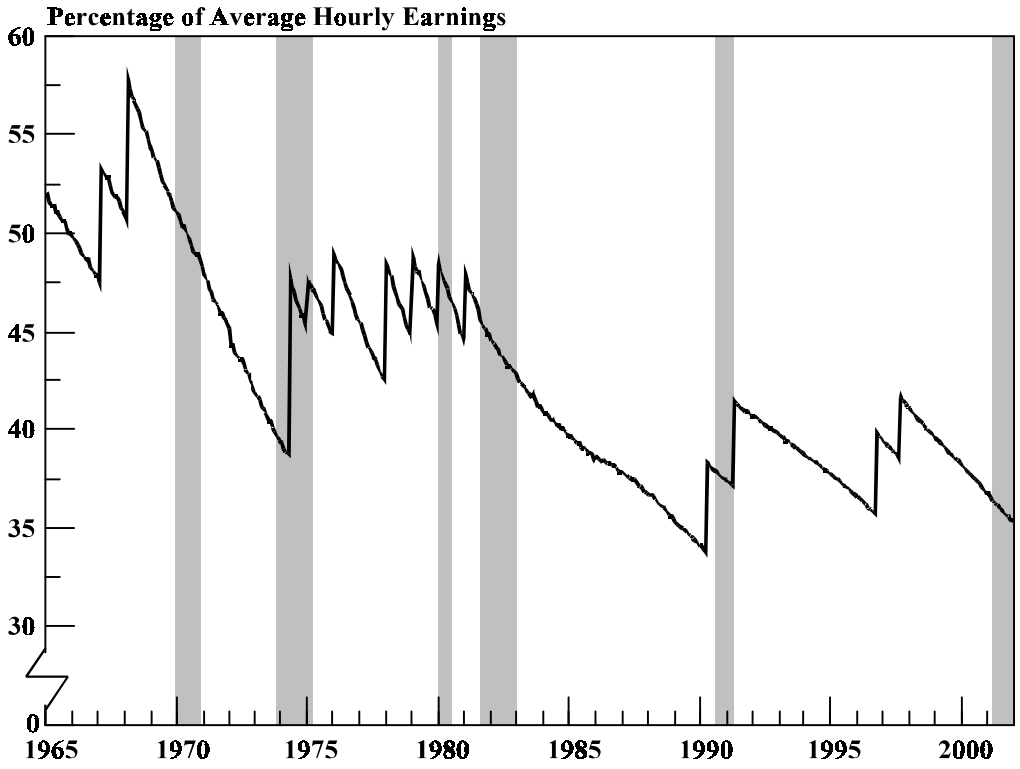
natural rate, because fewer and fewer workers would become affected by the minimum wage as wages rose throughout the economy.

Use of Performance-Based Pay

Along with those institutional changes, shifts toward more variable forms of pay, such as bonuses and stock options, may have contributed to a decline in the natural rate by weakening rigidities that had prevented labor markets from adjusting toward equilibrium.[32] If wages could adjust fairly readily to changes in demand for labor, that adjustment could at least forestall, and possibly preclude, the generation of structural unemployment in response to such shifts in demand. One study found that the use of performance-based pay has grown in importance in recent years and suggested that such growth could have reduced the natural rate (and the NAIRU) by

32. That statement does not imply that those rigidities have disappeared entirely. Rigidities arising from "efficiency wage" considerations, notions of fairness, or the preservation of customary wage differentials between occupations within an establishment are likely to still exist in many instances.

FIGURE 8. THE FEDERAL MINIMUM WAGE AS A PERCENTAGE OF AVERAGE HOURLY EARNINGS



SOURCE: Department of Labor, Employment Standards Division and Bureau of Labor Statistics.

making labor markets more efficient and flexible.[33] However, that study does not provide an estimate of the quantitative significance of the shift toward performance-based pay.

Security Concerns

The heightened emphasis on security after the September 11 terrorist attacks may increase the natural rate by generating new frictions in the labor market. If people were less comfortable relocating away from their family and friends, mobility between regions could fall as a result.

Another way in which security concerns could affect the natural rate of unemployment is through employers' perceived need to conduct extensive background checks on prospective employees before hiring them. Results from one study imply

33. David Lebow and others, *Recent Trends in Compensation Practices*, Finance and Economics Discussion Series, Paper No. 1999-32 (Washington, D.C.: Board of Governors of the Federal Reserve System, July 1999).

that a completed spell of unemployment typically lasts about 12 weeks.[34] If new background-check requirements added half a week, on average, to the process of filling vacant positions, the unemployment rate would rise by 4 percent (an increase of 0.2 percentage points if the natural rate was 5 percent). But the impact of new security requirements is likely to be considerably smaller, for two reasons. First, many job openings already require extensive background checks, and others are not likely to require such checks even in a period of heightened security. Second, procedures for conducting background checks are likely to be streamlined over time, and even additional checks need not add significant time to the hiring process if they can be conducted concurrently with other parts of that process.

34. Kuhn and Skuterud, "Does Internet Job Search Reduce Unemployed Workers' Jobless Duration?" That paper found that Internet job searching cut median search time from between three and four months to between one and two months. Under the assumption that 20 percent of unemployed workers used the Internet to search for a job, the estimated average completed spell is roughly 12 weeks.

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