Working Papers

FEDERAL RESERVE BANK OF BOSTON

No. 12-9

Potential Effects of the Great Recession on the U.S. Labor Market

William T. Dickens and Robert K. Triest

Abstract:

The effect of the Great Recession on the U.S. labor market will likely persist even after economic output has recovered. Although the recession did not greatly change the relative probabilities of job loss for different types of workers, the long-run impact will vary by worker characteristics. Workers who lost long-term jobs during the Great Recession are at increased risk of future job loss due to the loss of protection afforded by long-term job tenure, and older displaced workers are at a relatively high risk of prolonged spells of unemployment and premature retirement. The recent increase in the job vacancy rate with relatively little change in the unemployment rate suggests a decrease in the efficiency of job matching and an increase in the NAIRU. However, this phenomenon may pass once aggregate demand has increased enough to bring vacancy rates back within their normal range and extended unemployment insurance programs have expired.

JEL Classifications: E24, J6, J63, J64

William T. Dickens is a University Distinguished Professor in the department of economics at Northeastern University, a nonresident senior fellow at the Brookings Institution, and a visiting scholar in the research department at the Federal Reserve Bank of Boston. His e-mail address is w.dickens@neu.edu. Robert K. Triest is a vice president and economist in the research department at the Federal Reserve Bank of Boston. His e-mail address is robert.triest@bos.frb.org.

The authors thank Gary Burtless and Bart Hobijn, who provided valuable comments. They thank Jamie Fogel for helpful comments and for outstanding assistance with the SIPP data analysis. Thanks also to Tess Forsell, Matthew Jordan, Marie Lekkas, Elizabeth Meyer, Shaun O'Brian, and Irena Tsvetkova for their help in preparing this paper. This paper was written for the Federal Reserve Bank of Boston's October 2011 conference, "Long-Term Effects of the Great Recession." The revised papers, discussant comments, panelist remarks, and conference addresses by Ben S. Bernanke, Chairman of the Board of Governors of the Federal Reserve System, and Eric S. Rosengren, President and CEO of the Federal Reserve Bank of Boston, will be published in a special symposium issue of the *B.E. Journal of Macroeconomics*.

This paper, which may be revised, is available on the web site of the Federal Reserve Bank of Boston at http://www.bostonfed.org /economic/wp/index.htm.

This version: September 12, 2012

1 Introduction

Previous recessions in the United States have not left many long-lasting scars. Wage movements over past business cycles are hard to detect, labor force participation rates quickly return to trend levels, and unemployment rates show no long term effects after typically quick recoveries. Other countries have not been as fortunate. At least since Blanchard and Summers (1986) it has been noted that after economic downturns many other OECD countries have experienced long drops in labor market participation and persistent high unemployment.

It has been suggested that U.S. exceptionalism in this regard is due to our experiencing quick recoveries in output after our recessions (see, for example, Ball (1999)). Indeed, none of our postwar recessions have been particularly protracted until now. Will this difference, or any other aspect of the Great Recession, cause medium- or long-term changes in the functioning of the U.S. labor market?

We focus on a few areas where previous research and recent discussions have suggested that there may be medium- to long-term labor market effects. One area where the Great Recession may have a substantial impact is on the wages and earnings of workers displaced during the recession. Individuals who have been displaced from long-term jobs may lose the value of job-specific skills, and need to search anew for an employment situation to which they are well matched. As a result, such workers may suffer persistent decreases in labor market earnings. Displacement may also have persistent effects on the probabilities of future job separations and on the aggregate job finding rate. Workers who gain new employment after having been displaced from long-term jobs may be at a higher risk of termination in their new jobs than they were in their former long-term jobs. Workers separated from long-term jobs may also have relatively low job finding rates after displacement due to the greater specificity of their human capital. The potential for increased la-

bor market churning and relatively slow matching of displaced workers with new job opportunities might contribute to an outward shift of the Beveridge curve and an increase in the non-accelerating inflation rate of unemployment (NAIRU). We evaluate the evidence for this possibility, and examine the degree to which the apparent outward shift of the Beveridge curve may reflect structural issues in the U.S. labor market that will persist over a reasonably long horizon.

2 Related Research

A large increase in the fraction of those who are experiencing very long unemployment spells in the wake of the Great Recession has prompted concern that the pool of unemployed job searchers may, on average, be more difficult to match to job openings than has been true at the end of past recessions. Nearly all studies of the rate of new job finding show these match rates falling as the duration of unemployment increases.[1] Two processes could cause this result. One, it could be that extended unemployment makes it difficult for people to find jobs or two, it could be that those who have trouble finding jobs are disproportionately represented among the ranks of the long-term unemployed. A number of studies have attempted to determine the relative importance of these two explanations for the downward trend in new job finding rates for the long-term unemployed. Most studies, using a number of different methods to control for individual differences, still find a substantial downward trend in new job finding rates (Lynch, 1985; Arulampalam, Booth, and Taylor, 2000; Imbens and Lynch, 2006). However, all three of these studies rely on restrictive assumptions about the distribution of individual differences, leaving the findings suspect. Perhaps more important, the rate

[1] An exception is that studies often show an increase in the rate of exit from unemployment around the time that unemployment benefits expire.

of job finding at all durations of unemployment increases considerably when labor demand is stronger (Imbens and Lynch, 2006) and it could be that such increases cancel out the effects of longer average durations of unemployment.

A related literature examines the effect of unemployment spells on future income and the probability of future employment. Again, there is the problem of separating out individual differences from causal effects. Most typically this is done by comparing an individual's experience before and after a spell of unemployment. These studies often find that unemployment spells are followed by a medium- to long-term reduction in wages (Addison and Portugal, 1989; Arulampalam, 2001; Corcoran, 1982; Farber, 2005; Gregg and Tominey, 2005; Gregory and Jukes, 2001; Jacobson, LaLonde, and Sullivan, 1993; Kletzer, 1991; Kletzer and Fairlie, 2003; Podgursky and Swaim, 1987). In a recent paper using U.S. Social Security records, Von Wachter, Song, and Machester (2009) find that workers who were displaced from stable jobs during the 1982 recession suffered earnings losses of approximately 20 percent even after 15 to 20 years. Davis and von Wachter (2011) show that earnings losses attributable to displacement are roughly twice as large for workers who lose jobs during a recession compared to those who lose their jobs during an economic expansion. Farber (2011) documents that the Great Recession has been accompanied by job losers experiencing substantial earnings reductions, although he notes that it is not yet clear how prolonged the effects will be.

Research suggests that the earnings of young workers are particularly vulnerable to the effects of recessions. Oreopoulos, von Wachter, and Heisz (2006) find that graduating from college during a recession results in earnings losses lasting ten years. However, Von Wachter and Bender (2006) show that young German workers who leave apprenticeship programs during a recession generally suffer less persistent earnings

losses.

The future employment and earnings of older workers appears to be sensitive to economic conditions and job displacement. Von Wachter (2007) finds that both economic conditions and job displacement affect the earnings and employment of older men. Sass and Webb (2010) show that experiencing a job loss in one's early 50s is associated with subsequent future job losses and unemployment spells. Johnson and Mommaerts (2011) document that although long job tenure reduces the probability of job loss, age alone offers no protection. Older workers have slower rates of reemployment than do younger workers, and suffer much larger reductions in earnings upon reemployment. Bosworth and Burtless (2010) note that while decreased labor demand works toward reducing the employment of older workers during a downturn, falling asset prices may lead to increased labor supply through a wealth effect. They find that high unemployment is associated with increased claiming rates for Social Security benefits. While Bosworth and Burtless also find that low asset returns work in the opposite direction, the magnitude of this wealth effect is very small.

A few studies suggest that long spells of unemployment result in a lower probability of future employment for broader groups of workers (Arulampalam, Booth, and Taylor, 2000; Lynch, 1985; Ruhm, 1991), but except for Ruhm papers finding this result analyzed British data. Other studies of U.S. data conclude that unemployment leaves no long-lasting scars (Corcoran and Hill, 1985; Ellwood, 1982; Genda, Kondo, and Ohta, 2010; Heckman and Borjas, 1980)

3 Evidence from the Great Recession

With the U.S. unemployment rate still hovering near 9 percent (as of October 2011), it is too soon to fully assess the Great Recession's long- term

effects on labor markets. Recent data, however, can allow us to gauge the extent to which the Great Recession differed from the period that immediately preceded it. This can be helpful in extrapolating the results of research studies based on earlier data to predict how the Great Recession will affect labor markets as the recovery continues.

The data that we use in this exercise comes from the 2004 and 2008 panels of the Survey of Income and Program Participation (SIPP). The SIPP is a large-scale sample survey that interviews households every four months and that fields a new panel of sample members every few years. In each wave (sample interviews) of the SIPP, household respondents answer questions that refer to the preceding four calendar months; the particular calendar months covered in a wave depends on the rotation group to which the household is assigned. Only the first seven waves of the 2008 panel are currently available, and much of our empirical analysis compares data from the first seven waves of the 2004 panel, which covers October 2003 through April 2006, with the first seven waves of the 2008 panel, which covers a period of the same length starting in May 2008.[2] Comparison of data from the two panels provides a convenient means of contrasting labor market experiences before the recession with experiences during and after the recession.

A key advantage of the SIPP is that in first wave of each panel sample members are asked when they had started their current jobs, allowing researchers to distinguish between long-term and short-term job tenure. The SIPP also records the dates at which sample members start or end jobs when these employment transitions occur over the course of the

[2]The first wave of the 2004 panel covers October 2003 through April 2004, and the seventh wave covers October 2005 through April 2006. The first wave of the 2008 panel covers May through November 2008, and the seventh wave covers the same months of 2010. The first seven waves of the 2004 panel provides data for a 28 month stretch that ends well before the onset of the recession, with wave 7 data referring to months exactly two years after those covered in wave 1. The first seven waves of the 2008 panel provide similar data for a period of time that starts in the midst of the recession.

panel.

4 Job Transitions

Table 1 compares the experiences of workers who were employed during wave 1 of each of the two panels.[3] Corroborating patterns found in other data, a much higher proportion of workers observed at the start of the 2008 panel left their job involuntarily (through layoff or termination) than did workers observed at the start of the 2004 panel. The 2008 panel members were less likely to leave their wave 1 jobs voluntarily (quits) than were the 2004 panel members; they were also less likely to stay at their initial jobs over the first seven waves of the panel than were the 2004 panel members.

The composition of the job losers is important for assessing the long-term effects of job displacement. If a worker leaves a long-term job, there may be a substantial loss of job-specific human capital. In contrast, a worker who has been on the job a relatively short time has had little opportunity to build up capital specific to that job. Workers who have substantial job tenure are also likely to be in a situation where both the employee and the employer view the worker to be well-matched to the job. If this were not the case, either party would have terminated the employment relationship before substantial time had passed. Long-term workers who are displaced from jobs lose their "match capital" and must again search for an employment situation that is a good match for their skills.

We investigate the composition of job losers in a multinomial logit analysis of job transitions, the results of which are reported in table 2. All workers who were employed in wave 1 are included in the analysis. Workers are classified in terms of how and whether they left their wave 1

[3]Workers holding more than one job in wave 1 were excluded from these calculations.

jobs by the end of the wave 7 reference period: workers may have stayed in their initial job, left that job involuntarily, or left that job voluntarily. We treat staying at the initial job as the base case, and report the multinomial logit results for the probability of involuntary or voluntary transitions relative to staying at the initial job. The analysis is purely descriptive, and is not intended to capture the parameters of an underlying structural model of employment transitions.

The coefficients on the conditioning variables are generally of the expected signs and magnitudes. Coefficients on dummy variables for job tenure indicate that the probability of either a voluntary or involuntary job transition decreases sharply with time for the first few years of employment. In contrast, the probability of an involuntary transition varies relatively little with age. Young (under 25 years of age) and old (over 59 years of age) workers are at significantly higher risk of involuntary transition than those in the intermediate age groups, but the magnitudes of the effects for age are much smaller than those for job tenure. The age effects are larger for voluntary transitions than they are for involuntary transitions, most likely due to young workers leaving jobs for schooling or changing jobs, and older workers leaving jobs for retirement. The probability of an involuntary job transition decreases sharply with educational attainment; this is also true for voluntary transitions, but to a lesser extent.

The effect of the Great Recession is measured by an indicator variable for membership in the 2008 panel (the omitted group is the 2004 panel). The 2008 panel indicator enters the specification as both a main effect and an interaction with all of the conditioning variables. The main 2008 panel effect is large for involuntary transitions, although it is smaller and less statistically significant for voluntary transitions. Although most of the interaction coefficients are not individually significant, a Wald test decisively rejects the hypothesis that the group of interaction coefficients

are all zero.

One interpretation of these results is that the Great Recession greatly increased the probability of involuntary job transitions across the board, but did not greatly change the relative transition probabilities of different types of workers. Young, less educated, and short-tenured workers were at a greater risk of displacement both before and during the recession. Very low tenure workers were at somewhat less of a relative disadvantage during the recession than before the recession, but this may reflect employers who adopt a last hired-first fired policy needing to reach further into the tenure distribution when layoffs increased during the Great Recession.

Although the Great Recession did not greatly affect the relative risks of job displacement, this does not imply that the overall increased risk of displacement will not have long-term consequences. Although long-tenure workers were not disproportionately displaced during the recession, they were still at increased risk relative to the pre-recession period. To the extent that the displacement of long-tenure workers results in long-term consequences for these workers, the Great Recession will have a long-term impact through the increase in the number of long-tenure job matches that were destroyed.

5 Earnings Changes

Table 3 displays the mean change in nominal log monthly labor earnings between wave 1 and wave 7 for members of the 2004 and 2008 panels who held jobs during both of these survey periods. The results are separated for those who stayed in their wave 1 job, those who voluntarily left their wave 1 job, and those who involuntarily lost their wave 1 job. In interpreting this table, it is important to remember that the monthly earnings changes can only be calculated for those job changers who found new

jobs by wave 7. Mean earnings growth was lower in the 2008 panel than in the pre-recession panel for all three groups. Those whose job transitions were involuntary fared the worst both before and during the Great Recession. Nominal monthly earnings increased about 0.1 percent for the involuntary job changers over the first 7 waves of the 2004 panel, but fell about 8 percent in the 2008 panel. Voluntary job changers had the largest monthly earnings increase in the pre-recession panel, but in the 2008 panel were second to the job stayers. It is evident that job separations during the latest recession are having an impact on the monthly earnings of those workers who are observed in new jobs in wave 7, although it is not clear how long lasting the effect will be.

Table 4 shows results from regressions of the change in log monthly earnings between wave 1 and wave 7 on the change in log weekly hours between waves 1 and 7, worker characteristics, and an indicator variable for the 2008 panel. The regressions were estimated separately for job stayers, those making involuntary transitions, and those making voluntary transitions. The estimated values of the constant and 2008 panel coefficient are essentially providing the same information as that shown in table 3, but conditional on changes in weekly hours and worker characteristics. The regression estimates are not adjusted to account for a non-random selection of separated workers into reemployment.

Very few of the worker characteristic coefficients are statistically significantly discernable from zero. This is somewhat surprising, since one would expect workers with long tenure in their wave 1 jobs to have experienced a greater loss of earnings than did workers displaced from shorter-term jobs. Experiments with interacting worker characteristics and the 2008 panel indicator variable generally also yielded insignificant coefficients. A Wald test of the joint significance of the full set of interactions between worker characteristics and the 2008 panel indicator fails to reject the null hypothesis of no interactions for the job stayer and in-

voluntary separation regressions, and fails to reject for p values less than 0.04 for the voluntary separation regression.

The estimated coefficient on the dummy variable for the 2008 panel is negative for all three groups, but largest in magnitude for workers making voluntary job changes. This result is consistent with the dearth of job openings relative to the number of unemployed individuals during the 2008 panel period, and helps to explain why quit rates fell so much during the recession.

6 Reemployment of Separated Workers

In addition to having an influence on the labor earnings of separated workers who regain employment, the Great Recession may also have affected labor earnings through influencing the reemployment probabilities of workers leaving jobs. Table 5 shows the estimated coefficients from multinomial logit analysis of the labor force transitions of workers who left their wave 1 jobs. The transitions are defined in terms of their wave 7 labor force status (employed, unemployed, or not in the labor force). The specification was estimated separately for those who left their wave 1 jobs voluntarily and involuntarily. Reemployment is classified as the base case, and the coefficients have been transformed into relative risk ratios (with statistical significance again measured against the null hypothesis that the relative risk ratios equal 1).

Not surprisingly, the results indicate that the probability of unemployment (relative to reemployment) is much greater in the 2008 panel period than in the 2004 panel; this is true both for those losing their job involuntarily as well as for those leaving voluntarily. There is not a statistically significant difference between the two panels in the estimated probability of being out of the labor force (relative to reemployment). For both the involuntary and voluntary separations, Wald tests fail to reject

the hypothesis that the coefficients on the worker characteristic variables are the same in the two panel periods, so we report only the coefficients for the 2004 and 2008 samples combined.

Relatively few of the estimated worker characteristic coefficients are statistically significant. In particular, the job tenure coefficients do not have a statistically significant effect on the probability of remaining unemployed as of wave 7. This is surprising, since one might expect the greater specificity of the human capital of long-term employees to make finding a new job match more difficult. However, it may also be the case that having had a long-term job signals to potential employers that a job applicant is a reliable employee, possibly resulting in an increased chance of a job offer.

Conditional on previous job tenure, older workers are significantly more likely than young workers to remain unemployed. Although the human capital specificity associated with losing a long-term job does not appear to be an impediment to job matching, age does appear to be an impediment. Older workers are not only significantly more likely than younger workers to be unemployed rather than employed, but are also significantly more likely than middle-aged workers to drop out of the labor force after both voluntary and involuntary job separations. The voluntary separations that lead to being out of the labor force likely reflect planned retirement, but involuntary separations that lead to being out of the labor force are probably best interpreted as the unplanned retirements of discouraged workers.

Further analysis of the reemployment process is presented in tables 6 and 7, which show estimates of Cox proportional hazard models of reemployment following job separation. The hazard rate estimation includes all person-month observations in the SIPP 2004 and 2008 panels that make a transition from employment to non-employment. Table 6 shows that the hazard of reemployment is significantly lower in the 2008

panel than in the 2004 panel.

Table 7 investigates whether the slower rate of job finding during the Great Recession holds up after controlling for worker characteristics. The panel indicator coefficients are smaller in magnitude (indicating a lower hazard rate) than in the earlier table, but are estimated less precisely. A full set of interactions between the 2008 panel indicator and other covariates is included in the analysis, although most of the coefficients on the interactions are close to one and statistically insignificant. Among the main effects, the most notable pattern is that the hazard for reemployment decreases with age starting at about 50 years.

Overall, the empirical results from the reemployment hazards reinforce the message from table 5: the Great Recession's main long-run effect on job finding is likely in its impact on older workers, who tend to have a lower reemployment hazard (relative to younger workers) at all stages of the business cycle. Although older workers are not at a high risk of job loss, once unemployed they tend to stay unemployed longer than do younger workers, and are more likely to permanently leave the labor force. And once they have lost the protection of a long-term job, they are no longer at lower risk of job loss relative to younger workers.

7 Matching Efficiency and the Beveridge Curve

Although the micro-based evidence on the effects of recessions on separation and job finding rates is not conclusive, aggregate data suggests that the Beveridge curve may have shifted out. Figure 1 shows monthly data for the rate of unemployment and a measure of the vacancy rate constructed from the Conference Board's help-wanted index for the period from 1980 through 1983 and annual average data for those same measures from 1965 to 1980. The unemployment rate and the vacancy rate from the Job Openings and Labor Turnover Survey (JOLTS) for the pe-

riod 2001-2010 is also presented where the JOLTS vacancy rate has been adjusted to be compatible with the vacancy rate from the help-wanted index.[4] Beveridge curves for the 1980-1987 and the 1954-1969/2001-2009 periods are also drawn. In models of frictional unemployment (Blanchard and Diamond, 1989; 1991) or mismatch unemployment (Shimer, 2005), the Beveridge curve is derived as the locus where the number of jobs being filled is equal to the number of new unemployed workers and the number of new jobs becoming available. On this curve both the unemployment and vacancy rates remain constant so long as the rate of new job creation and the inflow rate of new unemployed workers stays constant. The position of the Beveridge curve is often interpreted as a measure of the efficiency of worker-job matching. The further the curve is from the origin the more unemployed workers there are with the same number of available job openings. The Beveridge curve relation fits remarkably well for long periods of time. In each of the periods for which the curves are drawn, monthly data on vacancies and unemployment remained remarkably close to these curves.

Starting in late 2009 the job vacancy rate began to rise while the unemployment rate remained mostly unchanged.[5] The last time there was a sustained increase in the vacancy rate, at similar levels of unemployment, was during the 1970s. That rise coincided with a period during which it is widely believed that the NAIRU increased. Similarly, during the late 1980s and 1990s the level of vacancies that coexisted with a particular level of unemployment fell, and this decline coincided with a period during which most estimates suggest that the NAIRU fell (Gordon, 1997; Staiger, Stock, and Watson, 1997).

Dickens (2009) developed and estimated a model of the Beveridge

[4]See Dickens (2009) for an explanation of the method.

[5]In April 2010 there was a large increase in the vacancy rate that should probably be ignored as it was mainly due to government hiring for the Census. But, even ignoring that month, there is still a noticeable increase in the vacancy rate over the last year.

curve and the Phillips curve that links movement in the Beveridge curve and the position of the long-run Phillips curve or NAIRU. The results from estimating the model suggest that in the United States all shifts in the NAIRU result from changes in the efficiency of worker-job matching as reflected in movements of the Beveridge curve. Using this model we can determine the implications of the recent increases in the vacancy rate for the NAIRU.

Figure 2 presents quarterly estimates of the NAIRU from the model going back to 1960. It suggests that since 2009 there has been a notable increase in the NAIRU from 5 percent to just under 6 percent. Similarly, when we estimate a model allowing for downward nominal wage rigidity to affect the inflation-unemployment tradeoff as in Akerlof, Dickens, and Perry (1996), we find that the lowest sustainable rate of unemployment rises from 3.9 percent to just over 5 percent. There is some variation when we estimate different specifications of these models but all suggest that it would be possible to lower unemployment by at least 3 percentage points without risking substantial inflation.

While the model interprets the increase in vacancies as indicating an outward shift in the Beveridge curve, there are several reasons to question whether the Beveridge curve really has shifted out. First, the high levels of unemployment we are now enduring have only been experienced once before during the sample period, 1960 to 2011. During this episode, the 1982 recession, the monthly values strayed from the curve that prevailed before and after the recession, and in that case the departure suggested an inward shift in the Beveridge curve. But as time passes this explanation seems less and less likely. The departure of the observed vacancy and unemployment rates from proximity to the Beveridge curve in the 1982 recession lasted only about one year, while it has been over two years since vacancies began increasing in the most recent recession with no similar reduction in unemployment. With adjustments to make the

JOLTS vacancy rate equivalent to the one derived from the help-wanted index, the vacancy rate has recently been below that experienced at any other time in the sample period. If there is some minimum level of vacancies that are always present (seasonal jobs that must be filled, firms looking for highly qualified labor at significantly below market wages) then the Beveridge curve will not have the same shape in the vicinity of that minimum. In figure 1 the curve could bend in to the right as the level of vacancies approached that minimum, as this would reduce the extent to which the current level of vacancies departs from the 2001-2009 Beveridge curve.

Note also that the Beveridge curve is the locus where the unemployment rate and the vacancy rate will settle given a constant rate of new job creation and entry of newly unemployed workers to the labor market. During a recession these rates are not constant. When the rate of new job creation falls, initially the vacancy rate declines faster than the unemployment rate increases. During an expansion, the opposite happens as new job creation causes the vacancy rate to rise before the unemployment rate begins to fall. These tendencies are exacerbated as frustrated workers leave the labor market when jobs are hard to find (causing the increase in the unemployment rate to lag the decline in vacancies) and enter the labor market as jobs become easier to find (causing the decline in the unemployment rate to again lag the change in vacancies). This leads to a clockwise movement around the Beveridge curve as it is depicted in figure 1. This lag is barely apparent in the 1980 and 2001 recessions, but is pronounced in the 1982 recession-the only other time in the sample period that unemployment approached the levels experienced in the most recent recession.[6]

[6]Tasci and Lindner (2010) have also pointed out the tendency for the unemployment rate-vacancy rate points to circle the Beveridge curve. They present three previous examples, 1975, 1982 and 2001. As shown in figure 1 the cycle in 2001 was quite muted. The cycle in 1975 took place while the Beveridge curve was moving out. Their use of quarterly rather than monthly data makes the 2009-2010 move look muted relative to

It is possible that the failure of the U.S. unemployment rate to fall in response to the increase in vacancies during the last two years is due to the slow response of the unemployment rate to an increase in the available jobs. But a direct comparison of what happened recently and in the earlier episode casts doubt on this explanation. In 1982-1983 it only took two months after the vacancy rate began to increase before the unemployment rate began to decline fairly quickly. It has been over two years since the vacancy rate began to increase following the most recent recession and the unemployment rate has hardly declined at all. This seems like too long a lag to be explained by labor market dynamics. We therefore turn to other potential explanations for deterioration in the efficiency of labor market matching.[7]

As reviewed earlier, the research on how the duration of unemployment spells affects job finding rates offers some support for the hypothesis of hysteresis in unemployment. More direct evidence on Ball's hypothesis comes from a study by Llaudes (2005). For a sample of OECD countries he estimates Phillips curves, separating out the effect of the unemployment rate for those out of work for more than a year and those out of work for less than a year. Llaudes finds that only those individuals who are unemployed for less than a year put downward pressure on prices while those unemployed for more than a year apparently have no effect on wages.

We have been able to almost exactly replicate Llaudes's result in an updated dataset that we have collected. However, the result is not robust to small changes in the specification. In particular, when the unemployment rate is broken down into as fine a set of durational categories as possible, only the category for unemployment lasting for 6 to 12 months puts statistically significant downward pressure on wages. Further, any

the comparison periods.

[7]Lubik (2011) using a labor market search model rejects the hypothesis of no shift in the Beveridge curve in the recent period.

set of categories that includes the 6 to 12 month duration will be found to put significant downward pressure on wages, while no set of categories that does not contain it is ever statistically significant or has a large negative coefficient. This holds true even if countries whose unemployment benefits normally expire after six months are removed from the sample. These results make no sense for the U.S. economy, and little sense for the rest of the world. A possible explanation for these results is that the 6-12 months category is the one that is most highly correlated with the overall unemployment rate (> 0.9) so it may just be standing in for total unemployment in the Phillips curve.

Overall, there is not much evidence to support the hypothesis that extended periods with high rates of long-term unemployment will lead to an increase in the NAIRU in the United States, but this is not to say that there is strong evidence against the hypothesis either. Given this conclusion, we turn to the evidence for other possible explanations of the deterioration in U.S. labor market efficiency.

8 Other Potential Explanations for an Outward Shift in the Beveridge Curve

Following the rise in the U.S. job vacancy rate, three other explanations for the reduction in labor market efficiency have been circulating. First, in response to the increasing numbers of long-term unemployed, the federal government has extended the duration of unemployment benefits several times. There is considerable evidence that increases in the duration of unemployment benefits increase unemployment durations and unemployment rates. Second, a mismatch between the skills of the unemployed and those demanded by employers has been offered as another explanation. Finally, it has been suggested that a mismatch between the location of available jobs and unemployed workers might help explain

the worsening efficiency of labor market matching, and that this problem might be exacerbated by difficulties in the U.S. housing and mortgage markets. These three explanations are examined below in more detail.

8.1 Extended Unemployment Benefits

Several studies have looked at the role that unemployment benefits may be playing in increasing the unemployment rate by extending the time unemployed workers are willing to search for jobs. Several of these studies use previous estimates of the effects of benefit duration on unemployment duration to compute the effects of current policy on unemployment (Aaronson, Mazumder, and Schechter, 2010; Elsby, Hobijn, and Sahin, 2010). Such studies produce a range of the estimated increase in the unemployment rate from 0.4 to 1.8 percentage points. A problem with these studies is that the estimates of the impact of extended benefits were made when the U.S. unemployment rate was much lower and jobs were easier to find. It is possible that such estimates overstate the impact in the current situation. Valletta and Kuang (2010) take a different approach to estimating the impact of extended benefits. They compare the unemployment durations of those who are eligible for unemployment benefits and those who are not as the duration of benefits is extended, and conclude that extended benefits increase the unemployment rate by about 0.8 percentage points. Valletta and Kung's estimate of the impact of extended benefits is very close to our estimate of the increase in the natural rate and is slightly below the mid-range of previous estimates. However, Rothstein (2011) analyzes how extended benefits affect the probability of leaving unemployment using data from after the peak of the Great Recession, and estimates that the benefit extensions raised the unemployment rate by only 0.2 to 0.6 percentage points. Thus, it seems likely that a substantial part of our estimate of the increase in the NAIRU is due to the effect of having extended unemployment benefits, but there is uncertainty

regarding the precise magnitude. An important implication of the effect of extended benefits on the increase in the NAIRU is that the portion of the increase due to extended benefits could be expected to go away as these benefits are withdrawn with an improving economy.

8.2 Skills Mismatch

It seems likely that in the wake of the Great Recession the U.S. will undergo some structural transformation. The housing boom probably brought more workers into the construction industry than can be sustained in the long run. The financial sector may contract relative to its pre-recession size as well. To the extent that it takes a long time for workers to move from one type of employment to another, structural shifts could cause extended increases in the equilibrium level of unemployment (Lilien, 1982). The 2001 recession seems to have involved a fair amount of structural reallocation (Groshen and Potter, 2003) and this may explain why it took a longer time than usual to bring the unemployment rate down during the recovery. To what degree is structural mismatch present in our economy today and has the degree of mismatch increased with the worsening efficiency of the labor market?

Figure 3 presents the ratio of vacancies to unemployment in several different industries. While it is possible to discern the increase in vacancies over recent months in some industries, the ratio remains substantially depressed in all industries. What we do not see is any industry with high vacancy-unemployment ratios. It is thus hard to make a case for structural mismatch being a major problem today.

An index of the extent of mismatch between unemployed workers and available jobs can be constructed by subtracting the fraction of unemployed workers in each industry from the fraction of vacant jobs in each industry and taking its absolute value. This result can be thought of as the fraction of workers who would have to move in order for the

fraction of workers unemployed in each industry to equal the fraction of all vacancies in that industry.[8] Figure 4 shows this measure, our estimate of the NAIRU, and the actual unemployment rate from 2001 to date. While the measure of mismatch rose considerably during the early phase of the recent recession, it has dropped off since then and has returned now to levels that prevailed during the mid-2000s when unemployment was much lower and our estimate of the NAIRU was constant at 5 percent. The rise during the early part of the most recent recession need not reflect a temporary rise in structural unemployment. Abraham and Katz (1986) showed that business cycles affect different industries during different phases. This can produce the appearance of structural mismatch which dissipates as the effects of the recession become widespread.

Although the JOLTS does not contain information on the occupations that created the vacancies, the Conference Board's Help Wanted Online data do. Researchers at the Federal Reserve Bank of New York (Sahin et al., 2011) have used that data to construct the same sort of mismatch index used here. They find that there has been an increase in the mismatch between workers and jobs; the pattern is similar to that seen in figure 4, with a rise beginning in late 2006 and a decline starting in 2009. The timing of these changes suggests that they have nothing to do with the outward shift in the Beveridge curve. Note that it would be entirely possible for the mismatch to increase and for it to have no impact on structural unemployment if the reallocation of workers between different occupations was easy at the margin.

[8] If the matching function exhibits constant returns to scale and the efficiency of matching is the same in all cells, an allocation of the unemployed that equates the fraction of vacancies and unemployed in each cell will maximize the match rate and minimize the unemployment rate.

8.3 Geographic Mismatch

A similar analysis can be conducted for the extent of geographic mismatch, but the JOLTS data on vacancies are only available at a very high level of aggregation-the four large Census regions: Northeast, South, Midwest, and West. Figure 5 presents a graph of the mismatch index by region from 2001 to date along with the NAIRU estimate and the actual unemployment rate. Not only is there no apparent relationship between the degree of mismatch and our estimate of the NAIRU, but the fraction of workers who would have to relocate to equalize the fraction of unemployed and job vacancies in each region declined while the NAIRU was increasing. Using the Conference Board's Help Wanted Online data Sahin et al. (2011) perform a similar exercise at a finer level of disaggregation and reach the same conclusion.

There is some reason to suspect that a combination of geographic mismatch and problems in the housing market could be responsible for the reduced level of matching efficiency in the U.S. labor market. In a series of papers Oswald (1996; 1997) has suggested that the level of the NAIRU in a country is closely linked to the fraction of housing that is owner-occupied.[9] Oswald argues that high owner-occupancy rates make it difficult for the unemployed to move when jobs become available elsewhere. In the past, the United States has been a huge outlier in this analysis, having both a high rate of owner-occupied housing and a low NAIRU. Oswald has explained this discrepancy by pointing to the greater ease of transacting housing sales in the United States and the efficiency of the U.S. mortgage market. However, with a large fraction of the U.S. housing stock underwater and the recent tightening of credit standards for mortgages, it is possible that our high owner-occupancy rates are now making the reallocation of labor substantially more difficult.

[9]See Havet and Penot (2010) for a skeptical view of the relationship that Oswald points to.

There have been many studies of the effects that "housing lock" may have on labor market mobility.[10] Most studies performed before the recent recession found evidence that distress in housing markets reduced labor mobility. However, more recent studies generally find little evidence that long distance moves have been impeded.[11][12] An exception to this is the work by Batini et al. (2010) that argues for a substantial role for skills mismatch in combination with a depressed housing market in increasing unemployment, but the paper has a number of serious flaws. The conclusions are drawn from a regression of the unemployment rate on skill mismatch, housing market distress, and an interaction of the two variables. The first problem is that the index of skill mismatch compares the educational level of the unemployed workers not to the demands of available jobs but to that of the average employed person. Since unemployment rates among the least skilled tend to rise most during recessions, this would induce a positive correlation between mismatch and unemployment. Second, the correlation between housing market distress and unemployment could be spurious since both could be due to adverse economic conditions in the state. Batini et al. recognize this and attempt to ameliorate the problem using the share of subprime mortgages among all mortgages in the state as an instrument, but this is as likely to be correlated with economic distress as is the state of the housing market, as families with poor employment prospects may be forced into taking subprime loans.

While there is little evidence that housing lock is currently causing

[10]See Chan (2001), Ferreira, Gyourko, and Tracy (2010), Henley (1998), and Quigley (1987; 2002). See Schulhofer-Wohl (2011) for a different view.

[11]Short distance moves are defined as within county and a reduction in this category would be unlikely to affect job matching.

[12]For example, see Donovan and Schnure (2011), Barnichon and Figura (2010), and Molloy, Smith, and Wozniak (2011). Modestino and Dennett (2012) present evidence supportive of negative housing equity reducing migration of homeowners, although they find that it has only a negligible effect on the national unemployment rate.

structural unemployment, that could be because there are not enough available jobs to make moving worthwhile. However, if the U.S. housing market remains distressed as the economy picks up, it is possible that housing market problems could cause future problems for the labor market.

9 Conclusion

The Great Recession appears to be exerting an influence on the U.S. labor market that will likely persist even after economic output has recovered. Here we review our main conclusions.

One channel through which job displacement associated with the Great Recession will likely have a long-term impact is in probabilities of future job separations. Although the relative risk of job loss did not increase for long-term employees during the recent recession, their rate of job loss went up along with those of other groups. And once reemployed, they will be at higher risk of future job loss because they will have lost the protection afforded by long job tenure. One caveat to this conclusion is that it depends on job tenure being a characteristic of the worker-firm job match, and not just a factor correlated with worker characteristics that are desirable and observable to employers but unobservable to researchers.

Although involuntary job loss is associated with decreased earnings in the short term, it is puzzling that this effect does not appear to be especially strong for those losing long-term jobs and then starting a new job. It may be the case that those who will eventually experience the greatest earnings loss upon reemployment are not yet observed in new jobs in the SIPP data. Or it may be that the persistent earnings losses of long-term displaced workers found in earlier research were specific to characteristics of the lost jobs in those studies (for example, rents associated with unionization) that are less prevalent now.

For older displaced workers, the relatively low probabilities of reemployment and relatively high probabilities of leaving the labor force are cause for concern. Although this group's overall labor force participation has been surprisingly high, this number appears to reflect workers who have not lost their jobs electing to retire at somewhat older ages than has been the norm in the recent past. Older displaced workers are at relatively high risk of prolonged spells of unemployment and premature retirement. Although job loss during the Great Recession was not disproportionately high for older workers relative to younger workers, the rate of job loss rose for older workers along with other groups, resulting in an increase in the pool of displaced older workers who are at risk.

The recent increase in the vacancy rate, while the unemployment rate has remained mostly unchanged, probably does suggest a decline in the efficiency of the matching process in the U.S. labor market and an increase in the NAIRU. Estimates from our model of the NAIRU as a function of labor market efficiency suggests that it has increased by about 1 percentage point. However, this may be a phenomenon that will pass once aggregate demand has increased enough to bring vacancy rates back within their normal range and extended unemployment insurance programs have expired. Our findings are consistent with those of other research, such as Elsby et al. (2011) and Daly et al. (2011), that concludes that the high unemployment rates experienced in the wake of the Great Recession are primarily due to insufficient demand rather than due to structural factors.

Of the explanations for the apparent outward shift of the Beveridge curve considered here, it seems likely that extended unemployment benefits explain some, if not all, of this shift. An improvement in the rate of unemployment will allow the federal government to drop extended benefit programs and that should further reduce the unemployment rate-possibly bringing back the levels of unemployment that prevailed before

the Great Recession.

References

Aaronson, Daniel, Bhashkar Mazumder, and Shani Schechter. 2010. "What is Behind the Rise in Long-Term Unemployment?" *Economic Perspectives* 34(2): 28–51. Available at `http://www.chicagofed.org/digital_assets/publications/economic_perspectives/2010/2qtr2010_part1_aaronson_mazumder_schechter.pdf`.

Abraham, Katherine G., and Lawrence F. Katz. 1986. "Cyclical Unemployment: Sectoral Shifts or Aggregate Disturbances?"." *Journal of Political Economy* 94(3): 507–522.

Addison, John T., and Pedro Portugal. 1989. "Job Displacement, Relative Wage Changes, and Duration of Unemployment." *Journal of Labor Economics* 7(3): 281–302.

Akerlof, George A., William T. Dickens, and George L. Perry. 1996. "The Macroeconomics of Low Inflation." *Brookings Papers on Economic Activity* 1: 1–59. Washington, DC: The Brookings Institution.

Arulampalam, Wiji. 2001. "Is Unemployment Really Scarring? Effects of Unemployment Experiences on Wages." *Economic Journal* 111(475): F585–F606.

Arulampalam, Wiji, Alison L. Booth, and Mark P. Taylor. 2000. "Unemployment Persistence." *Oxford Economic Papers* 52(1): 24–50.

Ball, Laurence. 1999. "Aggregate Demand and Long-Run Unemployment." *Brookings Papers on Economic Activity* 189–236.

Barnichon, Regis, and Andrew Figura. 2010. "What Drives Movement in the Unemployment Rate? A Decomposition of the Beveridge Curve."

Finance and Economic Discussion Series (48). Available at http://www.federalreserve.gov/pubs/feds/2010/201048/201048pap.pdf.

Batini, Nicoletta, Oya Celasun, Thomas Dowling, Marcello Estavao, Geoffrey Keim, Martin Sommer, and Evridiki Tosuta. 2010. "United States: Selected Issues Paper." Washington, DC: International Monetary Fund.

Blanchard, Olivier J., and Peter A. Diamond. 1989. "The Beveridge Curve." *Brookings Papers on Economic Activity* 1: 1–60.

Blanchard, Olivier J., and Peter A. Diamond. 1991. "The Aggregate Matching Function." NBER Working Papers 3175, National Bureau of Economic Research.

Blanchard, Olivier J., and Lawrence H. Summers. 1986. *NBER Macroeconomics Annual*, vol. 1, chap. Hysteresis and the European Unemployment Problem, 15–78. Cambridge, MA: The MIT Press.

Bosworth, Barry P., and Gary Burtless. 2010. "Recessions, Wealth Destruction, and the Timing of Retirement." Center for Retirement Research Working Paper 2010-22. Chestnut Hill, MA: Boston College. Available at http://crr.bc.edu/wp-content/uploads/2010/12/wp_2010-221.pdf.

Chan, Sewin. 2001. "Spatial Lock-in: Do Falling House Prices Constrain Residential Mobility." *Journal of Urban Economics* 49(3): 567–586.

Corcoran, Mary. 1982. *The Youth Labor Market Problem: Its Nature, Causes, and Consequences*, chap. The Employment and Wage Consequences of Teenage Women's Nonemployment, 391–426. Chicago: University of Chicago Press.

Corcoran, Mary, and Martha S. Hill. 1985. "Recurrence of Unemployment among Adult Men." *Journal of Human Resources* 20(2): 165–183.

Daly, Mary, Bart Hobijn, Aysegul Sahin, and Rob Valletta. 2011. "A Rising Natural Rate of Unemployment: Transitory or Permanent?" Federal Reserve Bank of San Francisco Working Paper Series: 2011-05. http://www.frbsf.org/publications/economics/papers/2011/wp11-05bk.pdf.

Davis, Steven J., and Till M. von Wachter. 2011. "Recessions and the Costs of Job Loss." Working Paper No. 17638. Cambridge, MA: National Bureau of Economic Research.

Dickens, William T. 2009. *Understanding Inflation and the Implications for Monetary Policy: A Phillips Curve Retrospective*, chap. A New Method for Estimating Time Variation in the NAIRU, 207–230. Cambridge, MA: The MIT Press.

Donovan, Colleen, and Calvin Schnure. 2011. "Locked In the House: Do Underwater Mortgages Reduce Labor Market Mobility?" http://ssrn.com/abstract=1856073.

Ellwood, David T. 1982. *The Youth Labor Market Problem: Its Nature, Causes, and Consequences*, chap. Teenage Unemployment: Permanent Scars or Temporary Blemishes?, 349–390. Chicago: University of Chicago Press.

Elsby, Michael W. L., Bart Hobijn, and Aysegül Sahin. 2010. "The Labor Market in the Great Recession." *Brookings Papers on Economic Activity* 1: 1–48.

Elsby, Michael W. L., Bart Hobijn, Aysegül Sahin, and Robert G. Valletta. 2011. "The Labor Market in the Great Recession: An Update." Working Paper 2011-29. San Francisco: Federal Reserve Bank of San Francisco. Available at http://www.frbsf.org/publications/economics/papers/2011/wp11-29bk.pdf.

Farber, Henry S. 2005. "What Do We Know about Job Loss in the United States? Evidence from the Displaced Workers Survey, 1984-2004." *Economic Perspectives* 19(2): 13–28. Chicago: Federal Reserve Bank of Chicago. Available at http://www.chicagofed.org/digital_assets/publications/economic_perspectives/2005/ep_2qtr2005_part2_farber.pdf.

Farber, Henry S. 2011. "Job Loss in the Great Recession: Historical Perspective from the Displaced Workers Survey, 1984-2010." Working Paper No. 17040. Cambridge, MA: National Bureau of Economic Research.

Ferreira, Fernando, Joseph Gyourko, and Joseph Tracy. 2010. "Housing Busts and Household Mobility." *Journal of Urban Economics* 68(1): 34–45.

Genda, Yuji, Ayako Kondo, and Souichi Ohta. 2010. "Long-Term Effects of a Recession at Labor Market Entry in Japan and the United States." *Journal of Human Resources* 45(1): 157–196.

Gordon, Robert J. 1997. "The Time-Varying NAIRU and its Implications for Economic Policy." *Journal of Economic Perspective* 11(1): 11–32.

Gregg, Paul, and Emma Tominey. 2005. "The Wage Scar from Male Youth Unemployment." *Labour Economics* 12(4): 487–509.

Gregory, Mary, and Robert Jukes. 2001. "Unemployment and Subsequent Earnings: Estimating Scarring among British Men 1984-94." *Economic Journal* 111(475): F607–F625.

Groshen, Erica, and Simon Potter. 2003. "Has Structural Change Contributed to a Jobless Recovery?" *Current Issues in Economics and Finance* 9(8). New York: Federal Reserve Bank of New York. Available at http://www.ny.frb.org/research/current_issues/ci9-8.pdf.

Havet, Nathalie, and Alexis Penot. 2010. "Does Homeownership Harm Labour Market Performances? A Survey." Groupe d'Analyse et de Thorie Economique (GATE) Lyon-St. Etienne. Available at ftp://ftp.gate.cnrs.fr/RePEc/2010/1012.pdf.

Heckman, James J., and George J. Borjas. 1980. "Does Unemployment Cause Future Unemployment? Definitions, Questions, and Answers from a Continuous Time Model of Heterogeneity and State Dependence." *Economica* 47(187): 247–283.

Henley, Andrew. 1998. "Mobility, Housing Equity, and the Labour Market." *Economic Journal* 108(447): 414–427.

Imbens, Guido W., and Lisa M. Lynch. 2006. "Re-employment Probabilities over the Business Cycle." *Portuguese Economic Journal* 5(2): 111–134.

Jacobson, Louis S., Robert J. LaLonde, and Daniel G. Sullivan. 1993. "Earnings Losses of Displaced Workers." *American Economic Review* 83(4): 685–709.

Johnson, Richard W., and Corina Mommaerts. 2011. "Age Differences in Job Displacement, Job Search and Reemployment." Center for Retirement Research at Boston College Working Paper 2011-3. Chestnut Hill, MA: Boston College. Available at http://crr.bc.edu/wp-content/uploads/2011/01/wp_2011-3.pdf.

Kletzer, Lori G. 1991. *Job Displacement: Consequences and Implications for Policy*, chap. Earnings after Job Displacement: Job Tenure, Industry, and Occupation, 107–135. Detroit: Wayne State University Press.

Kletzer, Lori G., and Robert W. Fairlie. 2003. "The Long-Term Costs of Job Displacement for Young Adult Workers." *Industrial and Labor Relations Review* 56(4): 682–698.

Lilien, David M. 1982. "Sectoral Shifts and Cyclical Unemployment." *Journal of Political Economy* 90(4): 777–793.

Llaudes, Ricardo. 2005. "The Phillips Curve and Long-Term Unemployment." Working Paper Series No. 441. Frankfurt: European Central Bank. Available at `http://www.ecb.int/pub/pdf/scpwps/ecbwp441.pdf`.

Lubik, Thomas A. 2011. "The Shifting and Twisting Beveridge Curve: An Aggregate Perspective." Working Paper. Richmond: Federal Reserve Bank of Richmond. Federal Reserve Bank of Richmond mimeo (October). Available at `http://ihome.ust.hk/~yfong/beveridge.pdf`.

Lynch, Lisa M. 1985. "State Dependency in Youth Unemployment: A Lost Generation?" *Journal of Econometrics* 28(1): 71–84.

Modestino, Alicia Sasser, and Julia Dennett. 2012. "Are Americans) Locked into Their Houses? The Impact of Housing Market Conditions on State-to-State Migration." Working Paper 12-1: Boston: Federal Reserve Bank of Boston. Available at `http://www.bos.frb.org/economic/wp/wp2012/wp1201.pdf`.

Molloy, Raven Saks, Christopher L. Smith, and Abigail Wozniak. 2011. "Internal Migration in the United States." *Journal of Economic Perspectives* 25(3): 173–196.

Oreopoulos, Philip, Till von Wachter, and Andrew Heisz. 2006. "The Short- and Long-Term Career Effects of Graduating in a Recession: Hysteresis and Heterogeneity in the Market for College Graduates." Working Paper No. 12159. Cambridge, MA: National Bureau of Economic Research.

Oswald, Andrew J. 1996. "A Conjecture on the Explanation for High Unemployment in the Industrialized Nations: Part I." The Warwick Eco-

nomics Research Paper Series No. 475. Coventry: University of Warwick. Available at http://www2.warwick.ac.uk/fac/soc/economics/research/workingpapers/publications/1995-1998/twerp_475.pdf.

Oswald, Andrew J. 1997. "Thoughts on NAIRU." *Journal of Economic Perspectives* 11(4): 227–228.

Podgursky, Michael, and Paul Swaim. 1987. "Job Displacement and Earnings Loss: Evidence from the Displaced Worker Survey." *Industrial and Labor Relations Review* 41(1): 17–29.

Quigley, John M. 1987. "Interest Rate Variations, Mortgage Prepayments and Household Mobility." *Review of Economics and Statistics* 69(4): 636–643.

Quigley, John M. 2002. "Interest Rate Variations, Mortgage Prepayments and Household Mobility." *Real Estate Economics* 30(3): 345–364.

Rothstein, Jesse. 2011. "Unemployment Insurance and Job Search in the Great Recession." *Brookings Papers on Economic Activity* 143–210.

Ruhm, Christopher J. 1991. "Are Workers Permanently Scarred by Job Displacements?" *American Economic Review* 81(1): 319–324.

Sahin, Ayeseg1, Joseph Song, Giorgio Topa, and Giovanni L. Violante. 2011. "Measuring Mismatch in the U.S. Labor Market." Working Paper. New York: Federal Reserve Bank of New York. Available at http://nyfedeconomists.org/topa/USmismatch_v14.pdf.

Sass, Steven A., and Anthony Webb. 2010. "Is the Reduction in Older Workers' Job Tenure a Cause for Concern?" Center for Retirement Research Working Paper 2010-20. Chestnut Hill, MA: Boston College. Available at http://crr.bc.edu/wp-content/uploads/2010/12/wp_2010-201.pdf.

Schulhofer-Wohl, Sam. 2011. "Negative Equity Does Not Reduce Homeowner Mobility." Working Paper No. 16701. Cambridge, MA: National Bureau of Economic Research.

Shimer, Robert. 2005. "The Cyclical Behavior of Equilibrium Unemployment and Vacancies." *American Economic Rview* 95(1): 25–49.

Staiger, Douglas, James H. Stock, and Mark W. Watson. 1997. "The NAIRU, Unemployment and Monetary Policy." *Journal of Economic Perspectives* 11(1): 33–49.

Tasci, Murat, and John Lindner. 2010. "Has the Beveridge Curve Shifted?" *Economic Trends*, August 10. Cleveland: Federal Reserve Bank of Cleveland. Available at `http://www.clevelandfed.org/research/trends/2010/0810/02labmar.cfm`.

Valletta, Rob, and Katherine Kuang. 2010. "Extended Unemployment and UI Benefits." FSBSF *Economic Letter*. San Francisco: Federal Reserve Bank of San Francisco. Available at `http://www.frbsf.org/publications/economics/letter/2010/el2010-12.html`.

Von Wachter, Till. 2007. "The Effect of Economic Conditions on the Employment of Workers Nearing Retirement Age." Center for Retirement Research Working Paper 2007-25. Chestnut Hill, MA: Boston College. Available at `http://crr.bc.edu/wp-content/uploads/2007/12/wp_2007-251.pdf`.

Von Wachter, Till, and Stefan Bender. 2006. "In the Right Place at the Wrong Time: The Role of Firms and Luck in Young Workers' Careers." *American Economic Review* 96(5): 1679–1705.

Von Wachter, Till, Jae Song, and Joyce Machester. 2009. "Long-Term Earnings Losses due to Mass Layoffs During the 1982 Recession: An Analysis Using U.S. Administrative Data from 1974 to 2004." Dept. of Eco-

nomics Working Paper. New York: Columbia University . Available at http://www.columbia.edu/~vw2112/papers/mass_layoffs_1982.pdf.

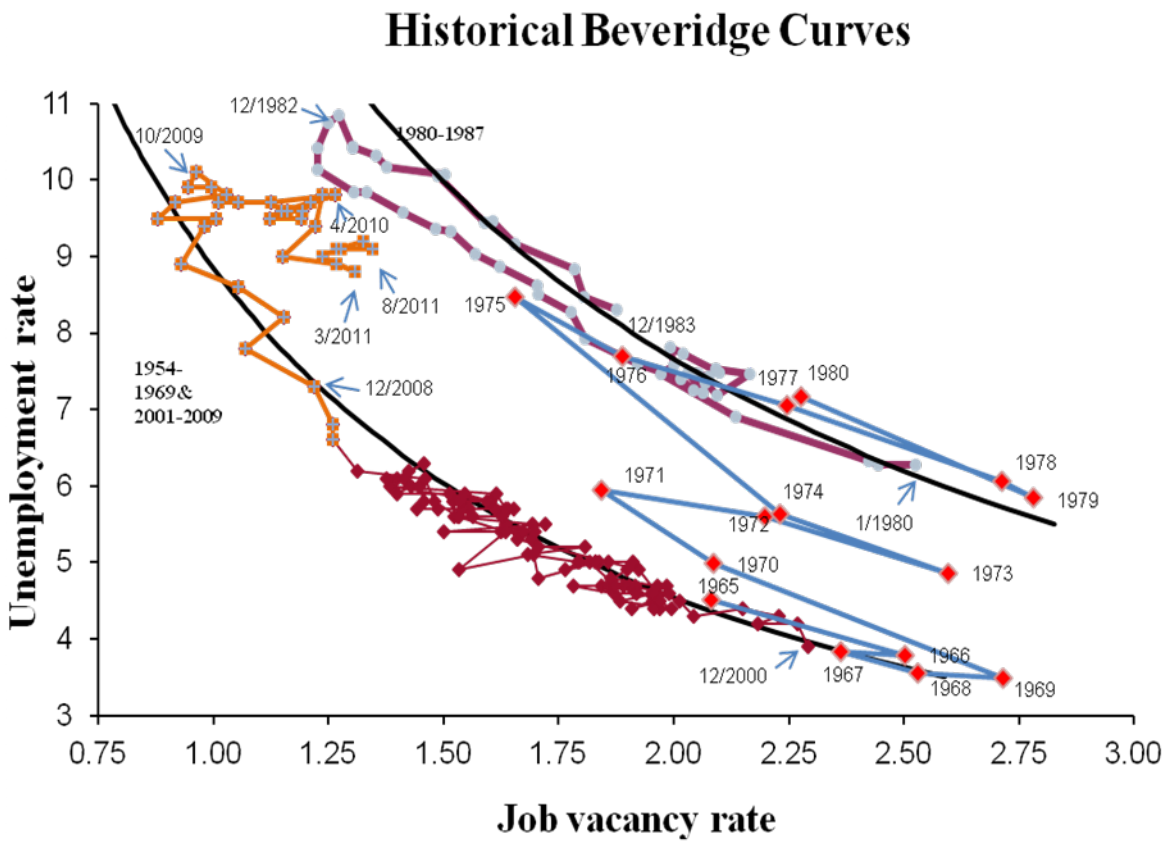

Figure 1: Historical Beveridge Curves

Notes: The monthly data run from January 1980 through December 1983 and January 2001 to March 2011 and. The annual data runs from 1965 through 1980. After 2000 vacancy rates are constructed using the Bureau of Labor Statistics's Job Openings and Labor Turnover Survey (JOLTS). The two measures are harmonized using a method described in Dickens (2009).

Sources: Authors' calculations from unemployment data from the Bureau of Labor Statistics (BLS) and vacancy rates from the Conference Board's help-wanted series and employment data from the BLS.

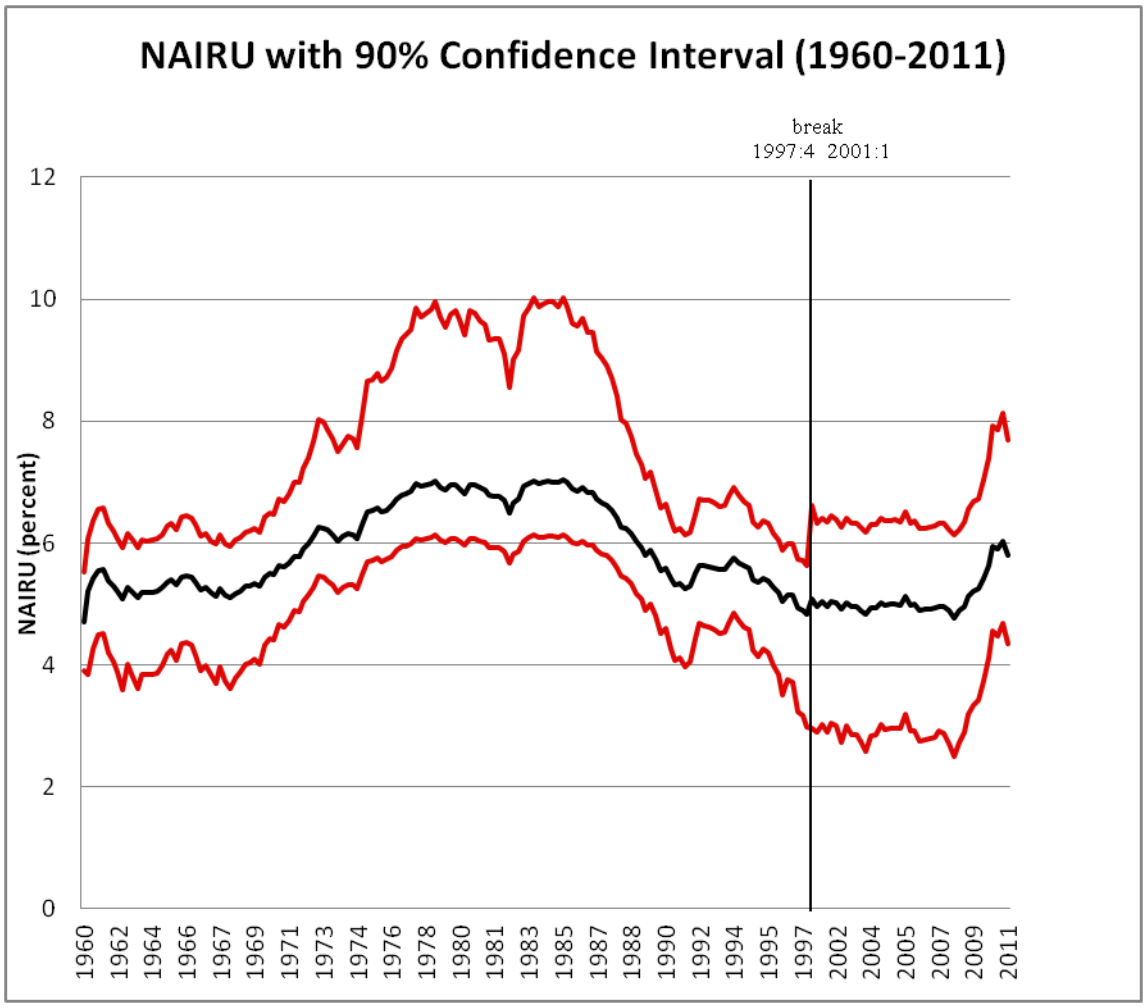

Figure 2: NAIRU with 90% Confidence Interval (1960-2011)

Source: Authors' calculations

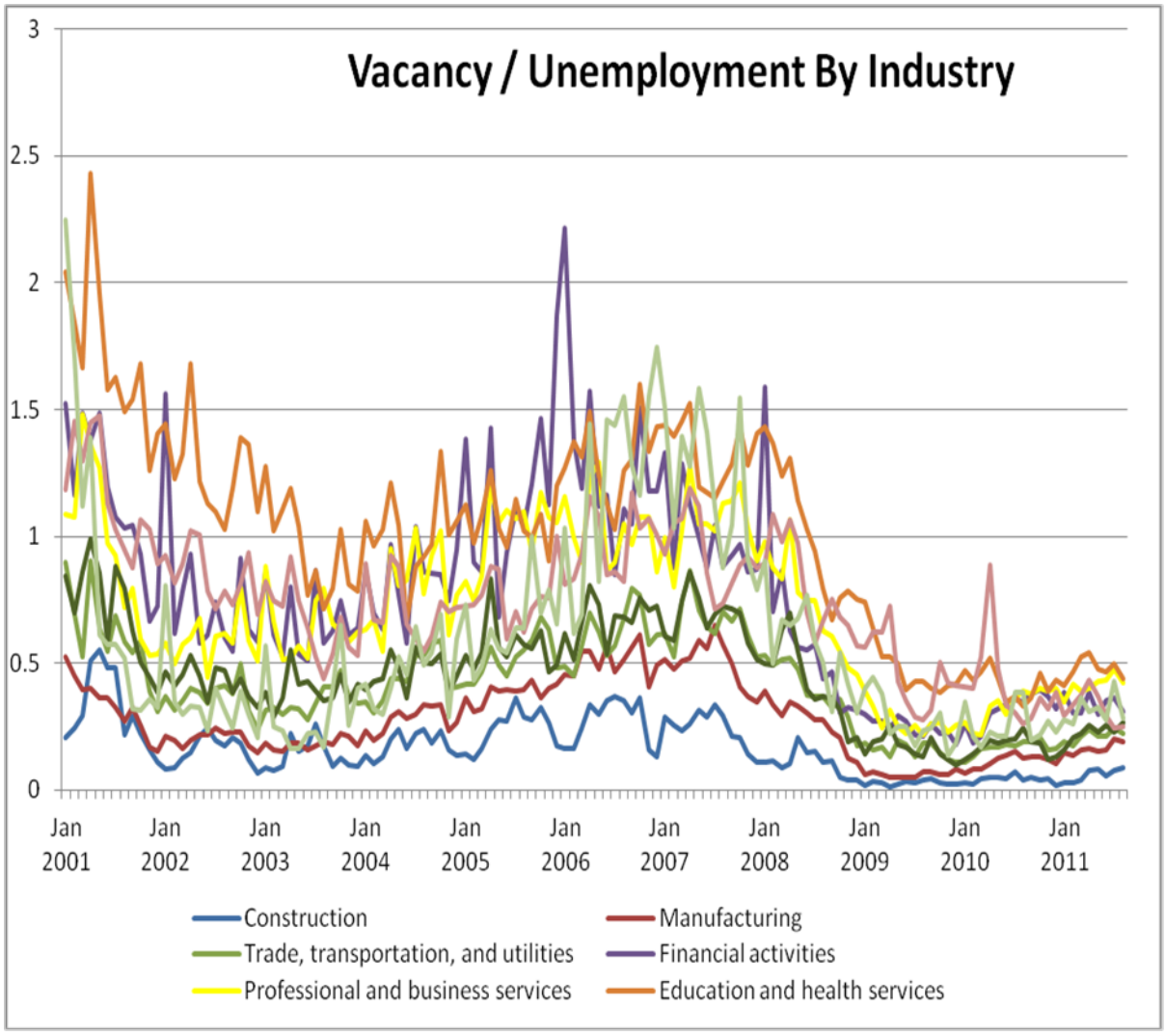

Figure 3: Vacancy/Unemployment By Industry

Source: Authors' calculations based on vacancy data from the Department of Labor's Job Openings and Labor Turnover Survey. Data on unemployment by industry from analysis of the Current Population Survey.

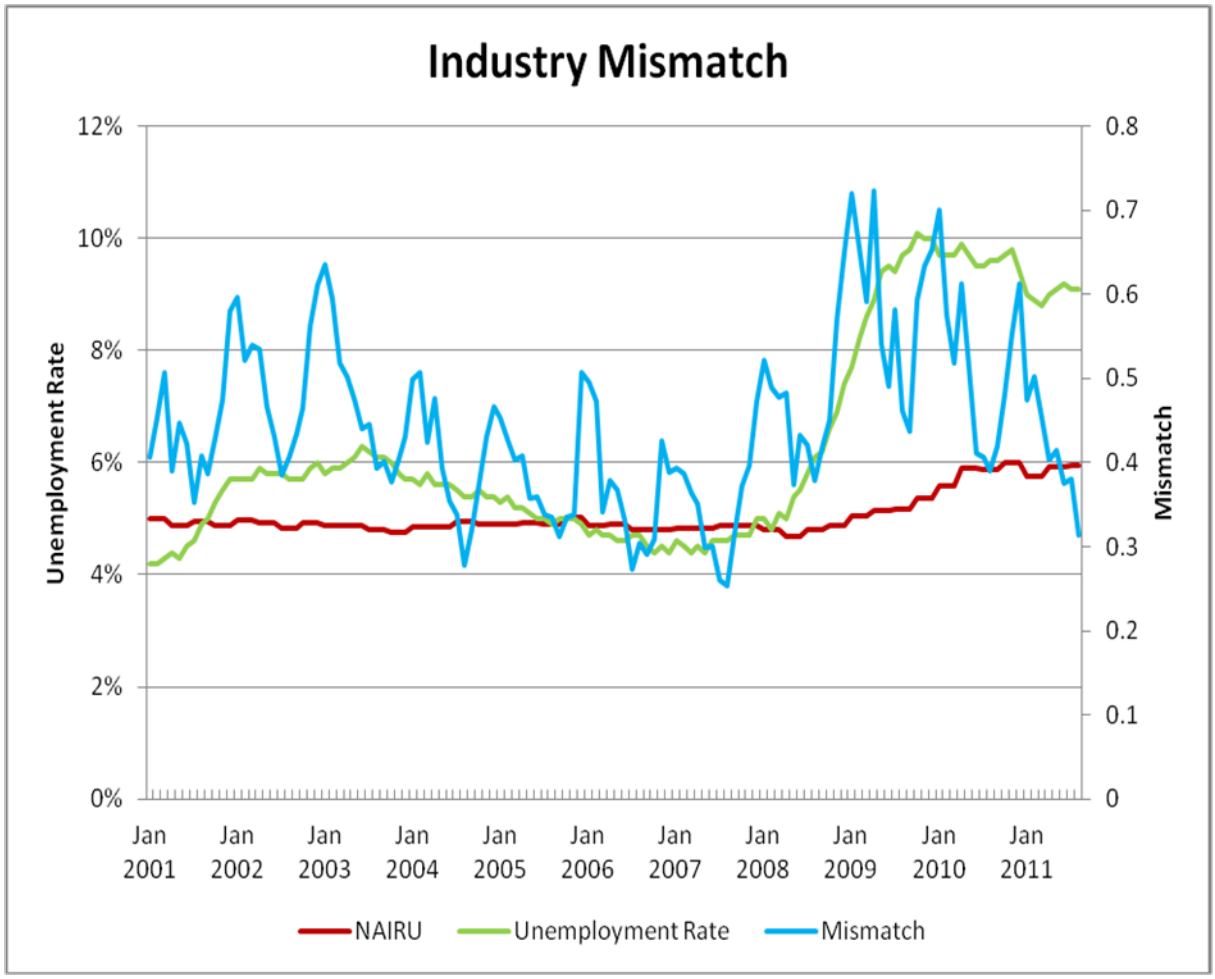

Figure 4: Industry Mismatch

Sources: Authors' calculations of the mismatch index and NAIRU. Unemployment rates from the Bureau of Labor Statistics.

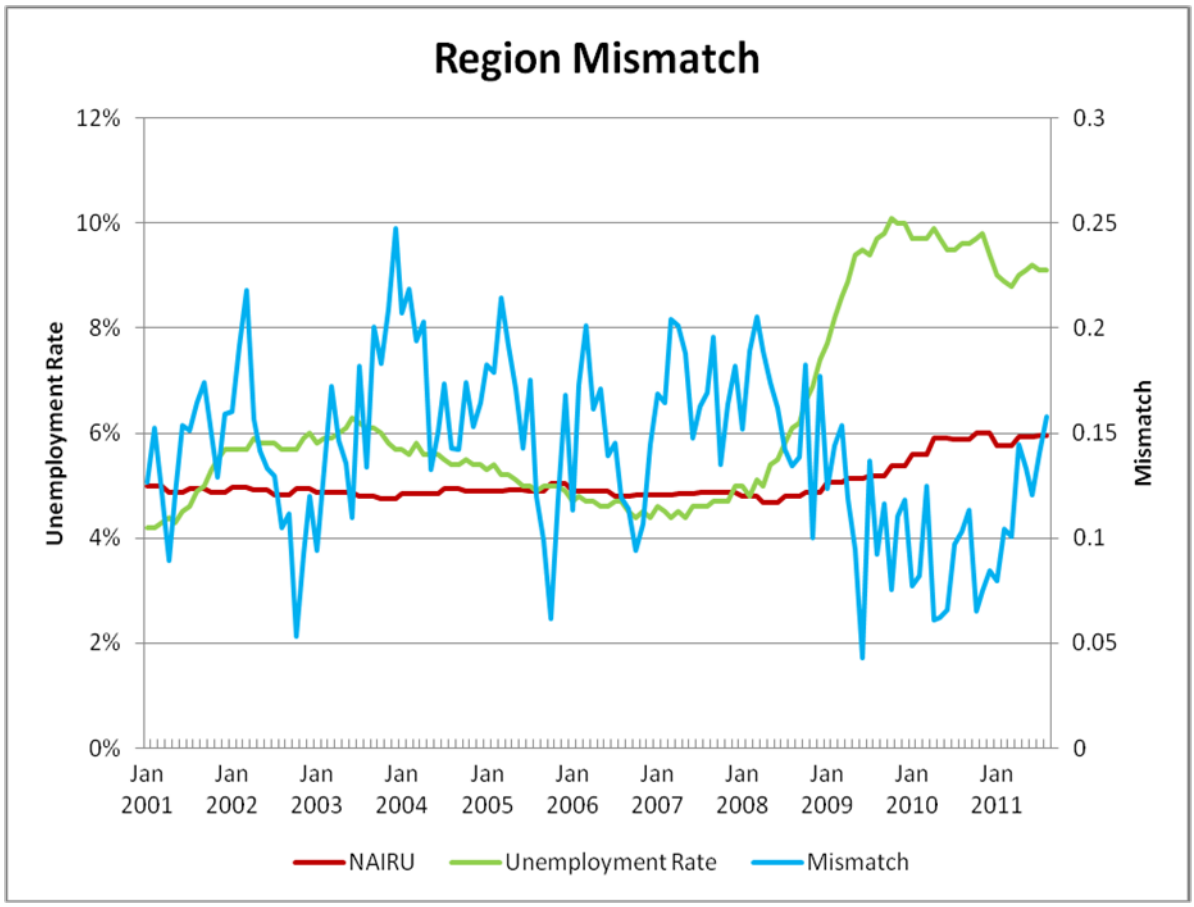

Figure 5: Region Mismatch

Sources: Authors' calculations of the mismatch index and NAIRU computed.
Unemployment rates from the Bureau of Labor Statistics.

Table 1: Job transitions in the first 28 months of SIPP panels

	SIPP Panel		
Reason why left job	2004 Panel	2008 Panel	Total
Did not leave	69%	63%	66%
Invol. term.	11%	19%	15%
Vol. term.	20%	18%	19%
N	26,050	26,391	52,441

Source: Authors' calculations using wave 1 SIPP person weights.

Table 2: Multinomial Logit Analysis of Job Transitions (coefficients transformed to relative risk ratios†)

	Involuntary Separation		Voluntary Separation	
		2008 Panel Interaction		2008 Panel Interaction
2008 Panel indicator	2.613***		1.512*	
	(0.478)		(0.263)	
Age (Years, 25 ≤ 30 omitted group)				
≤ 19	1.404*	0.875	3.569***	1.293
	(0.220)	(0.169)	(0.438)	(0.209)
19 ≤ 24	1.403**	0.880	1.980***	1.014
	(0.150)	(0.118)	(0.168)	(0.118)
30 ≤ 34	0.928	1.187	0.742***	1.054
	(0.103)	(0.164)	(0.064)	(0.133)
34 ≤ 40	0.856	1.137	0.642***	0.830
	(0.085)	(0.142)	(0.050)	(0.098)
40 ≤ 44	1.007	1.092	0.548***	1.045
	(0.106)	(0.146)	(0.048)	(0.137)
44 ≤ 50	0.949	1.116	0.473***	0.996
	(0.094)	(0.138)	(0.039)	(0.121)
50 ≤ 54	1.142	0.910	0.470***	1.144
	(0.131)	(0.130)	(0.046)	(0.160)
54 ≤ 59	1.204	0.862	0.892	0.874
	(0.142)	(0.127)	(0.077)	(0.109)
> 59	1.683***	0.924	1.921***	1.121
	(0.182)	(0.126)	(0.147)	(0.122)
Tenure at Previous Job (Years, 3 ≤ 5 omitted group)				
≤ 1	3.861***	0.700***	3.335***	0.827

	(0.316)	(0.073)	(0.224)	(0.082)
$1 \leq 3$	1.651***	0.919	1.562***	0.886
	(0.148)	(0.104)	(0.112)	(0.094)
$5 \leq 9$	0.646***	1.093	0.806**	0.985
	(0.070)	(0.144)	(0.065)	(0.116)
$9 \leq 14$	0.656***	0.866	0.686***	0.876
	(0.077)	(0.126)	(0.062)	(0.118)
$14 \leq 19$	0.504***	0.800	0.617***	1.022
	(0.070)	(0.143)	(0.063)	(0.156)
> 19	0.373***	1.050	1.067	0.951
	(0.050)	(0.171)	(0.085)	(0.112)
Highest Education Attained (high school omitted group)				
Less than High School	1.245**	1.299***	1.169	0.940
	(0.104)	(0.090)	(0.124)	(0.095)
Some post-Secondary	0.882	1.066	0.948	0.940
	(0.058)	(0.057)	(0.079)	(0.072)
2-Year Degree	0.637***	0.866	0.981	0.907
	(0.066)	(0.068)	(0.127)	(0.102)
Bachelor's Degree	0.573***	0.777***	0.847	0.898
	(0.049)	(0.050)	(0.089)	(0.082)
Master's or Higher	0.364***	0.813**	1.005	0.733**
	(0.046)	(0.063)	(0.154)	(0.084)
U.S. citizen	0.922	1.165	0.825	0.709**
	(0.093)	(0.104)	(0.104)	(0.088)
Male	0.993	0.681***	1.358***	1.167**
	(0.050)	(0.027)	(0.086)	(0.066)
Married	0.693***	1.024	1.008	0.882*
	(0.037)	(0.045)	(0.068)	(0.055)
Black	1.469***	1.104	0.873	1.152

	(0.102)	(0.067)	(0.079)	(0.100)
Hispanic	1.189*	0.975	0.918	0.819
	(0.100)	(0.072)	(0.096)	(0.085)
Constant	0.127***		0.189***	
	(0.018)		(0.023)	
Observations	46351			
R-Squared	0.129			
Wald Test for Joint Significance of 2008 Panel Interaction Terms				
Chi-squared	136.1			
p-value	0.000			

Exponentiated coefficients

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Authors' calculations using SIPP

† The reported multinomial logit coefficients have been transformed into relative risk ratios: each coefficient indicates how a unit increase in the conditioning variable affects the probability of the given outcome (voluntary or involuntary transition) relative to the base case (staying in the job). A value greater than one indicates increased risk of the outcome relative to the base case, and a value less than one indicates decreased risk; the reported significance levels are for rejection of the null hypothesis that the relative risk ratio is equal to one.

Table 3: Mean Change in Nominal Monthly Earnings between Wave 1 and Wave 7 (log points)

	SIPP Panel		
Reason why left job	2004 Panel	2008 Panel	Total
Did not leave	0.081	0.028	0.056
Invol. term.	0.006	-0.097	-0.060
Vol. term.	0.120	-0.010	0.056

Source: Authors' calculations using wave 1 SIPP person weights.

Table 4: Change in Monthly Earnings between Wave 1 and Wave 7 (log points) Regressions

	(1) Did not leave	(2) Involuntary separation	(3) Voluntary separation
Change in weekly hours (log points)	0.456***	0.819***	1.026***
	(0.024)	(0.087)	(0.051)
2008 Panel indicator	-0.042***	-0.047	-0.109**
	(0.005)	(0.037)	(0.041)
Age (25 $<$ 30 omitted group)			
$\leq$ 19	0.088*	0.060	0.059
	(0.040)	(0.126)	(0.089)
19 $\leq$ 24	0.054**	0.070	-0.013
	(0.018)	(0.072)	(0.072)
30 $\leq$ 34	-0.007	-0.044	-0.006
	(0.010)	(0.076)	(0.067)
34 $\leq$ 40	-0.005	-0.019	0.062
	(0.010)	(0.064)	(0.072)
40 $\leq$ 44	-0.014	-0.158*	-0.162*
	(0.010)	(0.073)	(0.081)
44 $\leq$ 50	-0.031***	-0.049	-0.069
	(0.009)	(0.067)	(0.092)
50 $\leq$ 54	-0.031**	-0.044	0.008
	(0.011)	(0.065)	(0.087)
54 $\leq$ 59	-0.042***	-0.071	-0.274*
	(0.010)	(0.068)	(0.114)
$>$ 59	-0.035**	0.035	-0.019
	(0.012)	(0.085)	(0.083)
Wave 1 Job Tenure (3 $<$ 5 omitted group)			

≤ 1	0.035***	0.155*	0.012
	(0.010)	(0.061)	(0.061)
$1 \leq 3$	0.005	0.040	-0.050
	(0.008)	(0.061)	(0.064)
$5 \leq 9$	-0.012	-0.019	-0.118
	(0.007)	(0.072)	(0.080)
$9 \leq 14$	-0.017*	-0.067	-0.181
	(0.008)	(0.078)	(0.099)
$14 \leq 19$	-0.017	-0.044	-0.453***
	(0.009)	(0.082)	(0.134)
> 19	-0.010	-0.076	-0.328**
	(0.008)	(0.087)	(0.113)
Wave 1 Educational Attainment (high school omitted group)			
Less than High School	0.009	-0.016	0.118
	(0.011)	(0.063)	(0.070)
Some post-Secondary	-0.005	-0.046	0.153**
	(0.006)	(0.046)	(0.051)
2-Year Degree	0.005	0.016	0.118
	(0.009)	(0.059)	(0.082)
Bachelor's Degree	0.009	0.066	0.079
	(0.007)	(0.057)	(0.058)
Master's or Higher	0.009	-0.093	-0.019
	(0.008)	(0.095)	(0.086)
U.S. citizen	0.001	0.064	-0.094
	(0.011)	(0.065)	(0.081)
Male	-0.005	0.052	-0.069
	(0.005)	(0.036)	(0.040)

Married	-0.001	-0.066	-0.079
	(0.005)	(0.039)	(0.044)
Black	0.019*	-0.071	-0.067
	(0.008)	(0.056)	(0.072)
Hispanic	-0.014	0.020	-0.062
	(0.008)	(0.048)	(0.064)
Constant	0.097***	-0.061	0.279*
	(0.015)	(0.098)	(0.116)
Observations	24938	1399	1384
R-Squared			
F-Statistic	1.226	0.603	1.557
p-value	0.205	0.934	0.0422

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Authors' calculations based on SIPP

Table 5: Multinomial Logit Analysis of Labor Force Status in Wave 7 for Job Changers (coefficients transformed to relative risk ratios)

	(1)		(2)	
Base case: Employed in Wave 7	Involuntary separation		Voluntary separation	
	unemployed	nilf	unemployed	nilf
2008 Panel indicator	3.518***	0.928	2.523***	1.063
	(0.368)	(0.077)	(0.353)	(0.066)
Age (25 < 30 omitted group)				
≤ 19	0.920	2.604***	0.640	1.483**
	(0.247)	(0.537)	(0.203)	(0.210)
19 ≤ 24	0.995	1.223	0.661	0.858
	(0.188)	(0.206)	(0.189)	(0.107)
30 ≤ 34	1.246	0.783	0.773	0.765
	(0.232)	(0.147)	(0.260)	(0.109)
34 ≤ 40	1.136	0.799	1.722*	0.957
	(0.198)	(0.134)	(0.456)	(0.126)
40 ≤ 44	1.351	0.692*	1.357	0.572***
	(0.241)	(0.129)	(0.397)	(0.089)
44 ≤ 50	1.616**	1.001	1.514	0.884
	(0.268)	(0.165)	(0.406)	(0.121)
50 ≤ 54	1.408	0.964	1.841	1.322
	(0.263)	(0.182)	(0.578)	(0.208)
54 ≤ 59	2.012***	1.496*	2.290**	2.225***
	(0.389)	(0.281)	(0.684)	(0.316)
> 59	1.757**	5.035***	1.291	6.184***
	(0.344)	(0.824)	(0.422)	(0.790)
Wave 1 Job Tenure (3 < 5 omitted group)				
≤ 1	1.105	1.206	1.183	1.318*

	(0.159)	(0.168)	(0.276)	(0.149)
$1 \leq 3$	0.944	0.886	1.103	1.247
	(0.144)	(0.133)	(0.288)	(0.153)
$5 \leq 9$	1.131	0.924	1.159	1.155
	(0.192)	(0.161)	(0.336)	(0.158)
$9 \leq 14$	1.043	0.761	1.182	1.512**
	(0.195)	(0.148)	(0.406)	(0.236)
$14 \leq 19$	1.288	0.736	1.574	1.857***
	(0.305)	(0.198)	(0.590)	(0.330)
> 19	1.116	1.373	1.588	2.793***
	(0.233)	(0.279)	(0.507)	(0.414)
Wave 1 Educational Attainment (high school omitted group)				
Less than High School	1.194	1.220	1.041	1.138
	(0.164)	(0.152)	(0.221)	(0.123)
Some post-Secondary	0.957	1.039	0.650*	0.889
	(0.106)	(0.111)	(0.115)	(0.076)
2-Year Degree	1.051	0.820	0.587	0.860
	(0.172)	(0.147)	(0.169)	(0.117)
Bachelor's Degree	0.790	0.682**	0.494**	0.636***
	(0.108)	(0.097)	(0.109)	(0.067)
Master's or Higher	0.512**	0.728	0.337***	0.472***
	(0.115)	(0.144)	(0.105)	(0.060)
U.S. citizen	1.172	1.159	0.977	1.088
	(0.187)	(0.184)	(0.308)	(0.153)
Male	0.923	0.445***	1.113	0.562***
	(0.078)	(0.036)	(0.150)	(0.036)
Married	0.789**	1.227*	0.773	1.209**

	(0.073)	(0.111)	(0.117)	(0.087)
Black	1.137	1.248	2.164***	1.130
	(0.141)	(0.145)	(0.359)	(0.110)
Hispanic	0.894	1.093	0.858	0.805
	(0.126)	(0.140)	(0.219)	(0.090)
Months between job loss and end of panel	0.946***	1.006	0.984	0.997
	(0.006)	(0.006)	(0.009)	(0.005)
Constant	0.324***	0.362***	0.084***	0.654
	(0.090)	(0.096)	(0.040)	(0.142)
Observations	4120		5352	
R-Squared	0.0925		0.121	
Chi-2 Statistic	50.15		61.43	
p-value	0.468		0.129	

Exponentiated coefficients

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Authors' calculations based on SIPP

Table 6: Cox proportional hazard analysis of re-employment following separation

	(1) Involuntary separation	(2) Voluntary separation
Indicator for 2008 panel	0.819***	0.891*
	(0.035)	(0.040)
Observations	70463	103792
R-Squared	0.000583	0.000181

Exponentiated coefficients

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7: Cox proportional hazard analysis of re-employment following separation

	(1)			
	Involuntary Separation		Voluntary Separation	
		2008 Panel Interaction		2008 Panel Interaction
2008 Panel indicator	0.573*		0.567	
	(0.147)		(0.173)	
Age (Years, 25 < 30 omitted group)				
≤ 19	1.145	1.166	1.596***	0.948
	(0.181)	(0.250)	(0.190)	(0.180)
19 ≤ 24	1.182	0.995	1.262*	1.155
	(0.157)	(0.174)	(0.134)	(0.195)
30 ≤ 34	0.762	1.202	0.860	1.000
	(0.122)	(0.242)	(0.122)	(0.234)
34 ≤ 40	0.916	1.029	0.704**	1.241
	(0.129)	(0.187)	(0.091)	(0.274)
40 ≤ 44	0.901	1.160	0.788	1.075
	(0.124)	(0.214)	(0.113)	(0.279)
44 ≤ 50	0.936	0.955	0.814	0.948
	(0.122)	(0.165)	(0.107)	(0.218)
50 ≤ 54	0.848	1.120	0.568**	1.437
	(0.131)	(0.224)	(0.101)	(0.393)
54 ≤ 59	0.670*	1.293	0.571***	0.696
	(0.113)	(0.274)	(0.086)	(0.198)
> 59	0.485***	1.051	0.270***	1.221
	(0.076)	(0.214)	(0.038)	(0.279)
Wave 1 Job Tenure (Years, 3 < 5 omitted group)				

≤ 1	0.860	1.131	1.175	1.005
	(0.098)	(0.169)	(0.121)	(0.176)
$1 \leq 3$	1.020	0.899	1.058	1.013
	(0.122)	(0.140)	(0.115)	(0.189)
$5 \leq 9$	1.042	0.797	0.972	0.852
	(0.150)	(0.147)	(0.133)	(0.201)
$9 \leq 14$	0.833	0.942	0.809	1.257
	(0.148)	(0.213)	(0.147)	(0.376)
$14 \leq 19$	0.593*	1.971*	0.977	0.651
	(0.149)	(0.590)	(0.188)	(0.258)
> 19	1.023	0.736	0.654**	0.872
	(0.203)	(0.189)	(0.105)	(0.245)
Wave 1 Educational Attainment (high school omitted group)				
Less than High School	0.951	0.768	0.896	0.994
	(0.093)	(0.105)	(0.076)	(0.148)
Some post-Secondary	1.103	0.967	1.194*	1.019
	(0.098)	(0.112)	(0.089)	(0.126)
2-Year Degree	1.260	0.848	1.067	0.939
	(0.184)	(0.158)	(0.139)	(0.204)
Bachelor's Degree	0.989	1.193	1.240*	1.295
	(0.122)	(0.184)	(0.123)	(0.209)
Master's or Higher	1.410*	1.074	1.187	1.729*
	(0.236)	(0.227)	(0.172)	(0.395)
U.S. citizen	0.983	1.168	1.053	1.453
	(0.133)	(0.204)	(0.126)	(0.309)
Male	1.036	1.122	1.179**	0.948
	(0.068)	(0.098)	(0.068)	(0.090)
Married	0.874	1.215*	0.887	0.991
	(0.066)	(0.119)	(0.062)	(0.120)

Black	0.790*	1.077	0.710***	1.044
	(0.076)	(0.139)	(0.063)	(0.157)
Hispanic	1.020	1.127	0.715**	1.289
	(0.114)	(0.160)	(0.075)	(0.208)
Enrolled in School	0.699**	0.939	0.663***	0.778
	(0.084)	(0.147)	(0.057)	(0.103)
Observations	70409		103727	
R-Squared	0.0059		0.0203	

Exponentiated coefficients

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$