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## **The Natural Rate of Unemployment**

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### Abstract

This paper assesses the natural rate of unemployment—the unemployment rate that arises from all sources other than fluctuations in demand associated with business cycles. The natural rate is determined by the rate at which jobs are simultaneously created and destroyed, the rate of turnover in particular jobs, and how quickly unemployed workers are matched with vacant positions. Those factors in turn depend on the characteristics of jobs and of workers and on the efficiency of the labor market’s matching process. Evidence points to a natural rate that has declined over the past two decades, in part as a result of shifts in the age composition of the labor force and in part because of some combination of an improved match between workers and jobs and a more efficient matching process.

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The Congressional Budget Office (CBO) projects the growth in labor input as a part of its forecast. A key element in that projection is what is sometimes called the *natural rate of unemployment*, the average unemployment rate that stems from sources other than the business cycle.<sup>1</sup> Post-World War II historical data show that while the unemployment rate rises in recessions and falls during expansions, it also has a significant noncyclical component that has varied over time, rising in the late 1960s and throughout the 1970s and declining after the early 1980s (see Figure 1). In CBO's most recent forecast, the natural rate was estimated at 5.0 percent, both currently and for the 10-year projection period through 2017; it is lower than the 6.0 percent rate of the mid-1980s.<sup>2</sup> Nonetheless, economists are uncertain about what the current natural rate is, how much it has fallen in recent years, and how it might evolve in the future. This paper examines the evolution of the natural rate of unemployment.

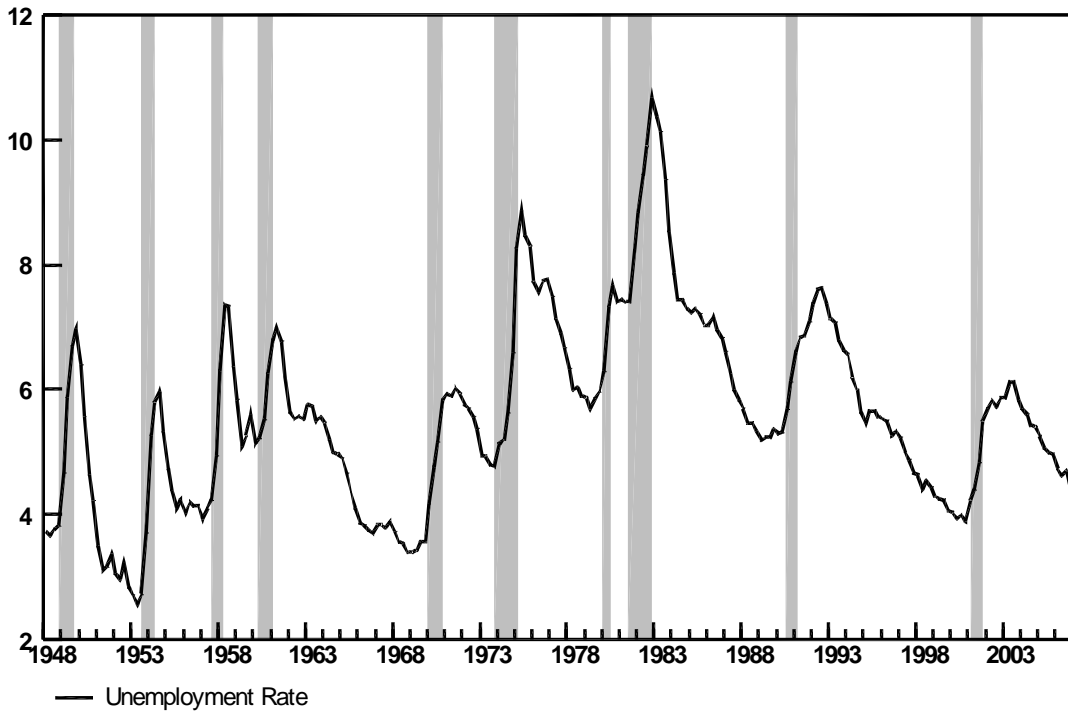
The natural rate of unemployment is determined by frictions and structural rigidities in the labor market. Each job has attributes—wages, hours, working conditions, required skills, and location, for example. Each potential worker also has a set of skills, abilities, and work preferences. Employment occurs when there is a match between a particular worker and a particular job. At any given time, however, some workers will not have jobs, some jobs will be unfilled, and some potential workers will not be participants in the labor force. Vacancies can arise as new jobs are created and as workers separate voluntarily or involuntarily from their jobs. At the same time, unemployment occurs as existing jobs are eliminated and as people enter (or re-enter) the labor force. (When separation occurs because a worker and job are poorly matched, and the worker remains in the labor force, the result is both an additional vacancy and additional unemployment.) The unemployment rate will depend in part on the rate at which vacancies and unemployment simultaneously occur as a result of the microlevel decisions made by individual people and

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<sup>1</sup> The concept of the natural rate is related to what is sometimes termed the *non-accelerating inflation rate of unemployment*, or NAIRU. In the long run, the two rates are expected to be equivalent; however, this need not be the case over a near-term forecasting horizon. The gap between the actual unemployment rate and the natural rate is just one of several factors CBO uses to make its near-term projections of inflation.

<sup>2</sup> See Congressional Budget Office, *The Budget and Economic Outlook: Fiscal Years 2008 to 2017* (January 2007).

**Figure 1.**  
**Unemployment Rate, 1948 to 2007**



Source: Bureau of Labor Statistics.

Note: The shaded vertical bars indicate business-cycle recessions, as determined by the National Bureau of Economic Research.

businesses. Thus, other things being equal, a higher rate of structural change in the economy—as exhibited by the simultaneous creation and destruction of jobs—will tend to result in a higher rate of unemployment. Similarly, higher rates of individual turnover in existing and continuing jobs also will be associated with higher unemployment. Turnover rates depend in part on the nature of jobs; but more important, they are heavily influenced by the age mix of the adult population. The age mix also influences the rate at which people enter and exit the labor force.

The unemployment rate also will depend on how quickly a typical vacancy can be filled. Broadly speaking, that in turn depends on two factors: how well the characteristics of unemployed job seekers fit those sought by employers and how efficiently the process of matching job seekers and job openings operates.

**Table 1.**  
**Unemployment Rate by Age and Sex, 2006**

	Male	Female	Both Sexes
16 to 19	16.8	13.8	15.3
20 to 24	8.7	7.6	8.2
25 and Older	3.5	3.7	3.6
25 to 34	4.5	4.9	4.7
35 to 44	3.3	3.9	3.6
45 to 54	3.1	3.1	3.1
55 and Older	3.0	2.9	3.0
<b>Total, 16 and Older</b>	<b>4.6</b>	<b>4.6</b>	<b>4.6</b>

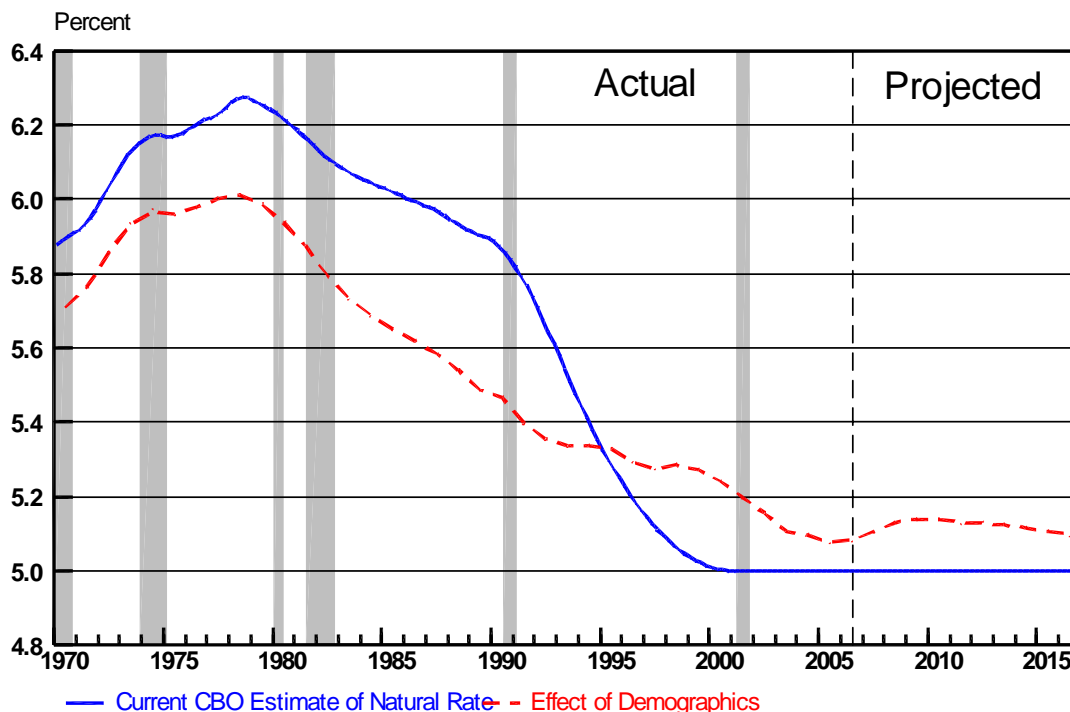
Source: Bureau of Labor Statistics.

### Composition of the Labor Force

Shifts in the composition of the labor force—the relative number of people in a given age group or the relative proportion of men and women—can influence the unemployment rate. The most important dimension is age, particularly the fraction of the labor force that is young. Workers between the ages of 16 and 24 often experience unemployment as they look for a first job or return to the labor force after attending school or receiving support from parents. Younger workers also are more likely to change jobs than are workers over the age of 25. Many older workers have settled into careers, and they are less likely than are younger workers to leave jobs because the work does not match their abilities and preferences.

The data on unemployment underscore the age differences (see Table 1). In 2006, 15.3 percent of teenaged workers were unemployed, as were 8.2 percent of workers between the ages of 20 and 24. That is in contrast to an overall unemployment rate of 4.6 percent. Those substantial differences are reflected in CBO's estimates of the natural rate of unemployment over the past 35 years, which have largely (although not entirely) reflected shifts in the population's age distribution (see Figure 2).

**Figure 2.**  
**Demographics and the Natural Rate of Unemployment**



Source: Congressional Budget Office.

Notes: The dashed line shows the unemployment rate calculated by holding the rates within groups defined by age and sex at their 2005 level, but with population shares varying over history and as projected by the Social Security Administration and with group-specific labor force participation rates varying over history and as projected by CBO. The shaded vertical bars indicate business-cycle recessions, as determined by the National Bureau of Economic Research.

In its summer 2006 forecast, CBO reduced its estimate of the current natural rate from 5.2 percent to 5.0 percent, reflecting a decline since the mid-to-late 1990s in the share of the labor force that is below the age of 25. That decline is attributable not to a change in the age mix of the general population, but to an unexpected sharp and sustained drop in the labor force participation rate of teens and young adults, most likely because of higher rates of school enrollment.<sup>3</sup> The labor force participation rate for 16- to 19-year-olds fell from 52.0 percent in 2000 to 43.7 percent in 2005 and 2006. The participation rate for 20- to 24-year-olds declined similarly, although less dramatically, from 77.8 percent in 2000 to 74.6 percent in 2005 and 2006. The participation rate

<sup>3</sup> See Congressional Budget Office, *What Is Happening to Youth Employment Rates?* CBO Background Paper (November 2004).

among people ages 55 and older has risen. Since 2000, those shifts in the participation rate together have reduced the aggregate unemployment rate by 0.2 percentage points. However, CBO's projections for growth in the labor force by age would indicate that no further decline is to be anticipated over the next decade.

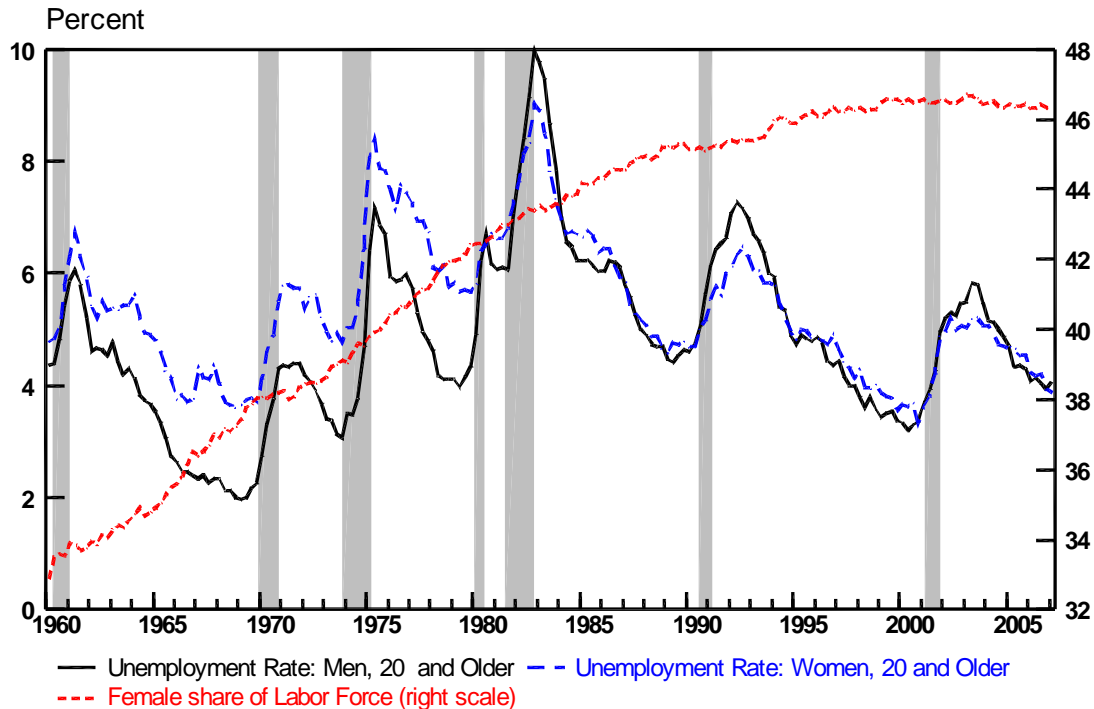
A generation ago, the gender mix also mattered; at least part of the increase in the natural rate of unemployment throughout the 1970s was attributable to rapidly rising labor force participation among adult women. At the time, the unemployment rate usually was higher among women than among men, largely because women as a group had less job experience and tended to move in and out of the labor force in their child-bearing years. For the past two decades, however, the unemployment rate of women actually has been on average slightly below that of men, and women's share of the labor force has been relatively stable (see Figure 3).

A change in national disability policy also might have contributed to the reduction in the average unemployment rate. The Disability Benefits Reform Act of 1984 relaxed federal restrictions on eligibility for Social Security Disability Insurance (DI). Since the mid-1980s, there also has been a general decline in job opportunities and relative wages for workers without postsecondary education. The increase in the number of DI recipients, particularly men, has been concentrated among the least educated. Therefore, for some eligible people without college degrees, receiving DI benefits could have become a more attractive prospect than remaining in the labor market.<sup>4</sup> As a result, some people who would otherwise have had an above-average incidence of unemployment were removed from the labor force all together. According to David Autor and Mark Duggan, that factor alone might have reduced the natural rate by as much as half a percentage point since the mid-1980s.

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<sup>4</sup> See David H. Autor and Mark G. Duggan, "The Rise in the Disability Rolls and the Decline in Unemployment," *Quarterly Journal of Economics*, vol. 118 (2003), pp. 57–205.

**Figure 3.**  
**Unemployment Rates, by Sex, 1960 to 2007**



Sources: Congressional Budget Office and Bureau of Labor Statistics.

Note: The shaded vertical bars indicate business-cycle recessions, as determined by the National Bureau of Economic Research.

Educational attainment, another factor that could lower unemployment, has increased over the past several decades. Better educated workers can perform a wider range of jobs, and vacant positions can be filled more quickly. The consequence of this improved match between employers' needs and workers' abilities is reduced unemployment. The existence of a more highly skilled workforce also could reduce unemployment if it causes employers to become more willing to commit resources to training. In that case, the employers' investments in training may give them additional incentives to minimize turnover. Moreover, better educated workers may be better able to search for new jobs while they are still employed, and thus more likely to move from one job to another without ever becoming unemployed. The importance of those effects is difficult to assess, however, in part because dimensions of skill other than educational attainment are difficult to measure.

## Job Stability, Churning, and Turnover

Changes in the structure of the labor market—the mix of available jobs—can influence the unemployment rate. A relatively rapid rate of structural change can result in the simultaneous creation and loss of a large number of jobs, thus increasing the average unemployment rate by simultaneously creating vacancies and unemployment. This also can occur if the mix of jobs shifts away from those characterized by stable, long-term employment relationships and toward those with higher rates of turnover. The effects might be amplified to the extent that structural change entails shifts in the demand for workers with particular sets of skills; retraining takes time, so the duration of unemployment or nonparticipation could rise.

There is only mixed evidence that those phenomena have become more important over time, but some data suggest that unemployment associated with structural changes has declined. Data from the Business Employment Dynamics series indicate that the rate of simultaneous job creation and destruction has been significantly lower during the current expansion than it was during the expansion of the 1990s, implying, other things equal, a lower average unemployment rate (see Figure 4).<sup>5</sup> The rates of job creation and destruction in manufacturing are currently at historic lows.<sup>6</sup> Data on individual turnover suggest that, by the end of 2006, hiring, job opening, and separation rates were all comparable to those of the final several months of the 1990s expansion.<sup>7</sup> And the prevalence of long-tenured jobs also appears to have changed little over the past several decades.<sup>8</sup>

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<sup>5</sup> The Bureau of Labor Statistics' Business Employment Dynamics series measures net job gains in opening and expanding establishments and net job losses in closing and contracting establishments over the course of a quarter. Data from the series are available for the third quarter of 1992 through the second quarter of 2006.

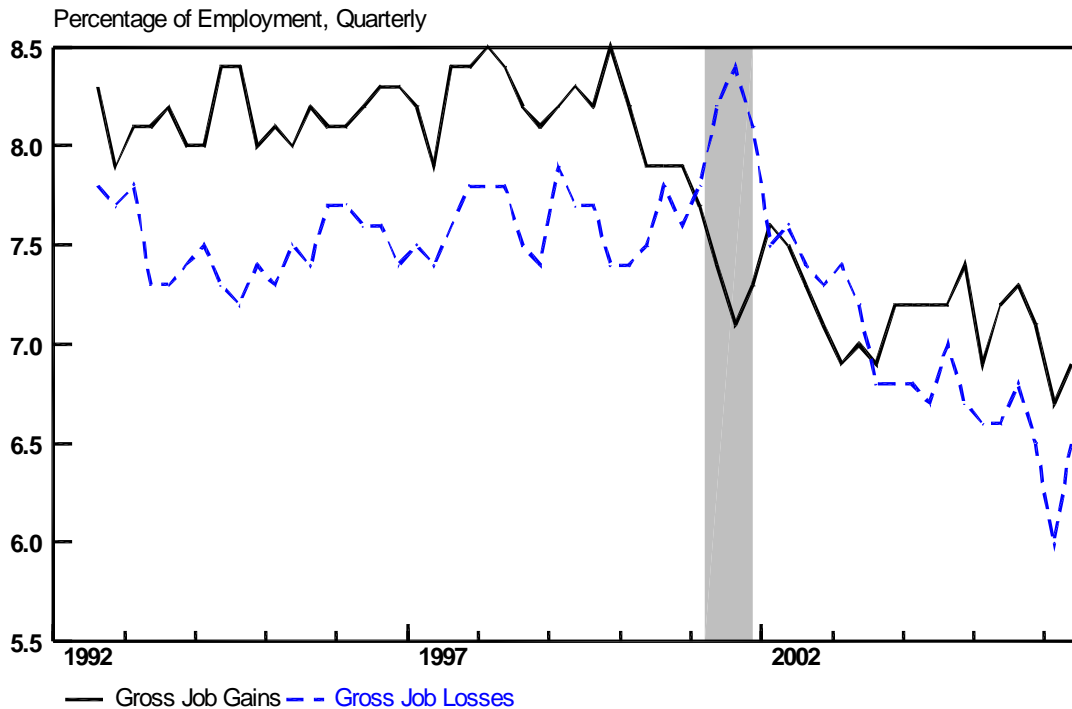
<sup>6</sup> R. Jason Faberman, *Job Flows and the Recent Business Cycle: Not All "Recoveries" Are Created Equal*, Working Paper 391 (U.S. Bureau of Labor Statistics, February 2006).

<sup>7</sup> This is based on data from the Job Openings and Labor Turnover Survey (JOLTS), which measures monthly rates of hiring and separation from jobs and the number of job openings at the end of each month. As of mid-April 2007, JOLTS data were available for the period from December 2000 through the end of February 2007.

<sup>8</sup> See Ann Huff Stevens, *The More Things Change, the More They Stay the Same; Trends in Long-Term Employment in the United States, 1969–2002*, Working Paper 11878 (Cambridge, Mass.: National Bureau of Economic Research, December 2005).



**Figure 4.**  
**Private-Sector Gross Job Gains and Losses, 1992 to 2006**



Source: Congressional Budget Office.

Note: The shaded vertical bar indicates a business-cycle recession, as determined by the National Bureau of Economic Research.

Changes in the mix of industries, however, may have led to reduced job stability. In particular, the share of jobs in manufacturing, a sector in which jobs in the past tended to be relatively stable, has declined sharply. The largest gains in the share of employment have been in professional and business services, in leisure and hospitality services, and in education and health services (see Figure 5). Leisure and hospitality shows above-average rates both of simultaneous job creation and destruction and of individual worker turnover. By contrast, there tends to be lower turnover in education and health services jobs (see Table 2).

**Table 2.**  
**Turnover Rates for Selected Industries, 2005**  
 (Percentage of total employment)

	<b>Job Churning</b>	<b>Individual Turnover</b>
Private Sector		
Construction	22.7	11.3
Manufacturing	8.3	5.0
Service providing	13.6	n.a.
Retail trade	13.4	9.2
Information	10.1	n.a.
Financial activities	11.3	n.a.
Professional and business services	16.3	10.0
Education and health services	9.0	5.1
Leisure and hospitality services	18.4	12.7
<b>Total Private Sector</b>	<b>13.8</b>	<b>7.8</b>
Government	n.a.	2.8
<b>Total</b>	<b>—</b>	<b>7.0</b>

Source: Congressional Budget Office based on Bureau of Labor Statistics data.

Note: Job churning is the sum of quarterly gross job gains and gross job losses, as a percentage of total employment, determined on the basis of Business Employment Dynamics data. Individual turnover is the sum of monthly hires and separations as a percentage of total employment, determined on the basis of data from the Job Openings and Labor Turnover Survey.

n.a. = not available; — = not applicable.

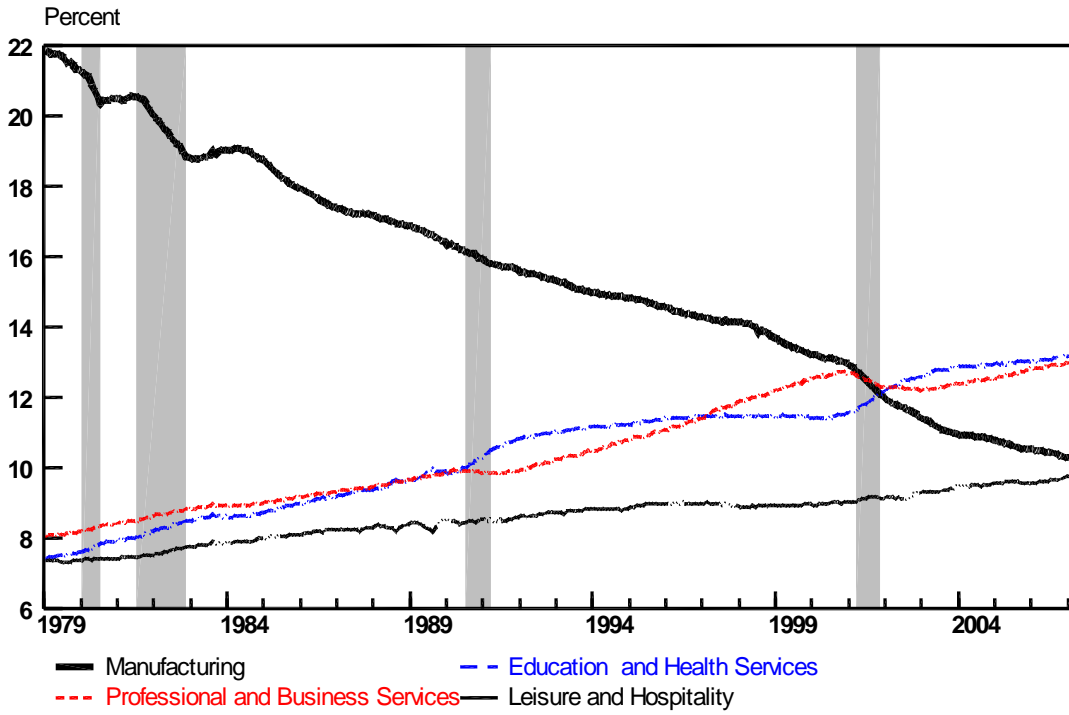
### **Labor Market Efficiency**

The final determinant of the natural rate of unemployment is the rate at which vacancies, once created, are filled. Any improvement in the efficiency of that process will result in a lower rate of unemployment. Analysts have cited two major efficiency-enhancing changes in the labor market in recent years—the expansion of the temporary-help industry and prospective employees' use of the Internet to search for jobs.

Employment in the temporary-help industry expanded from just over 400,000 people (0.5 percent of total payroll employment) in 1982 to 3.5 million (2.7 percent of the total) in mid-2000, although it declined sharply during the 2001 recession (see Figure 6). In particular, two studies concluded that the growth of this industry could account for a 0.2- to 0.4-percentage-point decline in unemployment during the period.<sup>9</sup>

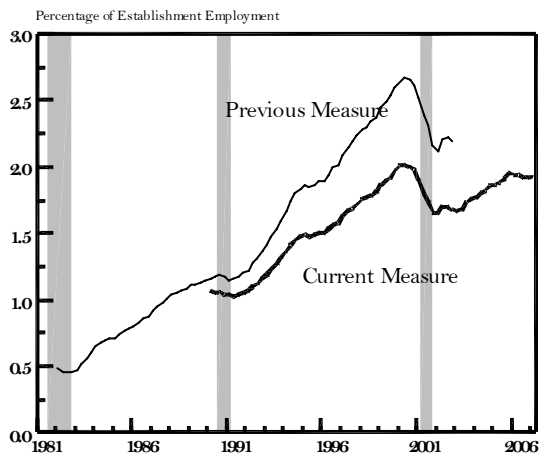
<sup>9</sup> Lawrence F. Katz and Alan B. Krueger, "The High-Pressure Labor Market of the 1990s," *Brookings Papers on Economic Activity*, vol. 1 (1999); Maria W. Otoo, *Temporary Employment and the Natural Rate of Unemployment*, Finance and Economics Discussion Series, Paper 1999-66 (Federal Reserve Board of Governors, December 1999).

**Figure 5.**  
**Employment Share, Selected Industries, 1979 to 2007**



Source: Congressional Budget Office.  
 Note: The shaded vertical bars indicate business-cycle recessions, as determined by the National Bureau of Economic Research.

**Figure 6.**  
**Employment in Temporary-Help Agencies, 1981 to 2007**



Source: Congressional Budget Office.  
 Note: The shaded vertical bars indicate business-cycle recessions, as determined by the National Bureau of Economic Research.

Temporary-help agencies can help employers fill vacancies expediently. Job seekers can benefit as well by going to work for an agency rather than remain unemployed while they search for permanent work. Moreover, some employers end up offering permanent positions to employees they find through such agencies. Despite what seemed to have been a trend, however, the portion of the labor force filled by temporary workers flattened after the recession and has not yet rebounded to its 2000 level. That sector therefore cannot account for any further decline in unemployment since the late 1990s.<sup>10</sup>

Some analysts have speculated that the Internet could be a faster route to employment than other methods job seekers have used in the past. Although initial findings suggested that was a plausible assumption, more recent analysis suggests that Internet use may in fact not have reduced search time.<sup>11</sup> Still, the Internet might have enhanced the labor market's efficiency by facilitating direct moves from one job to another, without interim unemployment, although that assumption seems questionable as well.

Recent evidence suggests that the job-finding rate (which includes the rate at which people move directly from one job to another) is much more important than is the separation rate in explaining cyclical fluctuations.<sup>12</sup> However, the studies do not reveal significant trends in job-finding rates, and data compiled by economists at the Federal Reserve Board of Governors indicates that, as a percentage of workers who separated from jobs for any reason, fewer people made direct job-to-job transitions in 2005 and the first half of 2006 than did so throughout the expansion of the 1990s.<sup>13</sup>

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<sup>10</sup> The temporary-help industry was redefined after the conversion to the North American Industry Classification System; with the new definition, its share is lower than previously reported. For the period (1990–2002) in which we have overlapping data based on both the old and new definitions, the trends are largely similar.

<sup>11</sup> See Peter Kuhn and Mikal Skuterud, "Does Internet Job Search Reduce Unemployed Workers' Jobless Duration?" (Society of Labor Economists conference, Austin, Tex., April 2001); Kuhn and Skuterud, "Internet Job Search and Unemployment Durations," *American Economic Review*, vol. 94, no. 1 (March 2004), pp. 218–232.

<sup>12</sup> See Robert E. Hall, "Job Loss, Job Finding, and Unemployment in the U.S. Economy over the Past Fifty Years," in Mark Gertler and Kenneth Rogoff, eds., *NBER Macroeconomics Annual 2005* (Cambridge, Mass.: MIT Press, 2006), pp. 101–137; Robert Shimer, "The Cyclicalities of Hires, Separations, and Job-to-Job Transitions," *Federal Reserve Bank of St. Louis Review* (July–August 2005), pp. 493–507; Eva Nagypal, "Worker Reallocation over the Business Cycle: The Importance of Job-to-Job Transitions" (Evanston, Ill.: Northwestern University, 2004.) For a somewhat different view, see Michael W. Elsby, Ryan Michaels, and Gary Solon, *The Ins and Outs of Cyclical Unemployment*, Working Paper 12853 (Cambridge, Mass.: National Bureau of Economic Research, January 2007).

<sup>13</sup> Bruce Fallick and Charles A. Fleischman, *Employer-to-Employer Flows in the U.S. Labor Market: The Complete Picture of Gross Worker Flows*, Finance and Economics Discussion Series 2004-34 (Federal Reserve Board of Governors, June 2004). Data updated to June 2006 are available online: [www.federalreserve.gov/pubs/feds/2004/200434/feds200434.xls](http://www.federalreserve.gov/pubs/feds/2004/200434/feds200434.xls).

## Overall Results: Evidence from the Beveridge Curve

Aggregate (economywide) changes in the relationship between vacancies and unemployment suggest that, on the whole, the efficiency of the labor market may have increased over the past 20 years. That relationship—known as the Beveridge curve—indicates that when labor markets are tight, vacancies rise and unemployment falls; the reverse is true in a slack labor market.<sup>14</sup>

Past analysis revealed a persistent outward shift in the Beveridge curve between the 1960s and early 1980s.<sup>15</sup> For any given number of vacancies, therefore, the number of unemployed people was higher. The shift was attributed mostly to growing geographic disparities in economic conditions. More recently, Robert Valletta showed that the Beveridge curve has shifted inward since the late 1980s, exhibiting a reduced number of unemployed people at any given level of vacancies and fully offsetting the earlier outward shift (see Figure 7).<sup>16</sup> This implies either that the job-searching process has indeed become more efficient over the past two decades or that the skills and other attributes of unemployed job seekers have become better matched with those sought by employers.<sup>17</sup>

To assess the quantitative impact of changes in the labor market, we used Valletta's measure of the cumulative shift in the Beveridge curve (see Figure 8). That measure was incorporated into an Okun's law regression, which relies on the historical relationship between the gross domestic product (GDP) gap—the difference between actual and potential GDP—and the unemployment

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<sup>14</sup> See William Beveridge, *Full Employment in a Free Society* (London: George Allen and Unwin, 1944).

<sup>15</sup> See Katherine G. Abraham, "Help Wanted Advertising, Vacancies, and Unemployment," *Brookings Papers on Economic Activity*, vol. 1 (1987), pp. 207–248.

<sup>16</sup> Robert G. Valletta, "Why Has the U.S. Beveridge Curve Shifted Back? New Evidence Using Regional Data," Working Paper 2005-25 (Federal Reserve Bank of San Francisco, December 2005); Robert G. Valletta and Jaclyn Hodges, "Job Matching: Evidence from the Beveridge Curve," Economic Letter 2006-08 (Federal Reserve Bank of San Francisco, April 21, 2006).

<sup>17</sup> That measure is based on a regression in which the age-adjusted unemployment rate is a function the vacancy rate (and its square) and on a series of year dummies for 1977 to 2005. The vacancy rate was derived from the JOLTS data for 2001–2005 and for earlier years from the Conference Board's "Help-Wanted Advertising Index," which is compiled from a monthly survey of job advertisements in major newspapers. The year dummies can be interpreted as a proxy for the impact of overall labor market efficiency on the aggregate unemployment rate after considering aggregate demand and the demographic mix. A negative value means that, relative to the base year (1976), the labor market was more efficient, workers and jobs were better matched, or both.

**Table 3.**  
**Impact of Shift Variable on Unemployment Among Married Males, 1978 to 2005**

	(1)	(2)	(3)
Coefficient	.267	.320	.280
(t-statistic)	(3.59)	(2.98)	(2.66)
Adjusted R <sup>2</sup>	.975	.427	.460
Impact			
1985 to 1998	−0.60	−0.71	−0.62
1998 to 2005	−0.22	−0.26	−0.23
1985 to 2005	−0.81	−0.97	−0.85

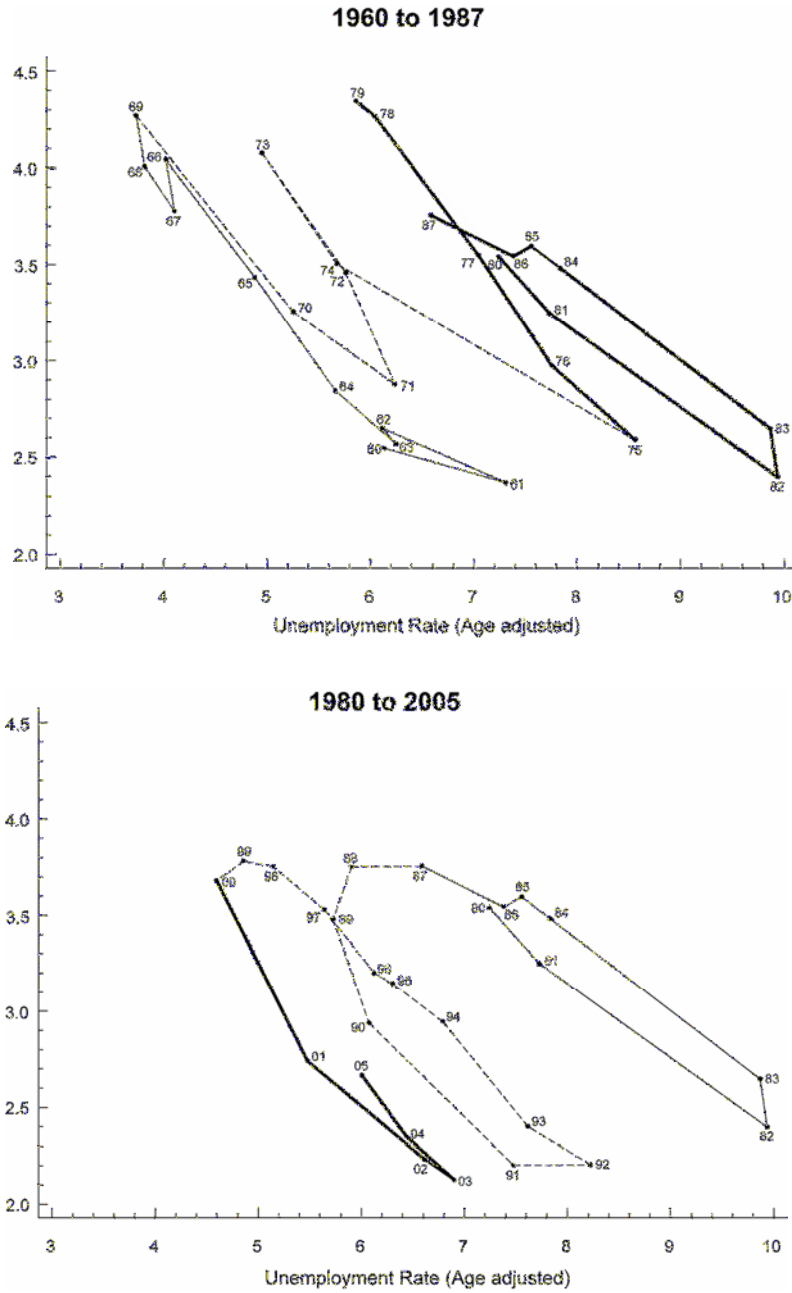
Notes: Specification (1) used a regression analysis of the unemployment rate of married men on the gross domestic product (GDP) gap (current and 8 lags) as well as the shift variable and is corrected for serial correlation. Specification (2) used a regression analysis of the first difference of the unemployment rate on the first differences in the shift and in the GDP gap. Specification (3) is identical to (2) except that it also includes an error correction term.

rate for married men. The latter rate is largely invariant to changes in the composition of the labor force. Results are shown in Table 3 for three alternative specifications; in each case the impact on the unemployment rate of shifts in the Beveridge curve over any period is obtained by multiplying the change in the shift variable by the coefficient on that variable. The results imply that between 1985 and 2005 the married male unemployment rate consistent with a given GDP gap declined by 0.8 to 1.0 percentage points, with 0.2 to 0.3 points of that decline occurring after 1998.

These results do not tell us exactly what caused the Beveridge curve to shift. We can, however, conclude that the natural rate has fallen significantly over the past two decades beyond the impact of shifts in the demographic mix. The results are broadly consistent with those of Lawrence Katz and Alan Krueger, who estimated that the natural unemployment rate fell by about a percentage point between the mid-1980s and the late 1990s (including 0.3 to 0.4 percentage points directly attributable to demographic shifts).<sup>18</sup> The findings here suggest that it has fallen by another 0.4 to 0.5 percentage points since then, reflecting continuing improvements in the efficiency of the labor market and the declining participation of teens and young adults in the labor force.

<sup>18</sup> Katz and Krueger, “High-Pressure Labor Market of the 1990s.” That analysis influenced CBO’s decision to reduce its then-current estimate of the natural rate from 5.5 percent to 5.2 percent in its January 2000 forecast.

**Figure 7.**  
**U.S. Beveridge Curve, Adjusted**  
 (Vacancy rate)



Source: Valletta, *Why Has the U.S. Beveridge Curve Shifted Back?* Fig. 6.

**Figure 8.**  
**Labor Market Efficiency and Unemployment, 1976 to 2005**



Source: Congressional Budget Office based on data provided by Robert Valletta.

Notes: Index (1976 = 0). The index records an estimate of shifts over time of the relationship between vacancies and (age adjusted) unemployment shown in Figure 7. A lower number corresponds to a leftward shift of the relationship and implies a lower unemployment rate for any given rate of vacancies. The shaded vertical bars indicate business-cycle recessions, as determined by the National Bureau of Economic Research.