Long-Term Nonemployment and Job Displacement

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I.   Introduction

The Great Recession was the largest recession since the Great Depression. While unemployment rates during the Great Recession were comparable to rates observed in the next-largest recession in the early 1980s, the Great Recession had, among others, two outstanding features. The rate of long-term unemployment was nearly double during and in the immediate aftermath of the Great Recession, compared to the early 1980s and other recent recessions. Moreover, while the overall rate of unemployment has declined steadily from its peak, the employment-population ratio has experienced a larger and more persistent decline than in previous downturns.[1]

These patterns have raised the concern whether the substantial rise in long-term unemployment (LTU) may have contributed to the persistent decline in the employment-population ratio (e.g., Council of Economic Advisers 2014). This could arise if long durations of joblessness affect workers' ability or desire to find stable jobs. Such a phenomenon, sometimes referred to as "hysteresis," has been associated previously with the large rise in long-term unemployment in Europe in the early 1980s and the ensuing persistent rise in unemployment rates (e.g., Blanchard and Summers 1986; Ball 2009). If

hysteresis in employment is a broad phenomenon in the U.S. labor market in the aftermath of the Great Recession, this has important implications for economic policy. In particular, it would imply that it might be difficult to reverse the persistent decline in the employment-population ratio via macroeconomic or microeconomic policies, at least in the short run.

There are at least two important difficulties in assessing the effect of extended joblessness on aggregate employment rates. The first difficulty is that currently in the U.S. the duration of joblessness is only recorded for those workers that are classified as unemployed in the Current Population Survey (CPS), the main labor force survey used to measure the unemployment rate.[2] There is currently no comprehensive measure of nonemployment duration for other types of jobless workers. It is well known that among those nonemployed not classified as unemployed, many may have some attachment to the labor force and may work given the opportunity.[3] This pool of nonemployed workers was substantial in the aftermath of the Great Recession, triggering an ongoing debate over how to appropriately measure the state of the labor market.[4] Hence, the duration of joblessness for an important part of nonemployed workers is not captured by standard measures of LTU, making it difficult to assess the true potential for hysteresis in the aftermath of the Great Recession.

Another, closely related issue is that since the CPS classifies workers as unemployed based on survey questions, the classification is influenced by the current institutional, social and economic environment. It has long been recognized that these factors make a comparison of unemployment rates between countries or demographic groups difficult (e.g., Card and Riddell 1993; Jones and Riddell 1999). The same problem arises when comparing the unemployment rate over time. For example, the maximum potential duration of unemployment insurance (UI) benefits during the Great Recession was 99 weeks, compared to 55 weeks during the similar recession during the early 1980s. Similarly, existing evidence finds that workers are more likely to recall longer, more salient spells and underreport shorter spells, and that the rate of recall error is pro-cyclical (e.g., Akerlof and Maine 1980; Levine 1993). Hence, for these and other reasons, the

LTU rate in the Great Recession may not be comparable to the LTU rate in previous episodes.

To address these two concerns with current measures of LTU, we have obtained access to longitudinal administrative data on individual-level employment and earnings covering the years 1980 to 2012. Using this data, we have generated new measures of the duration of long-term nonemployment (LTNE) that are based on the number of people that have no earnings in a given calendar year (or two consecutive years). The resulting measures of LTNE significantly extend our understanding of nonemployment dynamics over the business cycle and complement a large body of evidence based on unemployment duration alone. Our new measures of LTNE yield a first comprehensive measure of the duration of joblessness for all nonemployed workers spanning the period from 1980 and 2012. Since our data are derived from tax records, our measures are not affected by measurement issues related to self-reporting of labor force status or unemployment duration and hence are comparable over time. This allows us to compare the incidence of LTNE over four major downturns, and to assess whether the Great Recession was indeed an episode with an exceptionally high LTNE. In addition, our data also allows us to analyze the rate of re-entry among the long-term nonemployed for each year following job loss. This allows assessing whether jobless workers have faced greater difficulties to re-enter employment in the Great Recession than in past recessions, a pattern taken to be indicative of hysteresis.

Even with a better understanding of the incidence of LTNE, assessing the effect of higher nonemployment durations on employment rates has proven difficult. The main reason is that the causal effect of the duration of joblessness on the probability of re-employment (sometimes referred to as duration dependence) is difficult to estimate in practice. This is because hard-to-re-employ workers tend to have longer nonemployment spells, and one risks to attribute to duration any effect stemming from differences in worker characteristics. In addition, when comparing the duration of joblessness over time, one may wrongly attribute changes in duration dependence to changes in the characteristics of the nonemployed. These issues have

been important difficulties in assessing the extent of hysteresis in the labor market.[5]

To make some progress on this difficult issue, in the second part of the paper we cut the Gordian knot and propose an alternative measure of the extent of hysteresis in the labor market based on the analysis of displaced workers. Specifically, our measure of hysteresis is the amount of persistent decline in employment implied by job loss during a recession. Like long-term joblessness, job displacements are closely associated with recessions. However, the advantage of job displacements is that they are more likely to be determined by forces outside the worker's own control, such as mass layoffs and plant closings, and may represent true "shocks" not completely determined by workers' own characteristics. This implies the effects of job displacement can be more easily analyzed empirically with the appropriate data. A key question for policy is whether any lasting reduction in employment due to job loss is due to increased mobility in an out of employment while workers remain attached to the labor force—in which case policies fostering stable employment might be effective—or due to permanent exit from the labor force. An added advantage of studying the employment effects of job displacement is that one can also easily analyze the sources of the employment decline.

Using administrative longitudinal data on workers and their employers, we first analyze the causal effect of job displacements on employment over the short term and long term from 1980 to 2011. The resulting estimates are interesting in their own right, since they show how labor market shocks can persistently reduce workers' employment. We combine the estimates of the effect of job displacement with various measures of the incidence of job loss to construct an upper bound for the implied persistent reduction in the employment-population ratio. Although measuring the extent of hysteresis in the labor market based on job loss is not a panacea—and the paper discusses various measurement issues in depth—the advantage is that the measure is transparent, based on a causal estimate, and straightforward to implement in many contexts.[6]

Based on our approach and administrative data source, we obtain the following five main findings, whose implications are further

discussed below. First, we find that in terms of our main measure of LTNE—the fraction of individuals that experience an ongoing non-employment spell of one to two calendar years among the effective labor force (measured as all workers employed in a year plus those that have a new one-to-two-year nonemployment spell)—the Great Recession is less exceptional than the previous large recession in the early 1980s. In contrast to the rate of LTU lasting at least 12 months, which was twice as high in the Great Recession as in the early 1980s, the rate of LTNE moves proportionally to the aggregate unemployment rate, which statistically explains about 80 percent of the variation in LTNE.

Our second main finding is that the exit rates from long nonemployment do not exhibit strong cyclical movements, and was similar in the aftermath of Great Recession compared to recent recessions. Our finding that the survivor curves after nonemployment do not appear to have changed substantially during the Great Recession is consistent with similar evidence from the exit behavior from LTU over time (Elsby, Hobijn and Şahin 2010, 2011) or across regions (Krueger, Cramer and Cho 2014).[7]

Based on our new measures of LTNE, both the incidence and duration of jobless spells in the Great Recession is comparable to that of previous downturns. Since the incidence and duration of nonemployment are the two key determinants of hysteresis, this makes it unlikely that hysteresis arising from longer or more persistent jobless-ness is the main determinant of the exceptional decline in the employment-population ratio in the Great Recession. However, these findings do not preclude the possibility that the level of hysteresis was substantial in this or previous recessions. This is because a key determinant of hysteresis—the effect of LTNE on the probability of re-employment—is hard to estimate from descriptive data alone.

To provide direct evidence of whether employment shocks can lead to lasting declines in employment we turn to our analysis of the employment patterns of displaced workers from 1980 to 2012.[8] Based on our analysis of displaced workers, we obtain three additional findings. Our third main finding is that a job displacement leads to a sharp decline in employment rates of 15-20 percentage points in the immediate aftermath of job loss, and a persistent long-run decline in

employment of 5 to 10 percentage points lasting for 20 years. While the employment decline right after job loss is larger in recessions, on average the long-run employment effects do not vary with the cycle, consistent with our finding of approximately stable exit rates from long-term nonemployment.

Our fourth finding is that when comparing the Great Recession to previous downturns it appears that the medium- to long-term effect of job displacements was very similar, again consistent with the stable patterns of exit rates from LTNE we document. We also find that the incidence of job displacement as we measure it here did not rise particularly strongly in the Great Recession, in line with our findings regarding the incidence of long-term nonemployment spells and a range of other measures of job loss.

Our fifth main finding is that at least initially nonemployed displaced workers remain attached to the labor force. This is because in the first few years after job loss, repeated transitions to nonemployment and a rise in the duration of ongoing nonemployment spells play a larger role than permanent exit from employment. Between five to 10 years after job loss, this finding reverses, and permanent exit steadily becomes the dominant source, implying that over the longer-term employment declines due to job loss are mainly driven by lasting separation from the labor force.[9]

These results have several important implications. First, our analysis of job displacements constitutes direct evidence that labor market conditions can permanently affect the employment rate of affected workers. Hence, recessions involving a large amount of job destruction can persistently alter the aggregate employment rate and its composition between attached and nonattached workers.

The actual contribution of job displacement to lasting changes in the aggregate employment rate hinges on two key magnitudes, the incidence of job displacement and the effect of job displacement on employment. In our analysis, we deliberately chose a group of high-attachment workers for whom we can credibly estimate long-term employment effects, but that constitute a small fraction of the population. We review other measures of the incidence and effect of job loss, and

conclude that in each recession from 1980 to today job loss is likely to have led to lasting reductions in employment rates.

A second implication based on our analysis of LTNE and job displacement is that the scope for recession-induced hysteresis appears no larger in the Great Recession than in previous downturns. Although alternative measures of job loss imply different magnitudes, the upper bound of our estimates suggests that hysteresis arising from job loss in the Great Recession was moderate.

Our findings also imply that one has to be cautious in using standard indicators of long-term unemployment as the only measure to characterize the duration of joblessness in the labor market. Our results confirm that it is important to study the behavior and characteristics of the group of nonemployed more broadly, as emphasized among others by Erceg and Levin (2013) and Katz, Kroft, Lange and Notowidigdo (2014). These findings also underscore longstanding concerns that conventional measures of unemployment and unemployment duration may be influenced by factors beyond labor market conditions, and hence may not be difficult to compare over time.

The paper is organized as follows. Section II provides a brief overview of the cyclical patterns of employment, unemployment and long-term unemployment motivating our analysis. Section III contains our main findings from the analysis of our new measures of long-term nonemployment. In Section IV we analyze the effects of job displacement on short-term and long-term employment. Section V discusses the incidence of job loss and the implication of our findings for the persistence of employment in the aftermath of the Great Recession. The last section concludes.

II.   Background and Discussion

The developments in the labor market during and after the Great Recession have been analyzed in detail elsewhere (e.g., Elsby, Hobijn and Şahin 2010; Rothstein 2012; Lazear and Spletzer 2012). To set the stage of the analysis, Charts 1 to 3 display developments of several key labor market indicators relevant to our analysis. The unemployment rate (Chart 1A), which at its peak in the Great Recession was about at the same level of the last large recession in the early 1980s,

has been declining steadily, and by mid-2014 has reached a moderate level. In contrast, broader measures of labor utilization published by the Bureau of Labor Statistics (BLS), such as UR6 (Chart 1A), which among others includes discouraged workers and those involuntarily working part time, still give reason to concern. Similarly, the fact that the decline in the employment-population ratio during the Great Recession is larger and more persistent than in the early 1980s has gained attention from academics and policymakers (Chart 2A). As further discussed below, part of the differences between cycles arise from changes in female employment patterns. Finally, an exceptional feature of the Great Recession has been a substantial rise in the incidence of LTU lasting at least one year, shown in Chart 3A as proportion of the labor force for men and women separately. The rate of LTU in the Great Recession has been about double the level in the early 1980s recession for both men and women. In contrast, Chart 3B shows that the rise in the incidence of moderately long spells lasting 15 to 26 weeks and 27 to 51 weeks in the Great Recession relative to the early 1980s recession was substantially smaller, about 10 percent and 30 percent, respectively. Krueger, Cramer and Cho (2014) report that the job finding rates and other characteristics of the long-term unemployed differ from those of workers with short to moderately long spells. In Section III, we will focus the incidence and properties of longer spells of joblessness using administrative data.

Although these patterns broadly hold for the entire labor market, how exceptional the Great Recession was differs by age and gender. While the decline in the employment-population (EPOP) ratio for prime-age men was large during the Great Recession, this group experienced a persistent reduction in the EPOP ratio during the early 1980s as well (Chart 2B), qualifying the stark contrast in the recovery of the aggregate EPOP rate after the two recessions.[10] The difference arises because during the early 1980s increases in the female EPOP ratio more than offset the persistent reduction for men. Chart 2B also shows how younger workers, and in particular younger men, experienced larger and more persistent reductions in employment rates during the Great Recession. In contrast, workers near retirement age, who might have been expected to be more likely to permanently leave the labor force upon unemployment, saw a comparatively smaller

Chart 1A
Unemployment Rate and Extended Underemployment Rate (UR6)
**Unemployment Rate Reweighted to Hold Age and Gender Distribution Constant
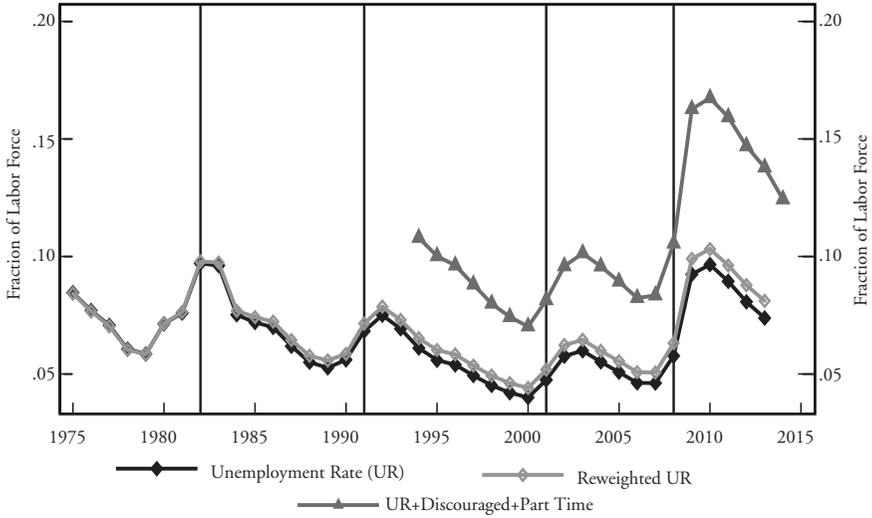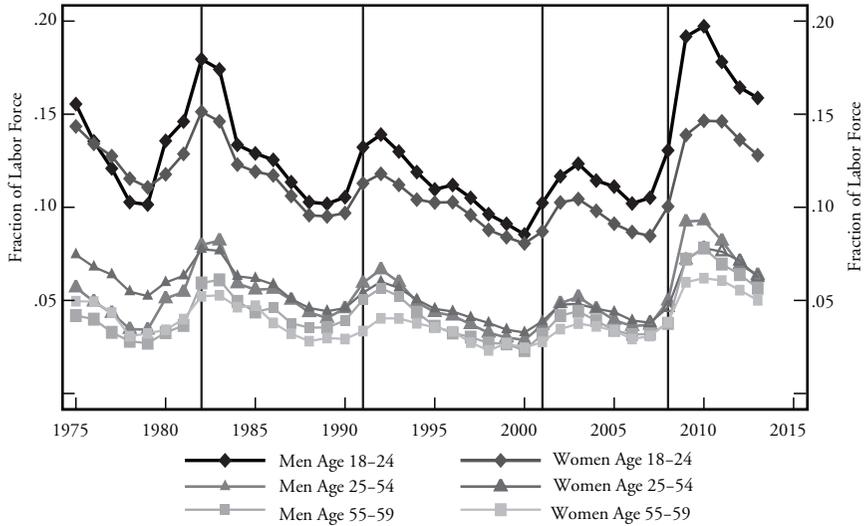at Level of 1980, Men and Women**

Chart 1B
Unemployment Rate by Age Groups and Gender

Note: Vertical lines drawn in recession years 1982, 1991, 2001, 2008.
Source: Bureau of Labor Statistics.

Chart 2A
Employment-Population Ratio and Labor Force Participation Rate
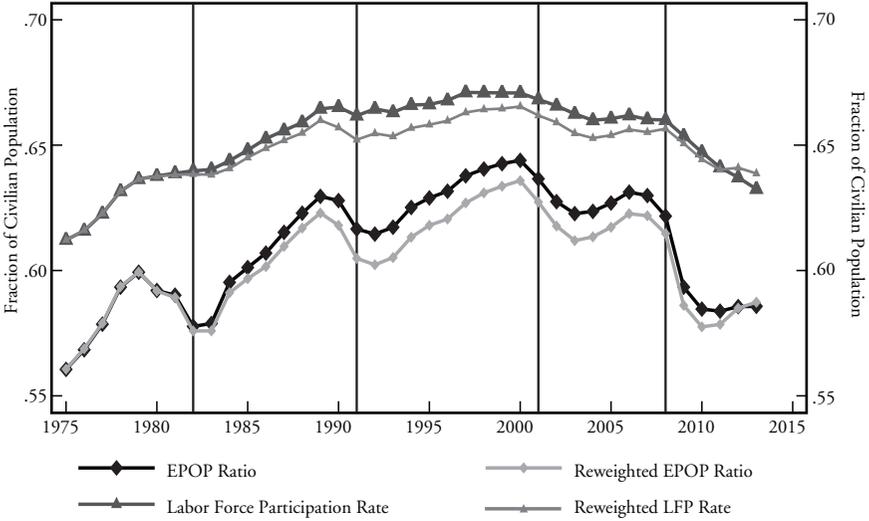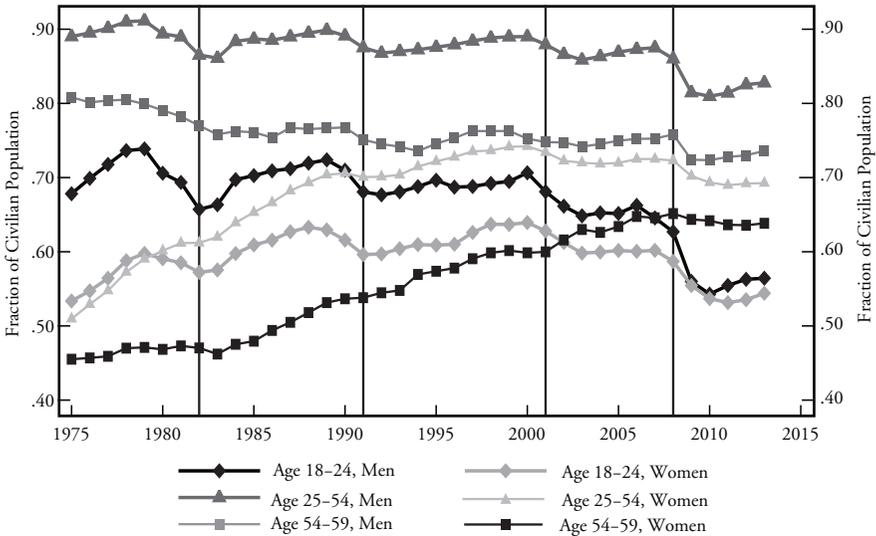### Reweighted to Hold Age and Gender Distribution Constant at Level of 1980,
Men and Women

	EPOP Ratio		Reweighted EPOP Ratio
	Labor Force Participation Rate		Reweighted LFP Rate

Chart 2B
Employment-Population Ratio by Age Groups and Gender

	Age 18–24, Men		Age 18–24, Women
	Age 25–54, Men		Age 25–54, Women
	Age 54–59, Men		Age 54–59, Women

Note: Vertical lines drawn in recession years 1982, 1991, 2001, 2008.
Source: Bureau of Labor Statistics.

Chart 3A
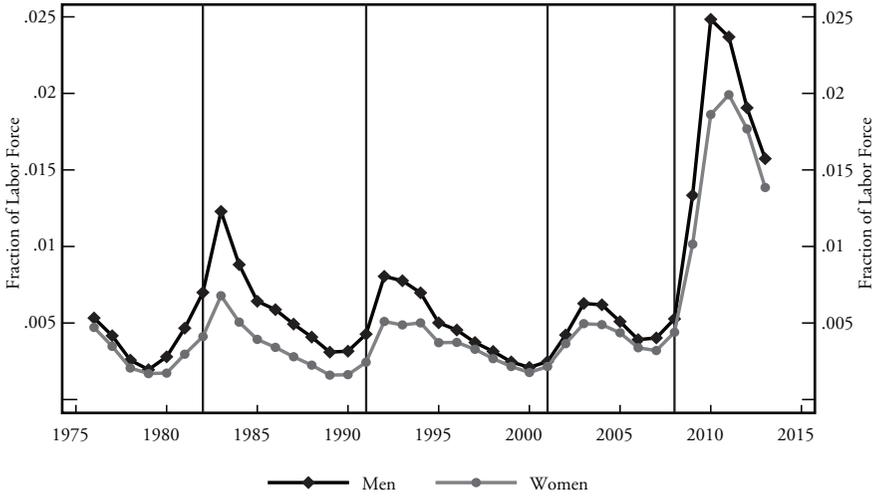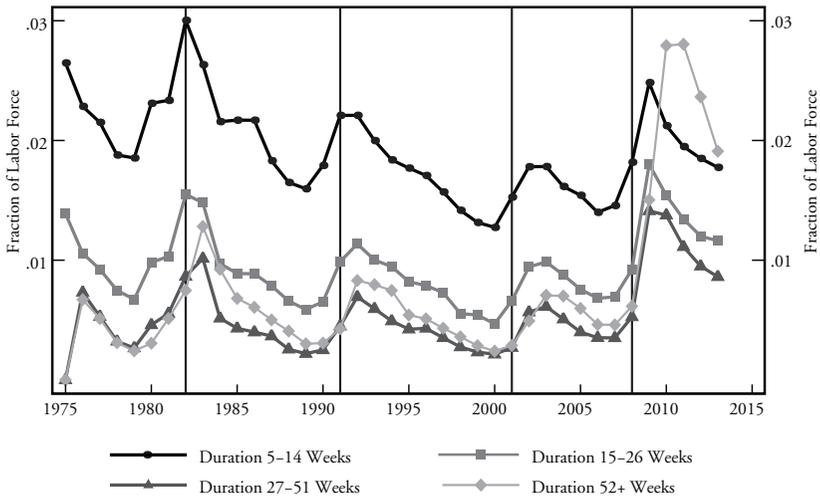**Long-Term Unemployment Rate (52+ Weeks) By Gender**

Chart 3B
Unemployment Rate by Duration, Both Genders

Note: Vertical lines drawn in recession years 1982, 1991, 2001, 2008.
Source: Bureau of Labor Statistics.

decline than prime-age workers. As a result, part of the decline in the EPOP ratio and almost the entire decline of the labor force participation rate shown in Chart 2A is driven by younger workers. Below, we report results for all demographic groups, but confirm our analysis based on prime-age men that are less affected by secular labor market trends and whose EPOP rate is more comparable across recessions.

An implication of these patterns is that the decline in the EPOP ratio in the aftermath of the Great Recession cannot be fully explained by population aging. Recently, Kapon and Tracy (2013) raised the hypothesis that part of the gap in employment after the Great Recession vis-à-vis pre-recession levels is fictitious because the impending retirement of the baby boom generation implies lower steady-state employment levels. To address this point directly, Chart 2A shows the predicted EPOP ratio when we hold the age-gender distribution of the population constant at its level in 1980.[11] This reweighted series shows that part of the persistent decline in the EPOP ratio is due to a shift in the age-gender distribution of the labor force. However, the majority of the gap arises within age-gender groups and is thus likely related to the Great Recession. The same finding holds for the unemployment rate (Chart 1A and Elsby, Hobijn and Şahin 2010), and the labor force participation rate (Chart 2A and Aaronson, Davis and Hu 2012; and Erceg and Levin 2013). Additional findings suggest that changes in unemployment rates and long-term unemployment cannot be explained by shifts in education, industry or occupation of unemployed workers (e.g., Farber 2010; Katz, Kroft, Lange and Notowidigdo 2014), something that we return to below.

Several recent studies presented statistical decompositions of the decline in the EPOP ratio. For example, Council of Economic Advisers (2014) decomposes the change in the EPOP ratio into components coming from aging-related pre-existing trends, cyclical factors, and other factors, which may include a persistent decline triggered by the rise in the LTU. The study finds that about two-thirds of the gap in EPOP rates is explained by trends in population aging and the cycle. The majority of the remaining gap is statistically explained by the rise in LTU rates, which reflects a high time-series correlation between LTU rates shown in Chart 3A and the EPOP ratio shown in

Chart 2A. However, as mentioned in the Introduction, there are at least two difficulties assessing whether a rise in the incidence of long-term joblessness can explain the observed decline in EPOP ratios. First, there currently is no systematic information on the duration of joblessness for the rising fraction of discouraged and other workers marginally attached to the labor force has been increasing (Chart 1A). In Section III, we turn to a large longitudinal administrative data source to generate measures of long-term joblessness covering all nonemployed workers.[12]

A second problem in interpreting the correlation mentioned at the outset is that it is hard to establish a causal relationship between joblessness and employment outcomes either at the micro or at the macro level. Absent such estimates, the literature has explored whether the duration of unemployment spells has risen in the Great Recession. Absent cyclical variation in the characteristics of unemployed workers, a rise in the duration of unemployment spells should reflect an increase in true (but unknown) duration dependence. Descriptive evidence based on flows out of unemployment finds that the outflow rate in the Great Recession has declined equally at all unemployment durations (Elsby, Hobijn and Şahin 2010, 2011), suggesting that unemployment was not more persistent in the Great Recessions than in previous downturns. Since these results pertain only to unemployed workers, to obtain a more complete picture of the change in the duration of jobless spells during the Great Recession we extend the analysis of durations to all nonemployed workers in Section III. Another concern is that any decline in exit rates by unemployment duration may still partly reflect an effect of unemployment duration on employment rates. We address the question of measuring the true degree of employment persistence during recessions in Sections IV and V.

III.   New Measures of Long-Term Nonemployment From Administrative Data

To fill the gap in available measures of duration of joblessness for broader groups of nonemployed workers and to better characterize persistence of joblessness during the Great Recession, we turn to the analysis of administrative data. In light of the preceding discussion,

we focus on the analysis of spells of nonemployment lasting at least one year whose incidence among the unemployed has increased dramatically and compare their incidence over time and by gender and age groups. To better assess the potential of hysteresis in the labor market, we also analyze the duration of long-term nonemployment spells over time and between demographic groups.

III.i Data and Approach

We have generated new summary measures of the duration of long nonemployment spells based on longitudinal administrative data from the Social Security Administration (SSA). We refer to these as measures of LTNE, in contrast to conventional measures of LTU published regularly by the BLS and discussed in Section II. The data we use contain information on individual W2-level (annual) earnings for a 1 percent random sample of individuals employed in the U.S. from 1980 to 2012.[13] For each individual in the sample we have complete earnings histories as long as the individual receives earnings recorded on a W2. Based on this data we define a worker to be employed in a given calendar year if he or she receives any positive annual earnings in that year. Other than detailed and high-quality information on annual earnings from tax records, the data also contain information on gender and age, but no further information on hours or weeks worked, unemployment, education, training, family status, or other demographics. The data do have information on employers, which will be further described and used in Section IV.

Using this data, we construct several measures of long-term nonemployment. We first measure the number of people N_t that were employed in a base year (t-1) and that had zero earnings in the following calendar year t. Hence, this captures ongoing spells of nonemployment whose elapsed duration is at least one calendar year and at most somewhat less than two calendar years.[14] To make this number comparable over time, we normalize it by the sum of the total number of people employed in year $t(E_t)$ and the number of newly long-term nonemployed (N_t), which one can think of as a measure of the "effective" labor force in the SSA data.[15] Thus, our first measure of LTNE is simply the fraction of individuals in the

labor force with nonemployment spells lasting at least a calendar year and at most somewhat less than two calendar years:

$$LTNE_t^1 = \frac{N_t}{E_t + N_t}.$$

Since we require workers to have had at least one year with positive earnings before a nonemployment spell, the data for the incidence of long-term nonemployment start in 1981, a year after the start of our sample period.

An advantage of our data is that we have sufficiently large sample sizes to also construct measures of the incidence of very long nonemployment spells that can be precisely measured for different demographic groups. This is particularly relevant if one is concerned about hysteresis, since it is these long spells that would most likely trigger a persistent decline in employment rates. To capture such spells, our second measure of LTNE is the fraction of individuals in the labor force that experienced a spell of nonemployment that has lasted at least two consecutive calendar years and at most somewhat less than three calendar years. If one denotes with M_t the number of people with an employment gap of two to three calendar years, then our second measure of long-term nonemployment is

$$LTNE_t^2 = \frac{M_t}{E_t + N_t + M_t},$$

where the denominator is again a measure of the "effective" labor force in year t, which consists of those currently employed, those newly nonemployed in year t, and those still nonemployed from year $t-1$. Since our raw data begin in 1980, this measure starts in 1982.[16]

Our third measure is effectively a version of the survivor curve of remaining in nonemployment by year since the initial gap of one to two years. The numerator is the number of people among the group that experienced a one- to two-year nonemployment spell in t that is still not employed in year $t+s$ ($M_{t,t+s}$). The denominator is the effective labor force in the year t of the initial nonemployment spell. Thus, the third measure captures the fraction of people in year $t+s$

that had become nonemployed in t and that had an ongoing nonemployment spell for s calendar years:

$$LTNE_{t+s}^3 = \frac{M_{t,t+s}}{E_t + N_t}$$

We plot this measure for different number of years s since the baseline year t. While the first two measures are defined as proportions of the current "effective" labor force, this measure is more akin to a cohort-based measure. We also consider the standard definition of the survivor curve (i.e., $M_{t,t+s}/N_t$). However, in contrast to our measures $LTNE_t^1$ to $LTNE_{t+s}^3$, this is more likely to be affected by differential selection of workers into nonemployment over time.

How do these measures of LTNE compare to the standard measures of LTU? By construction, our measures capture duration of joblessness for a broader group of nonemployed workers; are not affected by recall errors and changes in reporting and hence are comparable over time; and can be precisely measured for even smaller subgroups. Despite these advantages, since our measures of LTNE capture nonemployment from *any* source, as with other broader measures of labor utilization one has to be careful in interpreting their evolution over time. The measure would for example capture secular trends in female labor force participation, trends in retirement from the labor force, trends in takeup of disability benefits, or trends in health. To address this problem, we analyze our measures of long-term nonemployment by gender and by age groups. In principle, the composition of nonemployed workers may vary over the business cycle too. For example, it may be that a cyclical rise in layoffs leads to an increases in the average health and earnings capacity among the nonemployed. As mentioned in Section II, the literature has not found any notable composition changes for unemployed workers over the cycle (e.g., Farber 2010; Katz et al. 2014). To shed some direct light on this question, we examined the patterns of average earnings in the baseline year prior to the spell of nonemployment, and found there to be a precisely estimated but economically small positive correlation. To partly address this problem, when calculating exit rates we have chosen as denominator a measure of the labor force

whose composition evolves only slowly over time and is unlikely to be strongly affected by the cycle.

It is important to note that our measures of LTNE also differ in more subtle ways from the measure of LTU lasting at least 12 months as measured by the CPS. $LTNE_t^1$ misses 12-24 month-long spells that do not overlap with a full calendar year, which are included in the standard measure of LTU. As further discussed below, to address this issue we will perform an approximate adjustment for the potential undercounting of spells that do not overlap with a calendar year. Another difference is that $LTNE_t^1$ captures the number of ongoing (nonemployment) spells ranging from 12 to 24 months, while LTU captures any ongoing (unemployment) spell that is longer than 12 months. To address this difference, one can just add $LTNE_t^1$

and $LTNE_t^2$ to obtain a measure incorporating spells lasting up to 36 months, which is likely to capture most (albeit not all) relevant nonemployment spells. Another aspect is that since workers appear to differentially underreport short spells of unemployment over the cycle (e.g., Levine 1993), the level and cyclicality of LTNE may differ from LTU because it counts *any* spell of nonemployment. Hence, to mimic potential omission of short work spells in reporting of LTU, we also calculated a version of our LTNE measures that allows nonemployed workers to have small amounts of positive earnings in a given calendar year.

To benchmark the SSA data we are using with official BLS statistics, we compared the annual employment-population ratios from the two sources from 1980 to 2011 in Appendix Chart A1. The SSA series is computed as the total number of individuals ages 18 to 64 with any positive W2 earnings in a calendar year, divided by the same measure of civilian population used for the BLS employment-population ratio. The BLS series is the ratio of the annual average of monthly employment numbers over civilian population derived from the CPS shown in Chart 2. We show the BLS chart for age 16 and older as in Chart 2, as well as for ages 18 to 64 corresponding to our SSA tabulations. One can see that the overall level, long-term trends, and cyclical behavior of the SSA and BLS series are quite

similar. As expected, for the same age range, the BLS series is higher since it captures self-employment and informal employment, neither of which is measured by the SSA data. We do not expect these series to be the same because of differences in their definition.[17] More-over, it is common to find discrepancies in measures of aggregate employment in different data sources (e.g., Abraham, Haltiwanger, Sandusky and Spletzer 2013).

III.ii Summary of Patterns of Long-Term Nonemployment, 1981-2011

Charts 4 to 6 and Tables 1 and 2 display the evolution of our three measures of LTNE. Chart 4B displays the same measures by gender, while Chart 7 displays them by age. Appendix Charts A2 to A4 pro-vide additional information by age and gender. Several key findings emerge from the analysis of the administrative data. These are sum-marized here, and discussed in more detail below.

1. The proportion of workers in the effective labor force that is currently nonemployed for at least one to two calendar years, our main measure of LTNE ($LTNE^1$), is clearly countercycli-cal, rising in each major recession since 1980 and declining in expansions. In addition, the LTNE appeared to exhibit a secular downward trend that was reversed in the aftermath of the 2001 and 2008 recessions.

2. In terms of LTNE, the Great Recession looks substantially less exceptional with respect to other downturns, and in particular with respect to the strong recession in the early 1980s. Although it rises sharply with the onset of the recession, the proportion of workers that are nonemployed for at least one to two calendar years ($LTNE^1$) is somewhat lower after 2008 than it was at the trough in early 1980s.

3. The incidence of very long unemployment spells, captured by the fraction of the effective labor force with at least two consecutive calendar years of nonemployment ($LTNE^2$), is also countercyclical, and although it increases somewhat more strongly in the Great Recession, it increase is not as exceptional as the LTU rate shown in Chart A3. The maximum increase in

Chart 4A
Two Measures of LTNE
Fraction of Workers Not Employed for One and Two Calendar Years
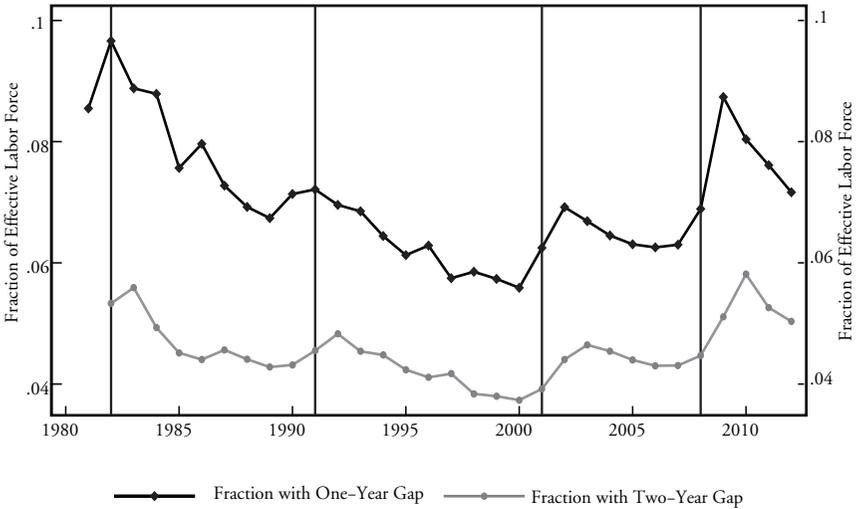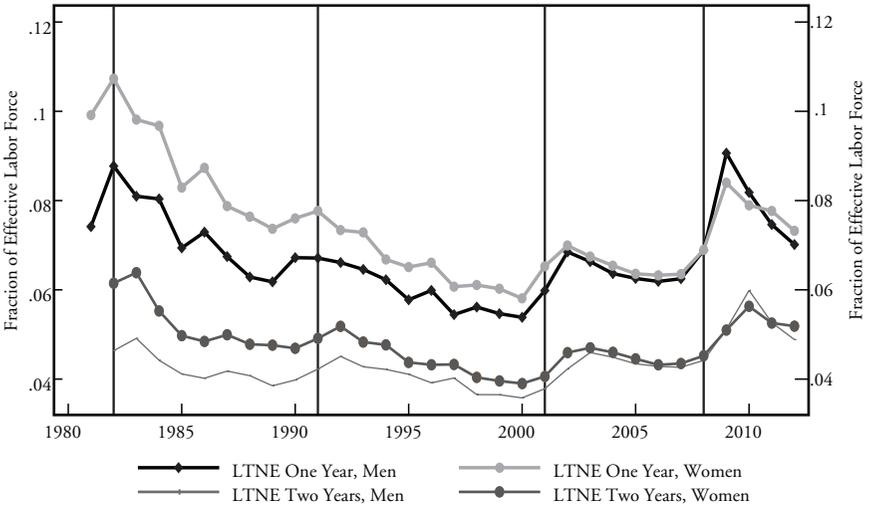**Men and Women, 1981–2011**

Fraction with One–Year Gap   Fraction with Two–Year Gap

Chart 4B
Measures of LTNE Rate by Gender
Fraction of Workers Not Employed for One and Two
Calendar Years, 1981–2011

LTNE One Year, Men   LTNE One Year, Women
LTNE Two Years, Men   LTNE Two Years, Women

Notes: Number of workers with an ongoing gap in earnings of at least one or two calendar years, respectively, relative to the sum of employed workers and those with a one or two year gap. Tabulations based on workers age 18-64 from 1 percent file of administrative data from Social Security Administration. Vertical lines drawn in recession years 1982, 1991, 2001, 2008.

$LTNE^2$ during recessions is 1-2 percentage points, suggesting that the scope for hysteresis is moderate.

4. All of these patterns hold within the group of prime-age men, and hence are unlikely to be driven by other shifts in participation such as changes in the retirement rates or takeup rates of Social Security Disability Insurance (SSDI), changes in school attainment of younger individuals, or changes in female labor force participation.

5. LTNE also exhibited some expected patterns by age and gender. As documented in Section II and elsewhere, the Great Recession appears to have had a stronger effect for men, for whom both $LTNE^1$ and $LTNE^2$ rose higher than in previous recessions. The cyclical patterns are similar for women, but these changes are combined with a secular decline in LTNE from high levels in the early 1980s to a level that is similar to men in the Great Recession.

6. Both younger men and women also seem to have had an exceptional rise in $LTNE^1$ and even longer durations ($LTNE^2$) during the Great Recession. In contrast, workers near retirement age have experienced a secular decline of $LTNE^1$ since the early 1980s, with only a small increase in the 2008 recession.

7. Finally, the entire survivor curve ($LTNE^3$) appears to exhibit a gradual upward rotation since the 1990s, but does not vary substantially with the business cycle. In particular, it has not changed substantially in the Great Recession with respect to earlier cycles. This result is consistent with similar findings for the exit rate from unemployment, which has been interpreted as evidence against there being a strong structural shift in the 2008 recession (e.g., Elsby, Hobijn and Şahin 2010, 2011).

Overall, our findings on the cyclical behavior of long-term non-employment paint a more moderate picture of the Great Recession than the often-noted incidence of long-term unemployment. This raises doubts about whether hysteresis arising from longer spells of joblessness alone was stronger in the Great Recession than in previous downturns.

Table 1
Annual Number and Rate of LTNE, 1981-2011
Averaged Over NBER-Dated Recession and Expansion Episodes

Years	Recession/ Expansion	Spells of Nonemployment Lasting at Least One Calendar Year		Spells of Nonemployment Lasting at Least Two Calendar Years	
		Fraction of Labor Force (LTNE[1])	Number of Individuals	Fraction of Labor Force (LTNE[2])	Number of Individuals
1981-1982	Recession	0.091	9,635,600	0.053	6,377,900
1983-1990	Expansion	0.077	9,587,966	0.046	5,913,574
1990-1991	Recession	0.072	8,878,100	0.044	5,993,634
1991-2000	Expansion	0.063	8,682,623	0.042	6,035,834
2001	Recession	0.062	8,201,900	0.039	6,046,000
2002-2007	Expansion	0.065	9,705,800	0.044	6,996,200
2008-2009	Recession	0.075	10,030,500	0.047	7,582,534
2009-2011	Expansion	0.08	12,378,700	0.055	8,785,400

Notes: Tabulations based on 1percent administrative data from Social Security Administration. Years belonging to both expansions and recessions are assigned to both episodes and weighted according to the proportion of months falling into the rispective episode.

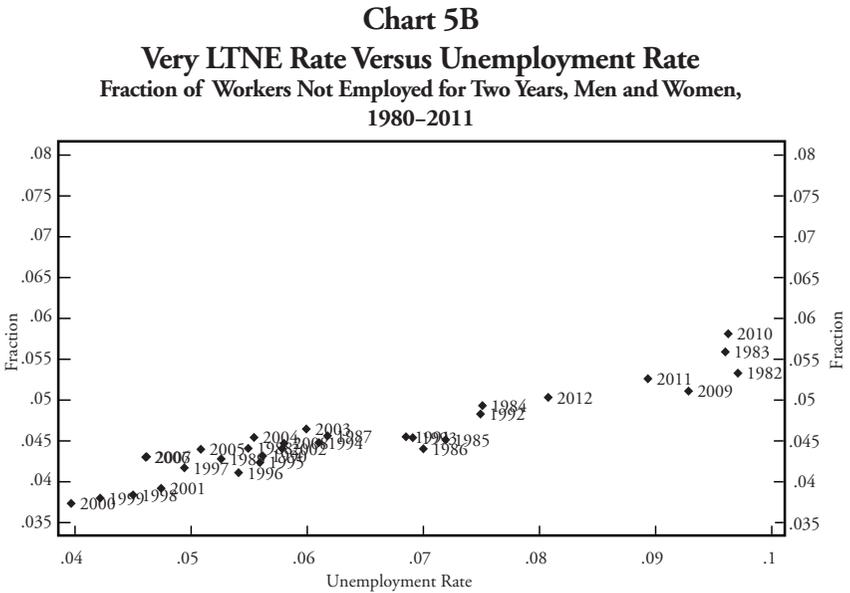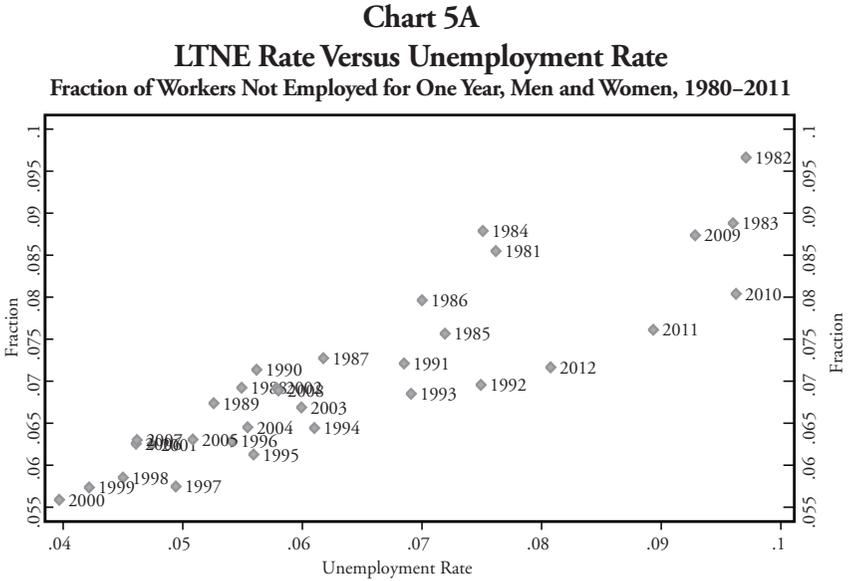## III.iii Discussion of Findings on Long-Term Nonemployment, 1981-2011

The first line in Chart 4A shows the time series of our main measure of long-term nonemployment, *LTNE*[1], the fraction of workers experiencing an ongoing nonemployment spell of one to two calendar years among the effective labor force as defined in Section III.i. The chart also displays *LTNE*[2], the corresponding measures based on nonemployment spells lasting at least two to three calendar years. Table 1 shows the average of *LTNE*[1] and *LTNE*[2] by expansions and recessions as dated by the National Bureau of Economic Research (NBER), and the corresponding averages of the underlying numbers of long-term nonemployed.

Over time, *LTNE*[1] has ranged from 6-10 percent of our measure of the labor force. This may appear large, but it is worth keeping in mind that the level of this series is more difficult to interpret because it contains nonemployment spells for all reasons, including unemployment, nonemployment for economic reasons, sickness, disability, or retirement. Since other sources of nonemployment are less likely to vary strongly with the business cycle, the time-series pattern of *LTNE*[1] may be more instructive. Two noteworthy features of

Chart 4A stand out. First, from a peak in the early 1980s recession, the series has experienced a secular decline that lasted until the mid-1990s to late-1990s. As will be further discussed below, this decline is particularly pronounced for women, whose labor force attachment was increasing during this period, but is also prevalent for men. This also happens to coincide with a decline in other indicators of labor market mobility (e.g., see our discussion of the incidence of job loss in Section V.ii and Chart 14) and measures of the variance in economic activity during what has been termed the period of the Great Moderation (e.g., (e.g., Davis, Faberman, Haltiwanger, Jarmin and Miranda 2010). There are few other trends during this period that can easily explain these patterns.[18]

Second, most important for our purposes here, the long-term nonemployment rate in Chart 4A shows a clear cyclical pattern. The peak of the series was in the large recession of the early 1980s, and while it only rose slightly in the relatively weak early 1990s recession, it increased sharply both in the 2001 and 2008 recessions. In the aftermath of each peak, the LTNE fell, though the reversal is smaller in the aftermath of the jobless recovery ensuing the strong 2001 recession, in the course of which the secular decline in the LTNE appears to have reversed. Most importantly, in contrast to the rate of long-term unemployment shown in Chart 3, the LTNE appears much closer to be proportional to actual unemployment rate, and does not peak after the Great Recession (see also Chart 5).

An advantage of our data is that we can precisely measure the incidence of very long spells of nonemployment, which should be more closely related to truly lasting employment declines. The second line in Chart 4A shows the fraction of the "effective" labor force that has an ongoing spell of nonemployment that lasted two to three calendar years ($LTNE^2$). The incidence of $LTNE^2$ has ranged from 4 percent to 6 percent, and hence is roughly half the level of $LTNE^1$. This implies that a substantial fraction of workers in $LTNE^1$ experience long but temporary spells (which is also apparent from $LTNE^3$ discussed below). The chart shows that $LTNE^2$ displays a similar secular decline and reversal as seen for $LTNE^1$, and exhibits somewhat weaker cyclical variation.

Chart 5A

LTNE Rate Versus Unemployment Rate

Fraction of Workers Not Employed for One Year, Men and Women, 1980–2011

Chart 5B

Very LTNE Rate Versus Unemployment Rate

Fraction of Workers Not Employed for Two Years, Men and Women, 1980–2011
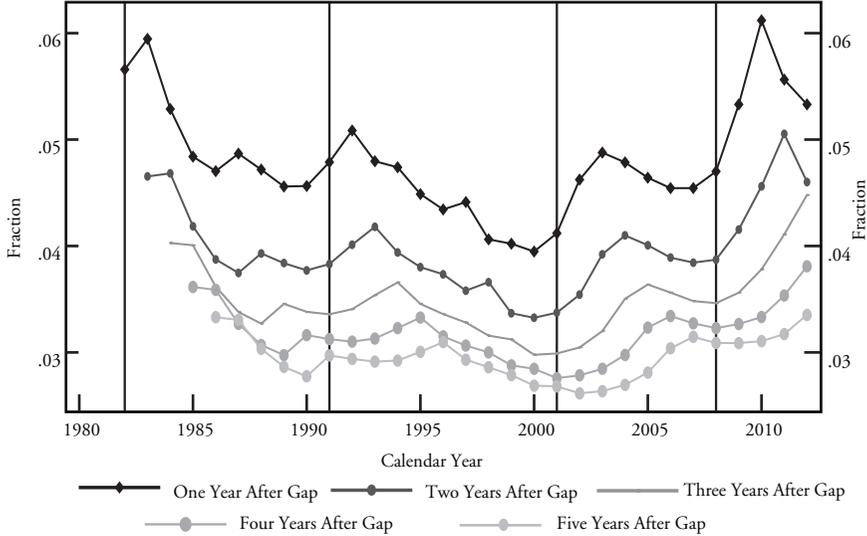

Notes: Author's calculations based on 1 percent administrative data from Social Security Administration. Number of workers with an ongoing gap in earnings of at least one or two calendar years, respectively, relative to the sum of employed workers and those with a one or two year gap. Aggregate unemployment rate from Bureau of Labor Statistics. Tabulations based on workers age 18-64 from 1 percent file of administrative data from Social Security Administration.

The rise in the incidence of very long spells in the Great Recession is pronounced, but not exceptional—from its lowest point in 2007 $LTNE^2$ rose by 1.5 percentage points to its peak in 2010, compared to a 1-percentage-point rise during the 2001 recession. This is moderate compared to the 4-percentage-point decline in the employment-population ratio during the Great Recession, especially given that part of these workers will return to employment in the following year. Not surprisingly, if one adds $LTNE^1$ and $LTNE^2$ across rows in Table 1 to obtain a more directly comparable number to LTU, which includes spells of any length above 12 months, one sees that the combined measure has similar cyclical properties as $LTNE^1$ and does not exhibit the large increase in LTU in the Great Recession.

To directly display the cyclicality of our two measures of LTNE shown in Chart 4, Chart 5 plots the data points against the annual rate of unemployment. The upper panel is based on ongoing spells lasting at least one to two years; the lower panel is based on ongoing spells lasting at least two to three years. For $LTNE^1$, there is a strong relationship with the unemployment rate that is close to linear. A simple regression has an R2 of 0.8, and a highly significant point estimate of 0.55 (standard error of 0.06). The relationship is somewhat weaker for $LTNE^2$, with an R^2 of 0.65 and a point estimate 0.25 (standard error of 0.03). A linear prediction based on patterns up until 2006 would have captured the cyclical relationship for the Great Recession quite well, confirming that the Great Recession was not an outlier in terms of incidence of LTNE.

Survivor Curves. Turning to the analysis of the duration of LTNE, Chart 6A shows our measure of the survivor curve for the first five years since the initial unemployment spell (hence, for say, year two this is based on individuals nonemployed for three calendar years). Chart 6A shows the time series pattern of the re-employment rate by year since the initial year of nonemployment. As expected, the lines shift downward, since as more time passes an increasing fraction of nonemployed workers becomes re-employed. The vertical distances decline gradually as one moves from year one to year five, indicating that the fraction of workers becoming re-employed declines with years since the initial spell. The time series patterns reflect the similar

Chart 6A

Survivor Curve After One–Year Nonemployment Spell

Fraction of Workers not Employed by Year Since One-Year Gap, Men and Women, 1981–2012

Notes: Fraction of workers with a gap in earnings of at least one year that still has zero earnings in the first five years following the initial gap, relative to sum of employed workers and those with a one year gap in the base year. Tabulations based on workers age 18-64 from 1 percent file of administrative data from Social Security Administration. Vertical lines drawn in recession years 1982, 1991, 2001, 2008.

Chart 6B

Normalized Survivor Curve After One-Year Nonemployment Spell

Fraction of Workers not Employed by Year Since One-Year Gap, Men and Women, by NBER Expansions (E) and Recessions (R)
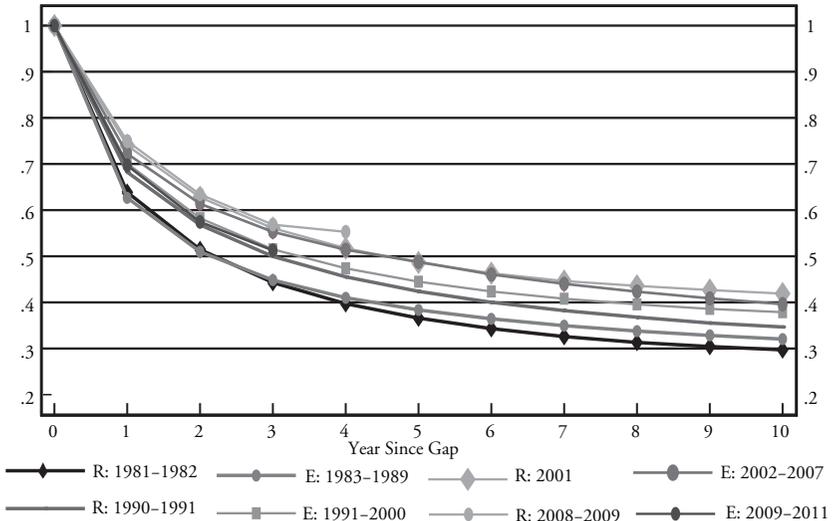
Notes: Fraction of workers with a gap in earnings of at one calendar year that still has zero earnings in the years following the initial gap, relative to sum of employed workers and those with a one-year gap in the base year. Averaged over NBER-dated recession and expansion episodes as described in text. Tabulations based on workers age 18-64 from 1percent file of administrative data from Social Security Administration.

secular trends and counter cyclicality shown in Chart 4A. It is note-worthy that the lines appear to move almost in parallel, though a secular upward shift is apparent. The comovement implies that most of the change is driven by a rise in the incidence of spells, rather than differences in exit patterns over the business cycle. This is shown directly in Chart 6B, which graphs the same information connecting the survivor curves directly averaging over expansions and recessions according to NBER business cycle dates.[19] To abstract from business cycle fluctuations in incidence of new LTNE spells, we normalized the curves to be equal to one in the year of the initial nonemploy-ment spell by dividing by the initial value of $LTNE^3$. The resulting curves show the fraction of a cohort of long-term nonemployed still not working after s periods, and hence correspond to the standard definition of the survivor curve (see Section III.i).

The survivor curves shown in Chart 6B are convex, reflecting de-clining exit rates with nonemployment durations. The slope is rela-tively flat, indicating a high degree of persistence. One year after the initial spell between 60 percent and 70 percent of workers are still nonemployed, and even five years later between 40 percent and 50 percent is nonemployed. The shape of these survivor curves appears to be quite similar over the entire time period. Consistent with evi-dence in Chart 6A, an upward parallel shift from the 1980s to the 1990s is apparent. It is noteworthy that this shift mostly takes place in the probability of exiting in the year after the first one-year spell. Afterward, the curves evolve more similarly. There is no strong evi-dence of cyclicality, in contrast with the exit patterns from long-term unemployment shown in Elsby, Hobijn and Şahin (2010, 2011).[20] There is also no evidence that the rate of exit from long-term non employment has slowed during the Great Recession compared to the patterns in all episodes since the 1990s.

Overall, thus, the *incidence* of LTNE since the early 1980s followed a reasonably predictable pattern. It moved secularly during the period of rising female labor force participation and declining volatility in the labor market, and then rose again during the period of prolonged jobless recoveries. It exhibited countercy-clical movements closely related to the variation in unemployment

rates. In contrast, the *duration* of long-term nonemployment has been stable over the business cycle. Overall, in light of the LTNE, nonemployment duration in the Great Recession does not appear to be exceptional, but in line with previous cyclical behavior.

When discussing the implications of our findings in Section V, we use past survivor curves to approximate future developments in the aftermath of the Great Recession, which appears reasonable given our findings in Chart 6. However, we cannot be sure that the implied degree of persistence is really due to a negative effect of nonemployment duration or due to selection. To obtain an estimate of the actual "true" degree of persistence induced by labor market shocks, we move to an analysis of displaced workers in Section IV.

III.iv Sensitivity Analysis

Patterns by Gender. For men, the Great Recession led to a somewhat stronger rise in long-term nonemployment compared to previous recessions. Chart 4B shows that for men our main measure *LTNE* [1] is about half of a percentage point higher in 2008 as in the early 1980s (less than a 10 percent rise), while our measure *LTNE* [2] is about 1 point higher (a 25 percent rise). (The same pattern holds for prime-age men, see Appendix Chart A3a). While this is suggestive that the Great Recession might have led to a rise in the persistence of employment for men, it may also reflect a stronger impact of cyclical factors, partly driven by the large decline in the construction sector. Chart 4B also shows the patterns for women. (Table 2 shows the average of *LTNE* [1] and *LTNE* [2] and number of long-term nonemployed by NBER-dated expansions and recessions for men and women, respectively.) It is clear that women experienced a higher rate of LTNE in the early 1980s, and that they experienced a more rapid decline in LTNE afterward. By the 2001 recession, the level of LTNE (both one-year and two-year gaps) of men and women is the same, and they experience a similar increase in the Great Recession. This is consistent with an increasing labor force attachment of more recent cohorts of women, and a higher rate of longer-term exit from the labor force in earlier cohorts of women. The survivor curves (shown in Appendix Chart A2) have moved approximately in

Table 2
Annual Number and Rate of LTNE, 1981-2011
By Gender, Averaged Over NBER Dated Recession and Expansion Episodes

Years	Recession/ Expansion	Spells of Nonemployment Lasting at Least One Calendar Year		Spells of Nonemployment Lasting at Least Two Calendar Years	
		Fraction of Labor Force ($LTNE^1$)	Number of Individuals	Fraction of Labor Force ($LTNE^2$)	Number of Individuals
			Men		
1981-1982	Recession	0.081	4,574,700	0.046	3,005,200
1983-1990	Expansion	0.071	4,715,540	0.042	2,854,793
1990-1991	Recession	0.067	4,348,200	0.041	2,913,100
1991-2000	Expansion	0.059	4,301,487	0.04	2,982,146
2001	Recession	0.06	4,077,600	0.038	3,006,000
2002-2007	Expansion	0.064	4,910,133	0.044	3,533,350
2008-2009	Recession	0.076	5,093,533	0.047	3,838,833
2009-2011	Expansion	0.081	6,442,400	0.055	4,529,100
			Women		
1981-1982	Recession	0.103	5,060,900	0.061	3,372,700
1983-1990	Expansion	0.084	4,872,426	0.051	3,058,780
1990-1991	Recession	0.077	4,529,900	0.048	3,080,533
1991-2000	Expansion	0.066	4,381,136	0.044	3,053,687
2001	Recession	0.065	4,124,300	0.041	3,040,000
2002-2007	Expansion	0.066	4,795,667	0.045	3,462,850
2008-2009	Recession	0.074	4,936,967	0.047	3,743,700
2009-2011	Expansion	0.079	5,936,300	0.054	4,256,300

Notes: Tabulations based on 1 percent administrative data from Social Security Administration. Years belonging to both expansions and recessions are assigned to both episodes and weighted according to the proportion of months falling into the rispective episode.

a parallel fashion over the cycle for both genders, reflecting a shift in the incidence of LTNE at a comparable exit hazard.

Patterns by Age. The main secular and cyclical pattern shown in Chart 4 for all ages are clearly displayed for prime-age workers in Chart 7A ($LTNE^1$). The same holds for our second measure of LTNE based on longer gaps, though again the level is lower and the cyclicality is weaker ($LTNE^2$ in Chart 7B).[21] The behavior of younger and older individuals differs from that of prime-age individuals. The LTNE has been larger for 55-59 year olds, reflecting both higher retirement rates and lower outflow rates from unemployment. Among older workers, LTNE has experienced a

secular decline lasting into the 2000s, such that by the Great Recession the LTNE for those close to retirement age is similar to that of prime-age workers. Cyclical patterns are visible, though somewhat muted with respect to their prime-age counterparts.

In contrast, younger individuals experienced a secular rise in LTNE starting in the early 1990s, perhaps due to rising educational attainment. As has been well documented, Chart 7 shows that LTNE for younger workers is more cyclical, culminating with a strong increase in LTNE in the Great Recession. The higher degree of cyclicality may reflect a lower attachment to the labor force, the fact that younger workers are more likely lose their job, and an increased return to school in response to unemployment. The pattern for young men and women are similar, with the exception that the rate of LTNE remains higher for women ages 25-34, presumably reflecting periods of motherhood (Appendix Chart A3).

These patterns suggest that the changes in the age structure of the labor force that occurred over the past 30 years will play only a small role in explaining the overall time series pattern of the LTNE. As for the time series in Section II, to directly control for changes in the age distribution, we have reweighted the aggregate patterns in Chart 4 to hold changes in the age and gender distribution constant. The reweighted charts are very similar to the patterns shown in Chart 4A (not shown).

Measurement Issues. Our main findings regarding the cyclicality of LTNE are unchanged if we count workers with low amounts of annual earnings as nonemployed. We replicated our main measures of LTNE introducing two alternative thresholds for a small earnings amount to be disregarded when classifying a worker as nonemployed: two and 13 weeks worked full time at the prevailing federal minimum wage, respectively. The former captures very short stints of employment of a duration that might go unreported in retrospective survey data. The latter excludes spells that are economically more meaningful but that are unlikely to constitute a return to stable employment.[22] As expected, the level of our two main measures of the incidence of LTNE rises. However, the cyclical movements are essentially unchanged.

Chart 7A
LTNE Rate by Age Group
Fraction of Workers not Employed for One Calendar Year,
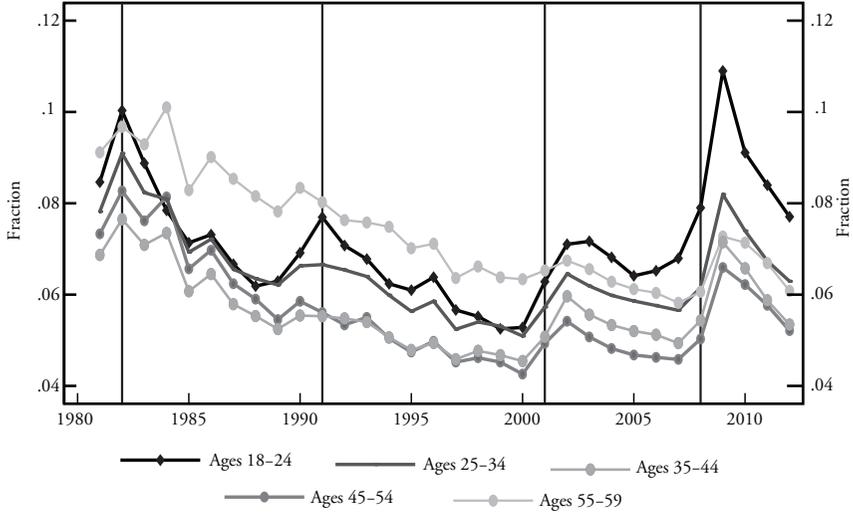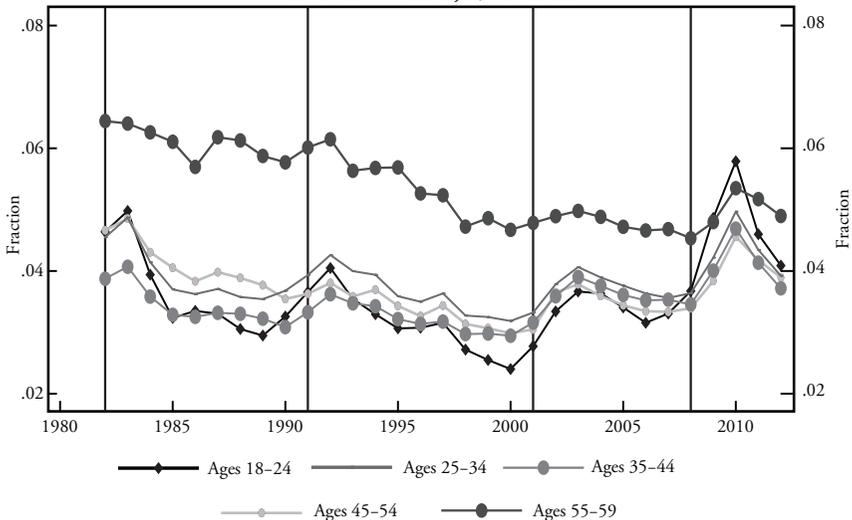**Men and Women, 1981–2011**

Chart 7B
Very LTNE Rate by Age Group
Fraction of Workers not Employed for Two Calendar Years,
Men and Women, 1981–2011

Notes: Number of workers with an ongoing gap in earnings of at least one and two calendar years, respectively, relative to the sum of employed workers and those with a one or two year gap. Tabulations based on workers age 18-64 from 1 percent file of administrative data from Social Security Administration. Vertical lines drawn in recession years 1982, 1991, 2001, 2008.

Adjusting for the potential undercounting of long nonemployment spells that straddle calendar years also affects the level of our measures of LTNE, but again has no bearing on the degree of cyclicality. To gauge the extent of possible undercounting of spells of 12-24 months that straddle two calendar years when measuring $LTNE^1$, we generate approximate measures of LTNE based on the assumption that the incidence of nonemployment spells lasting between 12-24 months is equally distributed between calendar months; we also assume that in any given month, a new spell has equal chance of lasting between 12 and 24 months (note that when measuring $LTNE_t^1$, we do not undercount any spell lasting longer than 24 months). In that case, in each calendar month of the base year in which the worker is last employed (*t-1*) there are 12 new "cohorts" of nonemployed with actual nonemployment duration between 12-24 months. We can then simply count what fraction of these cohorts does not overlap with a calendar year and hence not counted by our measure. Since we observe the number of people exiting nonemployment each year in our data, we can then use the fraction of spells that we miss given our assumptions to adjust the numerator and denominator of our original measure $LTNE_t^1$, and similarly with $LTNE_t^2$ and the survivor curves($LTNE_t^3$).[23]

The resulting adjusted charts are parallel to the original charts. The incidence of $LTNE_t^1$ rises about 1.5 percentage points, whereas $LTNE_t^2$ is about half a point higher. However, the cyclicality of both measures is not affected by our measurement error correction. This reflects the fact that the survivor curves, which effectively determine the size of our correction, do not have a strong cyclical component. When we adjust the survivor curves as well ($LTNE_t^3$), the adjusted curves shift upwards by about 1 percentage point, signifying a decline probability of exit at all durations. The shift is slightly higher for lower durations, and then close to parallel, consistent with larger initial declines in exit probabilities that drop off quickly.

Overall, both the incorporation of short employment spells and the adjustment for undercounting of long nonemployment spells suggests that our current measures likely understate the incidence and the duration of long-term nonemployment spells. Since we place

more weight on the cyclical dynamics than on interpreting the level of the incidence and duration already for other reasons, these results do not affect our main findings regarding the cyclical patterns of the incidence and duration of LTNE.

IV.   The Short- and Long-Term Effects of Job Displacement on Employment

In this section, we present new estimates of the causal effect of a specific event, a job displacement, on short- and long-term employment based on the same administrative data used in Section III. As discussed in Section II, these estimates allow us to directly infer about the potential of persistence in nonemployment during recessions, and hence side-step some of the difficulties associated with inferring true duration dependence from observed exits from nonemployment discussed in the previous section. A persistent negative effect of job displacement on employment would raise the possibility of true hysteresis, at least in recessions with a high amount of job destruction.

Recessions have been typically periods of rising job destruction and job loss. Clearly, in the aggregate job destruction and job loss are closely related to short-run reductions in employment.[24] But if job losses also trigger persistent declines in employment, a rise in the incidence of job loss could lead to a rise in long-term nonemployment and a decline in the employment-population ratio. While the literature so far has mostly concentrated on the large and persistent reductions in earnings that can follow job loss (e.g., Jacobson, Lalonde and Sullivan 1993; Couch and Placzek 2010; Davis and von Wachter 2011), long-term employment losses are plausible as well. Facing permanently lower wages, some workers may choose to exit the labor force. Moreover, if there is a fixed cost of working, or a fixed cost of participating in the labor force, upon job loss some individuals may permanently stop working. Finally, especially if losing stable jobs, displaced workers may have lost touch with the active labor force, become discouraged, or face high mobility costs.

IV.i   Estimation Approach

To estimate the effects of job displacement on employment and their sensitivity to economic conditions at the time of displacement

we follow the approach in von Wachter, Song and Manchester (2011) and Davis and von Wachter (2011). We define job displacement as the separation during mass-layoff events of high-tenure men, 50 years or younger, from firms with at least 50 employees at baseline.[25] Specifically, we regard a worker as displaced in year *y* if he separates from his employer in *y and* the employer experiences a mass-layoff event in *y*. We say a worker "separates" from an employer in year *y* when he has earnings from the employer in *y - 1* but not in *y*. To meet the prior job tenure requirement, the worker must have positive earnings from the employer in question in *y - 3, y - 2,* and *y - 1*. To qualify as a mass-layoff event in year *y*, the employer must meet the following criteria: 50 or more employees in *y-2*; employment contracts by 30 to 99 percent from *y -2* to y; employment in y-2 is no more than 130 percent of employment in *y-3*; and employment in *y+1* is less than 90 percent of employment in *y-2*. Although these criteria miss some displacements of long-tenure workers at larger employers, they help ensure that the separations we identify as job displacement events are indeed the result of permanent layoffs.[26] To qualify as a job displacement event in *y*, we also require that the separation be from the worker's main job, defined as the one that accounts for the largest share of his earnings in *y-2*.

To estimate the effects of job displacement, we compare the employment path of workers who experience job displacement to the path of similar workers who did not separate during the same time period, while controlling for individual fixed effects and differential earnings trends. We implement this comparison by estimating the following distributed-lag regression model separately for each displacement year y from 1980 onward:

$$e_{it}^{y} = a_i^{y} + y_t^{y} + \bar{E}_i^{y}\lambda_t^{y} + \beta^{y}X_{it} + \sum_{K=-6}^{20}\delta_k^{y}D_{it}^{k} + u_{it}^{y} \qquad (1)$$

where the outcome variable e_{it} is annual employment of individual *i* in year *t*, α_i^{y} are coefficients on worker fixed effects, γ_t^{y} are coefficients on calendar year fixed effects, X_{it} is a quartic polynomial in the age of worker *i* at *t*, and the error u_{it} represents random factors.

To allow for differences in the evolution of annual employment over time for different classes of workers, the specification includes differential year effects that vary proportionally to the worker's average earnings, $\bar{E}_i^y$, in the five years prior to the displacement year. The D_{it}^k are dummy variables equal to one in the worker's k-th year before or after his displacement, and zero otherwise.

We estimate (1) by displacement year using annual individual-level observations in the SSA data from 1974 to 2012. The sample for displacement year y contains data on workers displaced in *y*, *y+1* and *y+2* plus data on workers in a control group described below.[27] The evolution of employment of the control group over time helps identify the year effects γ_t^y and λ_t^y. Given the presence of the year effects and worker fixed effects in (1), the coefficients δ_k^y on the dummies D_{it}^k measure the time path of employment changes for job separators from six years before and up to 20 years after a displacement—relative to the baseline and relative to the change in employment of the control group.[28] The baseline consists of years seven and eight before displacement.[29] To interpret the estimated effects δ_k^y as the causal effect of job displacement on employment requires that, conditional on worker fixed effects and the other control variables, the counterfactual employment of displaced workers in the absence of job displacement is captured by workers in the control group.

For workers displaced in year *y*, the control group consists of workers not separating from in *y*, *y+1*, and *y+2* ("nonseparators"). Hence, as typical in the literature on job displacement based on administrative data, we exclude so-called "non-mass layoff separators" from y to *y+2* from the control group. Non-mass layoff separators comprise workers who quit their jobs and workers laid off by firms with an employment drop of less than 30 percent. On the control group of "nonseparators" we impose the same restrictions with respect to firm size, worker age and job tenure, gender, and industry as for displaced workers. We discuss the impact of alternative control groups and concerns related to potential selection bias in the earnings loss estimates in Section IV.v below.

As discussed in Section III, our measure of employment is based on the incidence of positive annual W2-level earnings. Hence, we

do not capture the total underlying loss in employment. On one hand, we may overstate employment losses because we do not have information on self-employment or informal employment in the data. Yet, estimates in Farber (1999) suggest that any increase in self-employment and nonstandard employment arrangements after job losses is short-lived. Hence, our findings may overstate employment losses somewhat in the short run. On the other hand, it is important to keep in mind that since we use information on employment per calendar year, we do neither measure nonemployment spells shorter than a year nor capture nonemployment spells lasting up two years that straddle two calendar years. Hence, we are likely to understate the effect of job displacement on employment. We discuss how one can explicitly correct for the latter undercounting in our sensitivity analysis in Section IV.v.

IV.ii Summary of Employment Effects of Job Displacement, 1980 to 2012

Charts 8 to 13 and Table 3 contain the main results of our analysis of the effect of job displacement (JD) on employment. The main findings can be summarized as follows.

1. On average, JDs occurring between 1980 and 2005 have led to significant declines in the probability of employment with respect to a control group of nondisplaced workers of 5-10 percent lasting over 20 years after job loss. Cumulated over 20 years, these results imply a loss in employment of one to two years, or about a 10 percent loss with respect to counterfactual remaining lifetime employment based on behavior of the control group.

2. The losses in the first two years after job displacement are substantially larger in recessions. The longer-term losses in employment are larger in recessions for high-tenured workers (at least six years of job tenure), but not for shorter-tenured workers (at least three years of job tenure).

3. Our analysis of job displacements occurring from 2007 to 2010 suggests that while the effect of job loss on employment in the Great Recession was larger initially, the medium-term effect is similar as in other downturns. Hence, while cyclical factors led to larger employment declines initially, there is no indication of stronger persistent effects in the Great Recession, consistent with our analysis of long-term nonemployment spells in Section III.

4. The size of the short-term and long-term employment losses rise substantially with age. Moreover, while cyclicality is weak among longer-term losses for younger workers, cyclicality of long-term losses is present for displaced workers ages 41-50, and substantial for displaced workers ages 51-60.

5. The sources of these losses differ by time since job displacement. In the short run, most of the decline in annual employment arises from repeated nonemployment spells and increases in the duration of ongoing spells. After a few years, most of the reduction is due to a rise in permanent exit from employment. Furthermore, while younger nonemployed displaced workers seem to retain substantial attachment to the labor force, older nonemployed displaced workers have mainly exited employment permanently.

Overall, our findings imply that job displacement can lead to substantial and long-lasting declines in annual employment, that this effect tends to be somewhat stronger in recessions, and that the effect appears to have been only initially larger during the Great Recession. As we further discuss in Section V, these results imply that a substantial rise in the incidence of job displacement in recessions can have a lasting negative impact on aggregate employment rates.

IV.iii Discussion of Employment Effects of Job Displacement, 1980 to 2010

Chart 8A shows the average annual employment rates for displaced workers before and after a job loss based on job displacements occurring from 1980 to 2005. Since workers are required to have at least

three years of job tenure, their employment rate is equal to one in the three years prior to job loss. After job loss, there is an immediate, steep decline in employment, followed by a small recovery, and then a downward trend lasting the following 20 years. Since part of the immediate drop and ensuing decline in employment may reflect regular employment transitions, Chart 8B shows our main estimates in which we control for these regular patterns by introducing a control group of nondisplaced workers as explained in Section IV.i. The chart shows the average effects of job displacement in recessions and expansions as defined by the NBER, respectively. Overall, in both recessions and expansions the estimates imply a sharp drop in employment in the year after displacement, a slight recovery afterward, and then a decline in employment of somewhat less than 10 percent lasting up to 20 years after displacement, which is the end of our observation window.

Cumulated over 20 years, these results imply a loss of about two years of employment relative to the benchmark of full employment. Since the control group also experiences gradual declines in employment as workers age, Table 2 shows the cumulated loss using control-group employment as benchmark. The table also displays the percentage effect relative to the total number of years the control group is expected to work. Relative to the control group, the cumulated loss in years worked over 20 years is 1.35, an 8 percent loss relative to the total average number of years left to work until age 55, which in our sample is 17.

In related work (von Wachter, Song and Manchester 2013) we provided an in-depth analysis of estimates of the effect of job displacement occurring in the 1980s recession on cumulated employment losses. Among others, the analysis controlled for a range of predetermined worker and firm characteristics to control for potential differences in the propensity to work for displaced and nondisplaced workers. This matters, since by construction pre-displacement employment levels are similar between the treatment and control group due to the restriction on job tenure, and hence worker effects are not suited to fully eliminate remaining potential differences in employment propensities.[30] The resulting estimates in von Wachter,

Table 3
Magnitude and Cyclicality of Cumulated Employment Losses Associated with Displacement in Mass-Layoff Events, 1980 to 2005
Men 50 or Younger with at Least Three or Six Years of Job Tenure Before Displacement

	Fraction of Years Covered by Row Category	At Least Three Years of Job Tenure		At Least Six Years of Job Tenure	
		(1)	(2)	(1)	(2)
		Cumulated Years of Employment Lost Compared to Control Group	Ratio of Years Lost and Counterfactual Employment in Absence of Displacement	Cumulated Years of Employment Lost Compared to Control Group	Ratio of Years Lost and Counterfactual Employment in Absence of Displacement
Average All Years	--	-1.35	-0.078	-1.43	-0.081
Average in NBER Expansion Years	0.88	-1.33	-0.077	-1.38	-0.078
Average in NBER Recession Years	0.12	-1.48	-0.085	-1.72	-0.097
Average in Years with:					
UR< 5%	0.23	-0.70	-0.064	-0.75	-0.067
5%<=UR<6%	0.35	-1.31	-0.076	-1.29	-0.073
6%<=UR<7%	0.13	-1.28	-0.074	-1.44	-0.081
7%<=UR<8%	0.21	-1.46	-0.084	-1.59	-0.090
UR>=8%	0.08	-1.56	-0.089	-1.68	-0.094

Notes: Calculations based on 1 percent sample from administrative data from Social Security Administration.

Chart 8A

Fraction Positive Annual Earnings Before/After Job Displacement Averages for Displacements in NBER Recessions and Expansions

Men with at Least Three Years of Job Tenure Displaced at Firms Size 50+ Displaced as Firm has Lasting 30 Percent Employment Drop Over Two Years
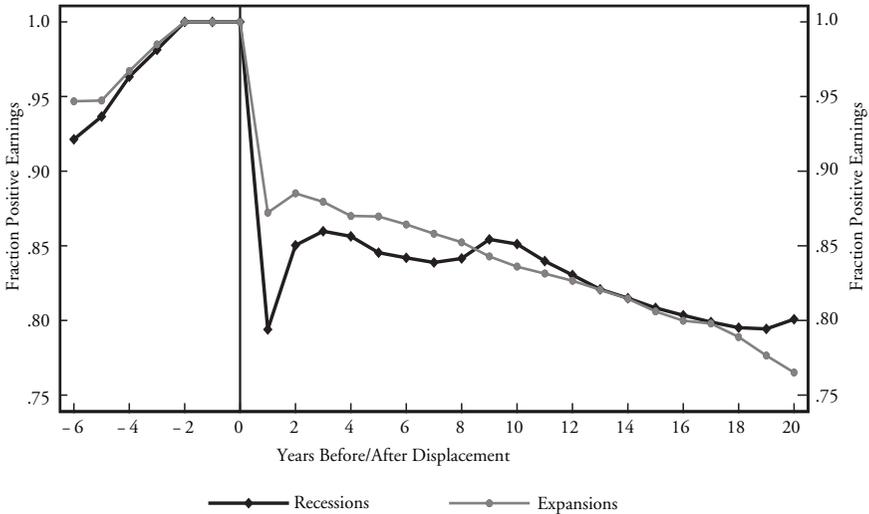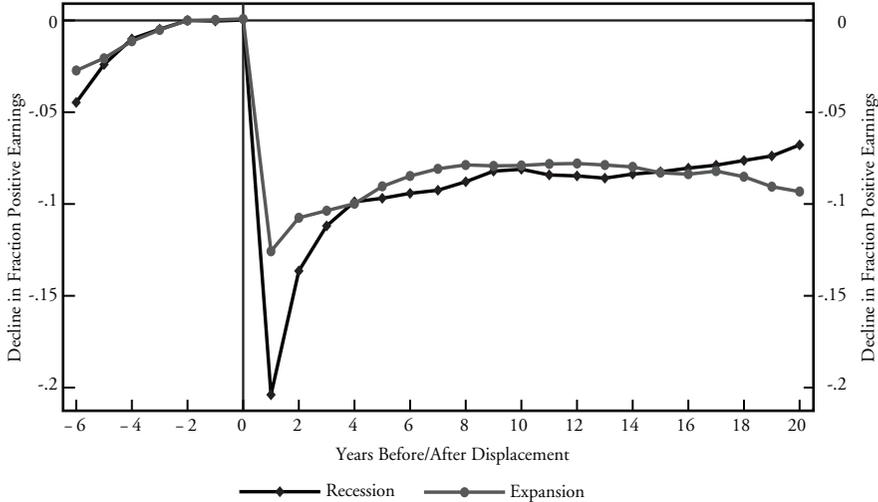

Notes: Includes recessions and expansions from 1980 to 2005. Chart based on 1 percent sample of administrative data from Social Security Administration.

Song and Manchester (2013) suggest that conditional on observable characteristics, job displacements in the 1980s recession lowered cumulated employment by 1.5 years for the average displaced worker compared to a worker not experiencing a job loss.

Few other studies have studied employment after job displacement in depth. The reason is partly that it is generally difficult to measure employment responses to job loss. This is because most survey data sets only have information on employment at the time of the survey. If retrospective information on cumulated employment in a calendar year is available, it is likely to be affected by recall error. The advantage of administrative data is that it reliably allows measuring employment for a long time period. Nevertheless, magnitudes from survey data appear similar to what is found here. For example, using the Displaced Worker Survey, Farber (2011) documents that the mean employment rate (at the survey date) in the years immediately following a job displacement ranges from 60 percent to 80 percent

Chart 8B
Change in Fraction with Positive Annual Earnings
Averages for Displacements in NBER Recessions and Expansions
Men with at Least Three Years of Job Tenure Displaced at Firms Size 50+ Displaced
as Firm has Lasting 30 Percent Employment Drop Over Two Years

Notes: Includes recessions and expansions from 1980 to 2005. Chart based on 1 percent sample of administrative data from Social Security Administration.

for prime-age workers, and can be as low as 50 percent in the Great Recession. These estimates do not include a control group, but are larger than the short-term effect shown in Chart 8A.

Turning to difference in the displacement effect over the cycle, Chart 8B shows that the immediate effect of job displacement on employment is substantially larger in recessions. However, the difference fades quickly, and for our main sample of all displaced workers with three years or more job tenure, the effect is the same in recessions and expansions about three to four years after job displacement. This finding is consistent with our analysis in Section III of survivor curves after a spell of long-term nonemployment that showed no cyclical differences in the degree of persistence of nonemployment. This suggests that the effect of labor market shocks on employment may not have a strong cyclical component, in stark contrast to the strong cyclicality of earnings losses at job loss documented in Davis and von Wachter (2011).

The cyclicality of the effect of job displacement on employment is shown directly in Chart 9. The scatter plot of employment losses one year after job displacement by year of displacement against the annual rate of unemployment is shown in Chart 9A. The chart shows a clear negative relationship of initial employment losses with the rate of unemployment prevailing in the year of job loss that is close to linear. A simple corresponding regression has a precisely estimated slope coefficient of -2.4, implying that a rise in unemployment of 4 points would raise the initial employment effect by about 10 percentage points. Chart 9B shows that there is no similar systematic relationship between employment effects four years after job displacement and aggregate unemployment rates. This is confirmed by a regression analysis, based on which one can exclude correlations more negative than -0.4 at a 5 percent confidence level. Estimates of the long-term effect for workers with six years or more of tenure (not shown) show greater cyclicality in recessions, but the correlation with unemployment rates is again not statistically significantly different from zero.

Table 1 also shows the difference in cumulated employment losses by job displacements occurring in expansions and recessions, as well as by five levels of the unemployment rate. The total loss is somewhat larger in recessions, and increases roughly monotonously with the unemployment rate. However, as shown in Charts 8 and 10, these differences mainly arise from the cyclicality of the immediate period after job displacement. Columns 3 and 4 of the table also confirm that the degree of cyclicality is larger for higher for workers with six or more years of job tenure.

Note that in contrast to Chart 8, Chart 9 also includes the effect of job displacement on employment for displacements occurring in years 2006 to 2010. It is striking how both the short-term and the long-term estimates in Charts 9A and 9B for these years appear to lie close to the approximately linear relationship with annual unemployment rates implied by the charts. Chart 10 directly compares our estimates of the short-term and long-term effects of job displacement on employment in different time periods. Chart 10A is based on the same estimates underlying Chart 9 and shows that while the effect of job displacement is particularly large initially during the Great

Chart 9A
Employment Loss One Year After Job Displacement
Plotted Against Annual Unemployment Rate in Year of Job Loss
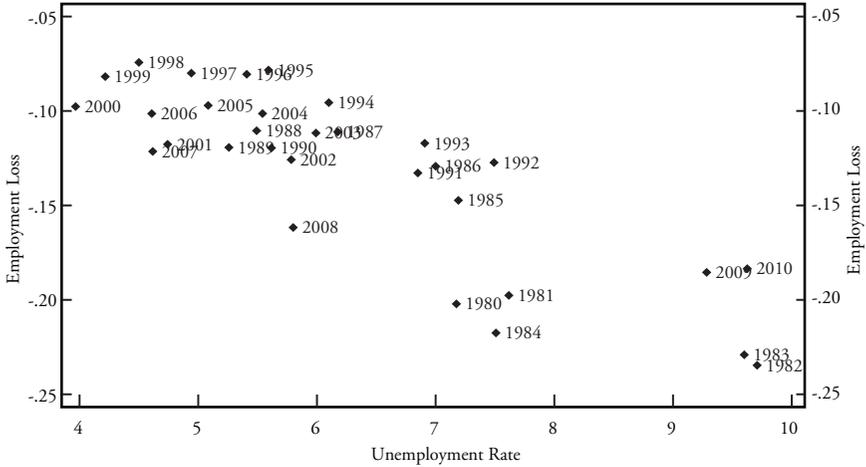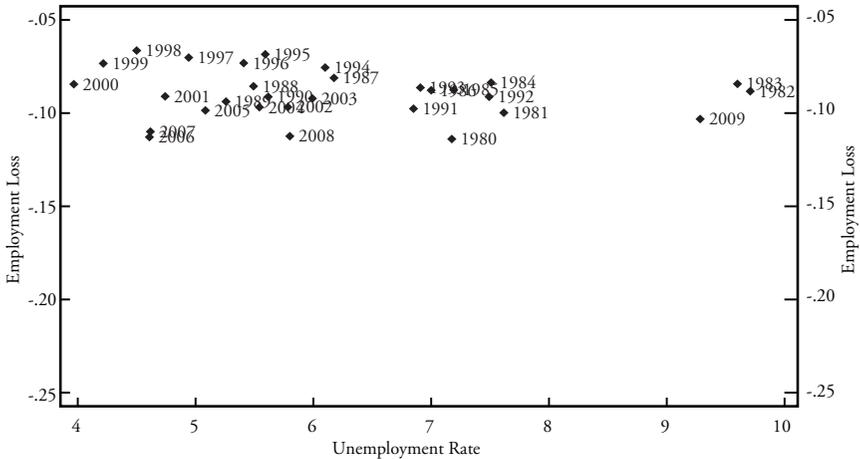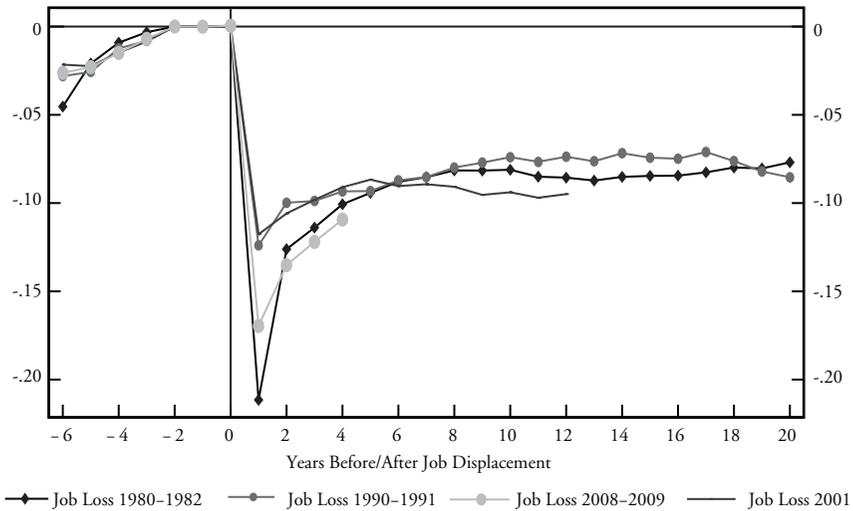### Workers with Three or More Years of Job Tenure, Men Only

Chart 9B
Employment Loss Four Years After Job Displacement
Plotted Against Annual Unemployment Rate in Year of Job Loss
Workers with Three or More Years of Job Tenure, Men Only

Notes: Job displacement defined as separation from main employer of at least size 50 while employer has a lasting decline in employment of at least 30 percent over two years (see text). Authors' calculations based on 1 percent sample from administrative data of Social Security Administration.

Chart 10

Change in Fraction with Positive Annual Earnings
Averages for Displacements in NBER Recessions Since 1980

Men with at Least Three Years of Job Tenure Displaced at Firms Size 50+ Displaced
as Firm has Lasting 30 percent Employment
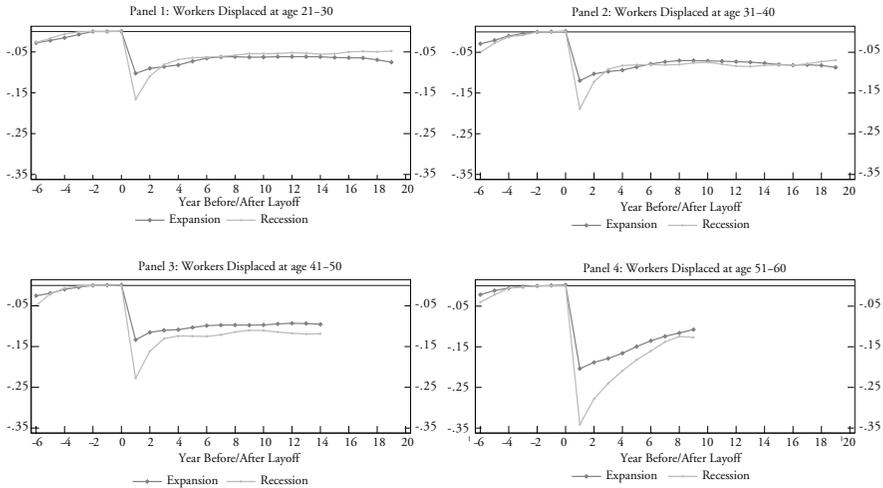**Drop Over Two Years**

Years Before/After Job Displacement

Job Loss 1980–1982   Job Loss 1990–1991   Job Loss 2008–2009   Job Loss 2001

Notes: Comparable estimates of the effects of job displacement in the Great Recession and previous time periods based on 1 percent sample of administrative data from Social Security Administration.

Recession, the medium-term effect is comparable to that in previous downturns. Since there are only a limited number of years after the Great Recession, it is useful that Vilhuber and von Wachter (2014) find similar results using comparable definitions of job displacement and a comparable regression approach based on quarterly earnings data from the Longitudinal Employer Household Dynamics (LEHD) data.

Finally, Chart 11 shows the effect of job displacement on short-term and long-term employment with respect to a control group of nondisplaced workers by four groups of age at displacement. Again, we display average effects over NBER-dated expansions and recessions. The chart makes two main points. First, the persistent effect of job displacement on employment we find is present for all age groups. However, it is particularly large for older displaced workers. This is consistent with existing estimates in the literature suggesting older workers are more likely to permanently leave the labor force in

Chart 11
Fraction Positive Annual Earnings
Before/After Job Displacement
**Averages for Displacements in NBER Recessions and Expansions Men with at Least
Three Years of Job Tenure Displaced at Firms Size 50+
Displaced as Firm has Lasting 30 percent Employment Drop Over Two Years**

Panel 1: Workers Displaced at age 21–30

Panel 2: Workers Displaced at age 31–40

Panel 3: Workers Displaced at age 41–50

Panel 4: Workers Displaced at age 51–60

Source: One percent files of Social Security administrative data (see text).

the aftermath of job loss (e.g., Chan and Stevens 2001). Second, the cyclicality of the effect of job displacement on employment increases with age of displacement. Older displaced workers suffer larger employment losses in recessions relative to expansions, while younger displaced workers do not. This is consistent with evidence that especially lower educated older workers suffer substantial declines in labor force attachment in recessions (von Wachter 2007).

IV.iv Sources of Employment Losses After Job Displacement

An important question for labor market policy is whether the persistent decline in employment after a job displacement occurs while nonemployed workers continue to have labor force attachment or not. To learn more about the sources of the nonemployment effects we find, we decomposed our employment effects into effects arising from recurring spells of nonemployment, a rise in the duration of nonemployment spells, or from lasting exit from the labor force.[31] Since we can only observe workers until the end of our sample window in 2012, a "lasting" exit here means that we do not observe the

worker with positive earnings in our data until 2012. For any worker that turns 55 in our sample window (61 for workers displaced from ages 51 to 60), this literally means no employment during prime working age. For younger workers or workers displaced towards the end of our sample period, it is possible that they return to employment after 2012. Hence, although for some it measures permanent retirement, we do not call our measure "permanent" exits.

The resulting estimates for job displacements occurring in the early 1980s recession are shown in Chart 12 for our main control group (Chart 12A) and a control group that includes non-mass layoff separators (Chart 12B) as further discussed in Section IV.v. In both cases, the result is qualitatively similar. The main finding is that the sources differ significantly depending on the time since displacement. With exception of the first year (when most spells are new, there are no ongoing spells, and a small fraction of workers exits permanently), over the first few years the three sources contribute about equally to the incidence of nonemployment. This is consistent with existing findings that show that a job displacement triggers an initial rise in instability in workers careers (e.g., Stevens 1997; von Wachter and Sullivan 2009). Then, the role of the incidence of new spells starts declining rapidly, and fades at 10 years after job loss. The importance of increased duration of ongoing spells fades as well, albeit more slowly, suggesting that the repeated spells are also longer lasting. Yet, at least by 10 years after job displacement most of the rise in nonemployment is due to lasting exits from employment.

The results in Chart 12 suggest that nonemployed displaced workers are initially attached to the labor force (at least based on the incidence of positive W-2 earnings), but that underlying labor force attachment fades reasonably fast with time since displacement. Chart 13 shows the fraction of the nonemployment effect explained by a "lasting exit" by age at displacement (Appendix Chart A4 shows the underlying estimates corresponding to Chart 12). It turns out that the rate of lasting exit is particularly large for workers nearing retirement age, but it is non-negligible for prime-age men as well, while for younger displaced workers most of nonemployment arises from new and ongoing spells but not lasting exits. Thus, while

Chart 12A
Sources of Employment Losses After Job Displacement
Workers with Three or More Years of Job Tenure, Men Only
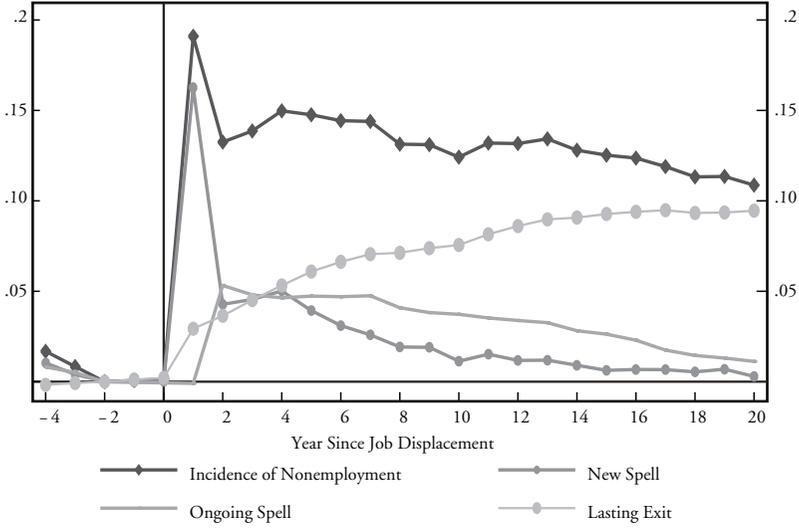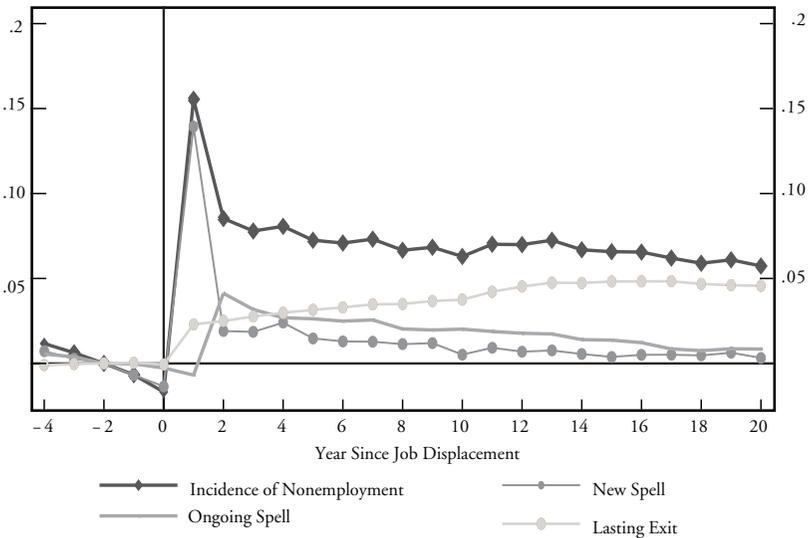**Excluding Non–Mass Layoff Separators (Main Specification)**

Chart 12B
Sources of Employment Losses After Job Displacement
Workers with Three or More Years of Job Tenure, Men Only
Including Non–Mass Layoff Separators (Alternative Specification)

Note: Authors' calculations based on 1 percent administrative data from Social Security Administration.

nonemployed workers that were displaced in their 20s and 30s appear to retain higher attachment to the labor force as measured by recurring incidence of positive annual earnings spells, already many nonemployed workers displaced in their 40s appear to have exited the labor force permanently.

IV.v Sensitivity of Estimates of Job Displacement on Employment

The main estimates of the effect of job displacement on employment are robust to several sensitivity checks, which are only briefly summarized here. One concern with any estimate of job displacement is that displaced workers may be negatively selected in terms of their employment potential. We have already argued that our findings are robust to the inclusion of pre-displacement control variables at the worker level (such as age, prior average earnings, prior growth rates of earnings) and at the firm level (such as major industry and firm size). In von Wachter, Song and Manchester (2011) we also implement the firm-level estimation strategy that is robust to selective displacement. We compare the change in the employment rate of a cohort of workers that were employed at a firm experiencing a mass layoff with that of cohort of workers employed at a non-mass layoff firm, irrespective of whether the worker separated or not (i.e., we essentially use the mass layoff at the firm level as an instrument for the displacement at the worker level). By foregoing a direct comparison at the worker level, we sidestep the concern that firms may have selectively chosen to displace workers with lower earnings and employment potential. As in the case of earnings, when implemented for the analysis of employment this strategy confirms our main findings. This suggests selective displacement is unlikely to be an important concern for our estimates.

A second question particularly relevant for the analysis of employment is whether the results are robust to the inclusion in the control group those workers that left their employer in the baseline period, but whose employer did not experience a mass layoff at the time. As discussed in Section IV.i, these "non-mass layoff separators" have been typically excluded in the literature, because some may have experienced a job loss at a firm experiencing smaller percentage

Chart 13
Fraction of Employment Effect Due to Lasting Exit
By Age Group, Displacements in 1980–1983
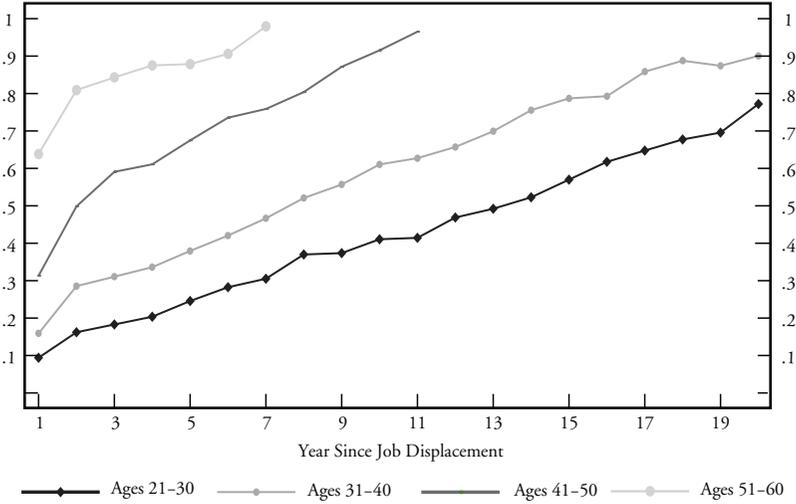
reductions   in   employment   or   employ-
ment   reductions   that   are   spread   over   a
longer period of time. Thus, the concern is that including these work-
ers in the control group may lead to an understatement of the effect
of job displacement. However, since we count any worker exiting the
labor force, say, for health reasons or because he retires when the em-
ployer experiences a mass layoff as displaced, our approach induces
a mechanical correlation of job displacement and nonemployment.
It is worth stressing that in contrast to the existing literature, our
main estimates only exclude those non-mass layoff separators that
are separating in a window of one year before and after the baseline
year, and hence mechanical effect is limited. Outside of this window,
the control group can freely separate from their firm, and hence our
estimates allow for substantially more mobility than other studies
based on administrative data (e.g., Jacobson, Lalonde and Sullivan
1993; Couch and Placzek 2010).

   To address the effect of the presence or absence of non-mass layoff
separators directly, we re-estimated our main specifications for job
displacements that include these in the control group. For reasons of

data access, this sensitivity check was based on job displacements occurring during the early 1980s only. The results are shown in Chart 12. Chart 12A shows findings that exclude this group as in our main analysis. Charts 12A and 12B show the effect of job displacement on nonemployment as opposed to employment. A comparison between charts suggests that, as expected, including non-mass layoff separators in the control group reduces the estimated long-term effect of job displacement on employment from about 10 to 5 percentage points per year after job displacement. For workers ages 40 to 49 at job displacement the effect is still at 10 points, whereas for those from 50 to 59 the effect is close to 15 points (not shown). Hence, even when we include these workers in the control group the long-term effect of job displacement remains substantial.

We also assessed to what extent we understate the effect of job displacement on employment due to the fact that we do not observe some nonemployment spells that straddle calendar years. To gauge the extent of possible undercounting of such spells, we followed the same strategy we used to adjust for measurement error in Section III. The assumption is again that the incidence of nonemployment spells lasting between 12-24 months is equally distributed between calendar months, and that in any given month a new spell has equal chance of lasting between 12 and 24 months. As before, we can then count how many "cohorts" of nonemployment spells we miss because our data is based on earnings by calendar year. A difference here is that since we follow workers for many consecutive years after a job displacement, in any given year s after job loss we undercount some spells that are d years long (or between s*12 and (s+1)*12 months), but overcount spells that are in effect longer and should be counted for year s+1 after job loss. One can show that given our assumptions, the resulting adjustment factor for measurement error varies by time since job loss, and is a function of changes in the slope of the survivor curve of the underlying nonemployment spells.[32] The adjustment factor only applies to the fraction of nonemployment due to ongoing or new spells, not the portion due to permanent exit (which is not mismeasured). We find that we may understate employment losses from new and concurrent spells by 15-20 percent in years one to two after job loss; by 5-10 percent in years three to 10 after job loss; and

by 3-4 percent afterward. Since we found in Section IV.iv that about two-thirds (half) of our employment effect initially (in medium term) appears to be due to new or concurrent spells, this implies that the short-run (medium run) effect of our main estimates had to be scaled upward by 10-15 percent (2.5-5 percent). The measurement error is likely to be insignificant for losses beyond 10 years after job loss, which are mostly driven by permanent exits. Hence, our data based on calendar years understates the short-run to medium-run employment effects by a small amount.

V.   Implications of Findings for Persistence of Employment Rates

The findings reported in Sections III and IV show that LTNE and job loss leads to lasting reductions in employment of affected workers. Using our estimates of the medium-term to long-term effects of a long spell of nonemployment or a job displacement, in this section we will assess what fraction of the observed gap in the employment-population ratio in Chart 2 could be explained. Thereby, we treat the proportion explained as an approximate estimate of the persistent decline in the employment-population ratio due to hysteresis.

V.i   Approximation of Hysteresis Based on LTNE

Our first approach to assess the potential degree of hysteresis is to use the survivor curves from long-term nonemployment from past recessions analyzed in Section III to infer about the likely persistence the aggregate employment gap in the aftermath of the Great Recession. An advantage of this approach is that the calculation of the degree of persistence based on the survivor curves shown in Chart 6B is relatively straightforward. The steep decline in the employment-population ratio in the Great Recession shown in Chart 2 can be interpreted as stemming from a rise in the number of individuals that are not employed in a calendar year. Hence, absent population growth, changes in labor force participation, and further inflows into nonemployment, the survivor curves shown in Chart 6 give the fraction of the gap in the employment-population ratio that is likely to persist over time based on experience from past recessions. The approximate decline in the employment-population ratio from the

peak in 2006 to the aftermath of the Great Recession shown in Chart 2 is roughly 4 percentage points. Based on the average survivor curve for the more recent period, about half of the gap should have disappeared five years after the initial decline, and roughly 60 percent of the gap 10 years after. Thus, five to 10 years after the Great Recession the employment population ratio would be predicted to be 1 to 2 percentage points lower than it was before the recession.

As mentioned in Section III, there are potential issues with this approach. One disadvantage is that one has to assume that the characteristics of cohorts of long-term nonemployed workers do not differ substantially across cycles. Another disadvantage that without the benchmark from a control group the survivor curves are partly estimated based on individuals that may have retired or left the labor force even in the absence of the Great Recession. Hence, one would risk overstating the degree of persistence with this approach.

V.ii Alternative Measures of the Incidence of Job Loss

Our second approach to approximate the extent of hysteresis in employment during the Great Recession is to use estimates of the effect of job displacement on employment discussed in Section IV in conjunction with an estimate of the total number of job losers. An advantage of this approach is that it uses causal estimates of the effect of job displacement on employment, and hence selection is controlled for by the comparison to a control group. Treatment effects might differ across cycles, of course, but this can be assessed directly from the data. A difficulty with this approach is that to make inference about aggregate employment rates, one needs to obtain estimates of the incidence of job loss and the effect of job loss for a broader population. In Section IV, we deliberately chose to focus on a specific group of displaced workers for whom the event of job loss and the control group is more clearly defined than for broader populations, and compared our findings to that for broader definitions of job loss. Here, we briefly review estimates of the incidence of job loss.

Measuring the incidence of job loss is difficult for conceptual and measurement reasons. Conceptually, to measure the extent of hysteresis the at risk group consists of all workers potentially affected by long or recurring nonemployment spells, which is the group of all job losers (we discuss labor market entrants below). A job loss is typically defined as leaving a job involuntarily for economic reasons. This is distinct from measures of job separations, which include voluntary quits and retirements, and hence are too broad; measures of net employment changes, which are net of hires, and hence risk being too narrow.[33] Measurement difficulties arise because administrative data sources have no information about the reason of job loss, while worker surveys suffer from substantial misreporting. When measuring the costs of job loss in Section IV, we circumvented these problems by choosing a particular definition of job loss that is too narrow to approximate job loss in the economy as a whole.

To get a better sense of the time-series pattern of job loss we follow Davis and von Wachter (2011) and report several alternative measures of job displacement that span our entire time period in Chart 14. The first measure is the displacement rate for male employees implied by our definition of job displacement discussed in detail in Section IV.i.[34] In addition, the chart displays annual measures of job destruction, which captures gross employment losses summed over shrinking and closing establishments in the Business Dynamics Statistics (BDS) published by the U.S. Census Bureau. The chart also includes two measures of flows to unemployment, the annual average of monthly unemployment inflow rates from the CPS and the annual fraction of initial UI claims among nonfarm payroll employment. Since these charts condition on entry into unemployment (some of which could be arising from individuals that were previously nonemployed), they are likely to understate the total amount of job loss. However, they are often used as proxy for job loss, and hence we include them here.

Chart 14 confirms that job loss rates move in a countercyclical manner, and that recessions involve notable jumps in job loss. The deep recession in the early 1980s saw dramatic increases in rates of job destruction and job displacement. Our measure of the job

displacement rate rose from 1.9 percent in 1980 to 5.0 percent in 1983. In the Great Recession, it rose from 2 percent in 2007 to 3.5 percent in 2009. While the incidence of job displacement might seem modest in any given year, it cumulates to a large number during severe downturns. For example, summing the job displacement rates in Chart 14 from 1980 to 1983 yields a cumulative displacement rate of about 20 percent (2.7 million) among men 50 years or younger with three or more years of job tenure and working in industries with continuous SSA coverage.[35] Similarly, from 2007 to 2010, the comparable cumulative displacement rate among higher-tenured male workers was about 11.5 percent, corresponding to about 1.75 million displacement events. Given our criteria for job displacements, this chart is conservative. According to the Displaced Worker Supplement, (DWS) to the CPS, 6.9 million persons with at least three years of prior tenure lost jobs due to layoffs in the years from 2007 to 2009 (Bureau of Labor Statistics 2010). This chart includes women and does not impose our mass-layoff criteria. The Bureau of Labor Statistics also reports that an additional 8.5 million persons were displaced in 2007-09 from jobs held less than three years.

It is noteworthy that the measures of job loss in Chart 14 have been gradually declining over time. The rate of inflow into unemployment and the rate of new UI claims peaked in the early 1980s, and has been decreasing until the Great Recession. Similarly, the displacement rate as defined here has gradually declined from its high level during the early 1980s recession. At the peak of the Great Recession, the displacement rate was about the same level as in the 2001 recession, and a bit more than half the rate of the 1980s recession. A similar decline in job displacement rates from the mid-1990s to 2012 has been documented in quarterly displacement data from the LEHD database in Vilhuber and von Wachter (2014). In contrast, job destruction as measured by the BDS has not exhibited a secular trend. It is worth noting that the DWS also does not show a secular change in job displacements (not shown here). Moreover, the DWS implies that the incidence of job loss after the Great Recession rose above the level of the early 1980s recession (e.g., Farber 2011). These are both outliers in a general pattern of declining labor market

Chart 14
Alternative Measures of Job Loss, 1975–2014
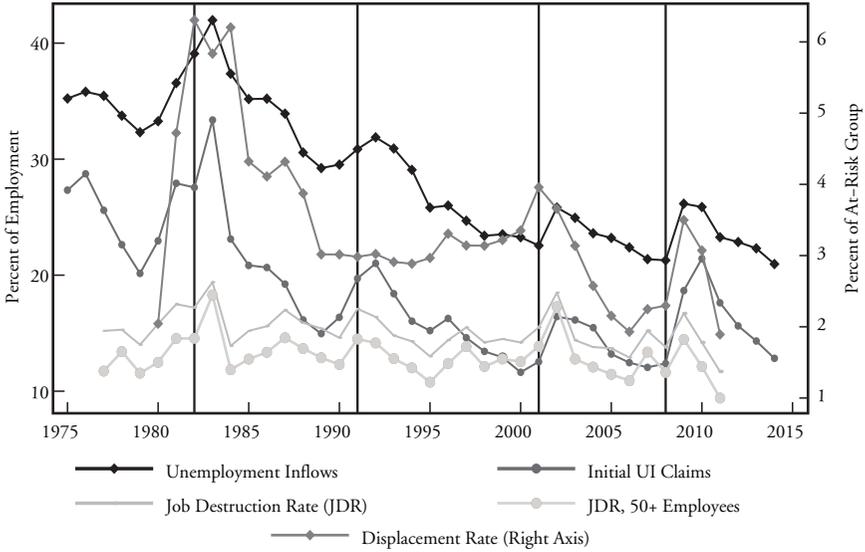
Notes: All series are annual rates and are scaled to the left scale except where stated otherwise. Vertical lines drawn in recession years 1982, 1991, 2001, 2008. Job Displacement Rate is the rate of job loss in mass-layoff events among male workers 50 years or younger with at least three years of prior job tenure, expressed as a percent of all male employees 50 or younger with at least three years of tenure at firms with at least 50 employees in the same age range. See text for a definition of mass-layoff events. Job Destruction Rates for the nonfarm private sector are from the Business Dynamics Statistics program at the U.S. Census Bureau. They are tabulated from March-to-March employment changes summed over all contracting establishments in the Longitudinal Business Database, available at *www.ces.census.gov/index.php/bds/bds_database_list*. Annual sums of weekly new claims as a percent of total employment; series is constructed as in figure 1 except that the monthly rates are summed from April of the previous year to March of the indicated year. Monthly unemployment inflow rates are calculated from CPS data as the number unemployed less than five weeks divided by total civilian employment, then summed over months. To adjust for the 1994 CPS redesign, we divide the number of short-term unemployed by 1.1 before 1994. See Shimer (2012) on the CPS redesign.

instability documented in several papers in the literature (e.g., Davis, Faberman, Haltiwanger, Jarmin and Miranda 2010).[36]

V.iii *Approximation of Hysteresis Based on Displaced Workers*

To assess the degree of potential persistence of employment rates using evidence from displaced workers, consider the following simple hypothetical decomposition of the employment-population ratio,

$$epop_t = epop_t^{ND} + \pi_t^D \delta^D ,$$

where π_t^D is the fraction of individuals in the population that were displaced before period t, and where for simplicity it is assumed that

the difference in the employment-population ratio δ^D among the displaced and the nondisplaced is constant over time.[37] Suppose one knew what fraction of the population in the Great Recession was displaced π_{GR}^D, and had an estimate of the effect of displacement on long-term employment-population ratio. Together with an estimate of the employment–population ratio of nondisplaced individuals, one can infer something about the potential employment-population ratio in the aftermath of the Great Recession.

We have presented estimates of the medium-term effect of job displacement on employment ranging from 5 to 10 percentage points in Section IV, where the magnitude varied with age of displacement and the chosen control group. These estimates focused on a group of workers that had higher tenure and came from larger firms. Although as discussed in Section IV estimates of the effect of job loss on the entire population of job losers from the Displaced Worker Survey (DWS) suggests that job loss has also substantial effects on employment rates on a broader group of individuals, we treat these estimates as the upper bound of the employment effect.

The total impact of job displacement during the Great Recession on aggregate employment rates then depends on the fraction of individuals in the population that experienced a job loss. A the lower end, the numbers underlying the displacement rate in Chart 4 imply that about 3-4 million workers were displaced from long-term jobs at midsize to larger firms experiencing mass layoffs (assuming that the layoff rate among men and women is similar). This would imply that about 1-2 percent of the civilian *population* (the denominator of the epop rate) was affected by job displacement. At the higher end, suppose one assumed that all individuals experiencing a one-year employment gap in the administrative data we used in Section III during 2008 and 2009 had been laid off—about 24 million. That would imply that 10 percent of the civilian population experienced a job loss. The actual number is likely to be somewhere in between. For example, from the DWS of 2010, 15.4 million individuals reported losing their jobs in 2007-09. This would imply a rate of job loss among the civilian population of about 6.5 percent. Yet, after accounting for some measurement issues, Farber (2011) reports a

job loss rate among those employed for 2007-09 of about 16 percent, implying a population-based rate of about 10 percent. Yet another data source discussed in Davis and von Wachter (2011), the Job Openings and Labor Turnover Survey (JOLTS), implies a rate of layoff of about 15 percent relative to the civilian population during the Great Recession.[38]

In a worst-case scenario, these numbers thus imply that 15 percent of the population experienced a 10 percent permanent drop in employment, and hence that the employment-population ratio permanently declined by 1.5 percentage points. If one takes a more conservative number of a 5 percent permanent drop in employment, the implied persistent decline in the employment-population ratio is three-quarters of a percentage point. (The implied degree of persistence is substantially smaller if we assume that only 1-2 percent of the population was affected by costly job displacement.)

It is worth emphasizing that given our findings on the cyclicality of employment persistence in Sections III and IV, what leads to a greater amount of hysteresis in recession is the increase in the incidence of job loss, not an increase in the duration of nonemployment, which is also substantial in normal times. Given the U.S. labor market experiences a substantial amount of job loss in normal times, and that the duration of nonemployment is similar, the increase in job loss during the Great Recession is the more relevant number to assess the recession's impact on hysteresis. The rise in the incidence of layoffs and job loss in the population in the Great Recession was 6.5 and 5.3 percentage points according to the JOLTS and the DWS, respectively.

If one takes the epop ratio before the Great Recession as an approximation of in the relationship above, then these back-of-the-envelope calculations suggest that job loss in the Great Recession led to a lasting decline in the epop ratio from 64 percent to 62.5 percent or 63.25 percent. The implied reduction is about a third to a half of this if one only takes the difference in the amount of job loss with respect to normal times. These calculations would imply that the remainder of the gap of the current employment-population ratio to this implied steady state cannot be explained by a persistent employment reduction due to hysteresis. It is important to keep in mind

that this may be an underestimate of the degree of persistence in so far as the effective number of job losers is greater, or if there is substantial hysteresis among new labor market entrants. Alternatively, it may be an overestimate if estimates of the effect of job displacement for higher tenured workers are larger than for other job losers.

A relevant question in interpreting these numbers is to what extent nonemployed job losers have dropped out of the labor force permanently or not. If job losers drop out permanently, they would lower the overall employment rate, but not contribute to typical measures of "potential" employment, which weight nonemployed individuals by their probability of re-employment.[39] Our findings in Section IV implied that in the short run, about one-third of the rise in nonemployment constitutes permanent labor force exit (i.e., a re-employment probability of zero). Hence, about two-thirds of the 1- to 2-percentage-point decline in employment is predicted to remain in the active labor force. This implies there is scope for reversing some of the effects of hysteresis via labor market policies in the immediate aftermath of a recession.

VI.   Summary and Conclusion

It has been a long-standing question in economics whether substantial increases in the incidence of long-term unemployment in recessions can lead to a persistent reduction in employment rates. One difficulty in assessing the presence of such hysteresis effects in the United States labor market is that no systematic information on unemployment duration exists for the large fraction of nonemployed workers that are not formally classified as unemployed in official statistics. To provide a more comprehensive measure of nonemployment duration, in this paper we have analyzed the incidence, duration, and sources of LTNE spells over the business cycle over the last 30 years using a large, longitudinal administrative data. We also provide an alternative measure of the extent of hysteresis occurring in recessions based on an analysis of displaced workers.

We have obtained several key findings. The incidence of ongoing LTNE spells lasting at least one to two years has been countercyclical in all recessions since 1980. In contrast to the behavior of the

standard LTU rate based on ongoing spells lasting at least one year, LTNE behaved similarly in the Great Recession as in previous recessions. LTNE rose somewhat more in the Great Recession for prime-age men and for younger workers. The incidence of very long LTNE spells (spells lasting at least two years) has also exhibited moderate cyclical movements that are comparable across recessions. Similarly, the survivor curve in the Great Recession does not represent an outlier with respect to previous downturns. Overall, these findings suggest that the potential for hysteresis in the aftermath of the Great Recession is moderate, especially compared to previous recessions.

To obtain direct evidence on whether the upheaval in employment during the Great Recession may have led to a persistent decline in employment, we then analyzed the short-term and long-term effects of job displacement on employment. We find that job displacements lead to lasting declines in employment, that on average this pattern was similar in recessions and expansions, and that it was unchanged in the Great Recession. We also document that the incidence of job displacement is countercyclical and for many measures no larger in the Great Recession than in foregoing downturns.

These findings point to several potentially important implications and open questions. Our results suggest that every recession since the early 1980s involving a substantial amount of job loss triggered a persistent reduction in employment. Since we find that re-employment patterns after a job loss or a long-term nonemployment spell have remained relatively stable over time, the scope of hysteresis depends on the number of workers losing their jobs. The results also suggest that it is unlikely that rising durations of nonemployment or widespread job loss during the Great Recession can explain the majority of the observed persistent decline in aggregate employment-population ratio. However, different measures of job loss imply somewhat different hysteresis effects, and this is an important subject for future research.

The results also suggest that care has to be taken when inferring about the persistence of joblessness for the group of nonemployed as a whole from measures of long-term unemployment. Our findings underscore the importance of studying the behavior of those nonemployed workers that are not classified as unemployed by the Current

Population Survey.[40] Our results also suggest caution is warranted when comparing standard measures of long-term unemployment, since they may reflect factors other than just the current economic environment. Studying changes in retrospective reporting behavior of unemployment duration is an important subject for future work.

Another important open question given our findings is what can explain the persistent decline in the employment population ratio. Since our analysis is based on workers that had been previously employed, it is likely that part of this decline is due to employment reductions for new labor market entrants. Hall (2014) and Ball (2014) discuss reasons other than job loss and long-term nonemployment that may explain the persistent reduction in employment. Last but not least, it would be interesting to generate comparable comprehensive measures of nonemployment durations for other countries with depressed labor markets, especially in Europe where comparable administrative data is often available. This would allow a better assessment of the scope of ongoing hysteresis, and a reassessment of past levels of hysteresis that helped to coin the term during the 1980s.
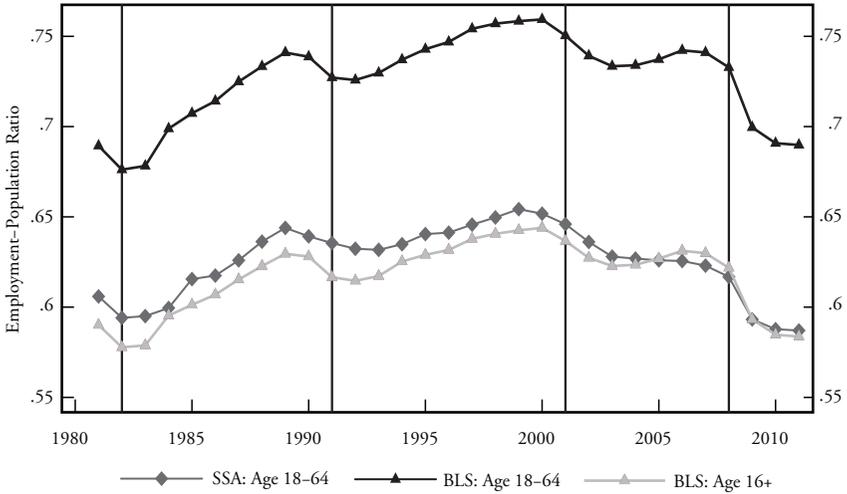
Appendix

Chart A1

Employment–Population Ratio, Both Genders, 1980-2010

BLS Data and Tabulations from SSA, Employment in
Different Age Ranges

Note: Vertical lines drawn in recession years 1982, 1991, 2001, 2008.
Sources: Bureau of Labor Statistics and Social Security Administration.

Chart A2a
Survivor Curve After One–Year Nonemployment Spell
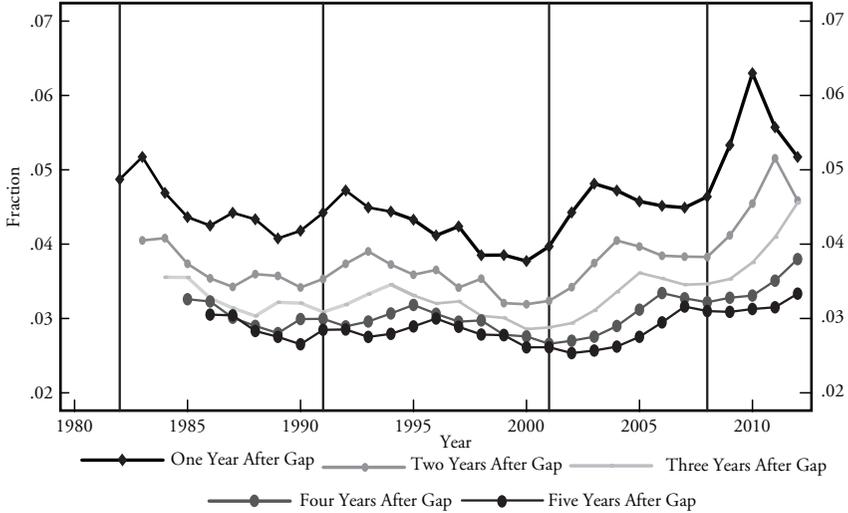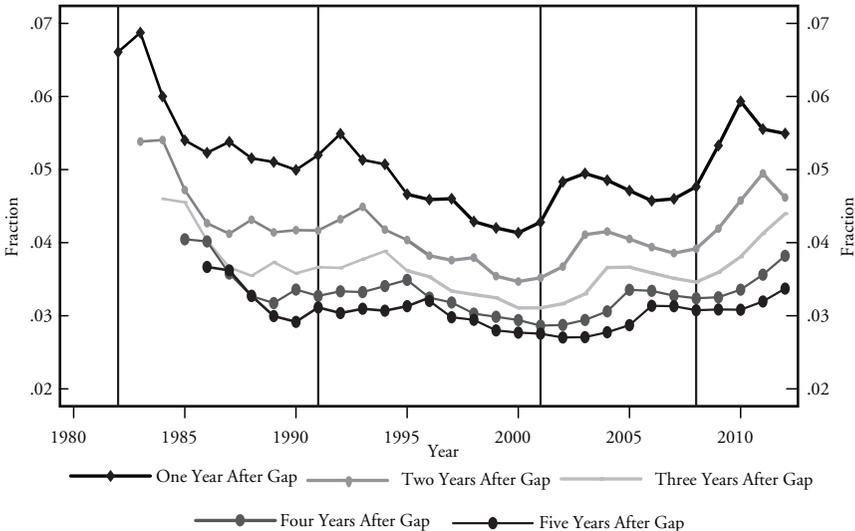**Fraction of Workers not Employed by Year Since One–Year Gap, Men Only, 1981–2011**

Chart A2b
Survivor Curve After One–Year Nonemployment Spell
Fraction of Workers not Employed by Year Since One–Year Gap, Women Only, 1981–2011

Notes: Number of workers with a gap in earnings of at least one year in a baseline year zero that still has zero earnings in the first five years following the initial gap, relative to sum of employed workers and those with a one year gap in the base year. Tabulations based on workers ages 18-64 from 1 percent file of administrative data from Social Security Administration. Vertical lines drawn in recession years 1982, 1991, 2001, 2008.

Chart A3a
Long-Term Nonemployment Rate by Age Group
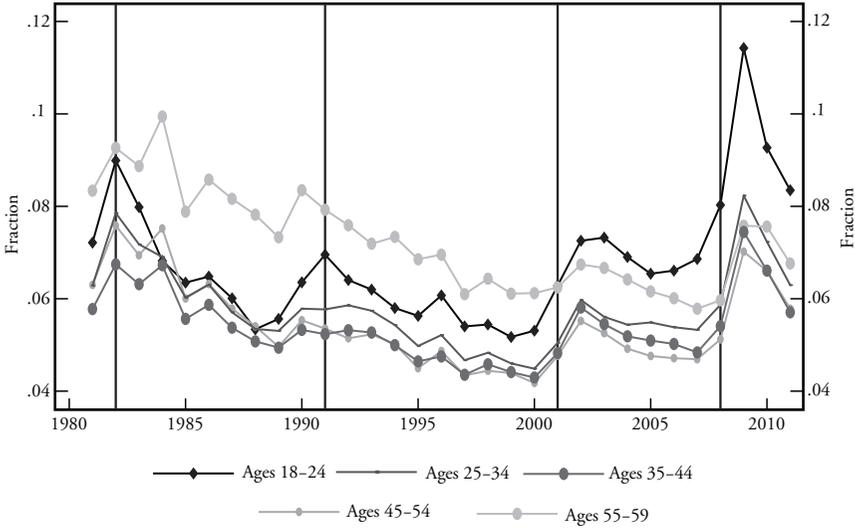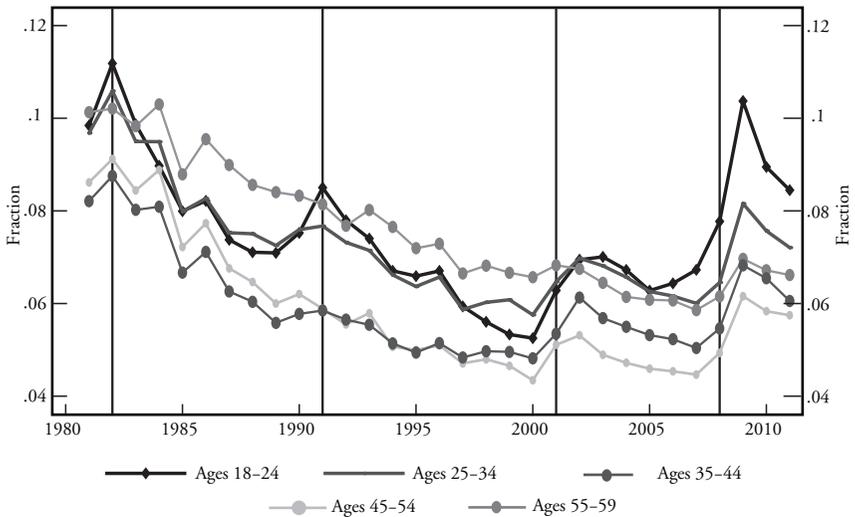**Fraction of Workers not Employed for a Calendar Year, Men Only, 1981-2011**

Chart A3b
Long–Term Nonemployment Rate by Age Group
Fraction of Workers not Employed for a Calendar Year, Women Only, 1981–2011

Notes: Number of workers with a gap in earnings of at least one year, respectively, relative to the sum of employed workers and those with a one year gap. Tabulations based on workers age 18-64 from 1 percent file of administrative data from Social Security Administration. Vertical lines drawn in recession years 1982, 1991, 2001, 2008.

Chart A4a
Very Long-Term Nonemployment Rate by Age Group
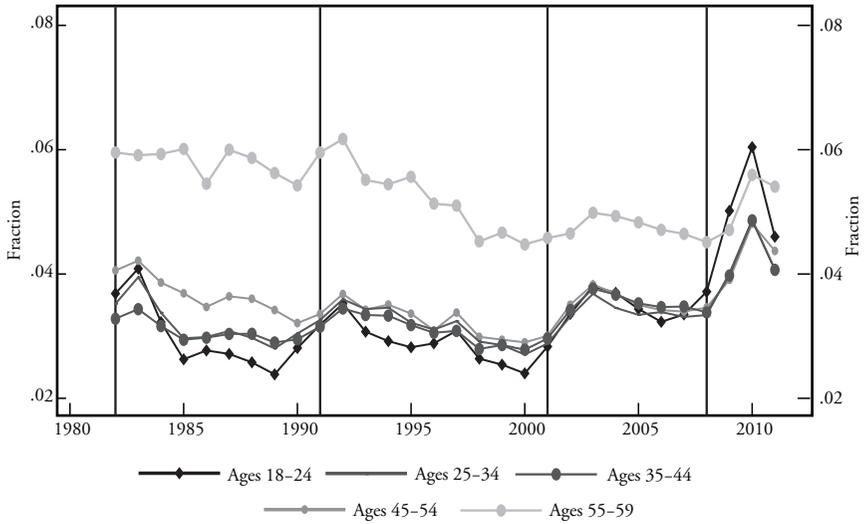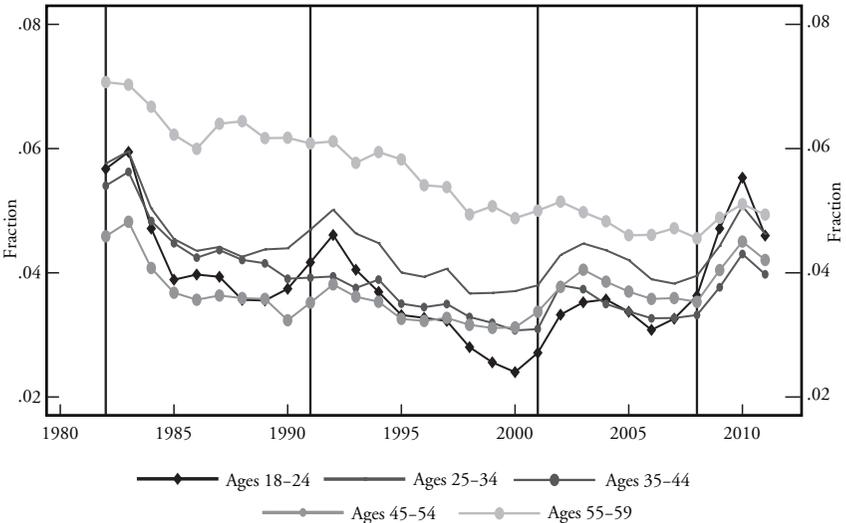**Fraction of Workers not Employed for Two Calendar Years, Men Only, 1981-2011**

Chart A4b
Very Long-Term Nonemployment Rate by Age Group
**Fraction of Workers not Employed for Two Calendar Years,
Women Only, 1981-2011**

Notes: Number of workers with a gap in earnings of at least two years, relative to the sum of employed workers and those with a one and two year gap. Tabulations based on workers ages 18-64 from 1 percent file of administrative data from Social Security Administration. Vertical lines drawn in recession years 1982, 1991, 2001, 2008.

Chart A5
Sources of Employment Losses After Job Displacement
Workers with Three or More Years of Job Tenure, Men Only
Excluding Non-Mass Layoff Separators (Main Specification)
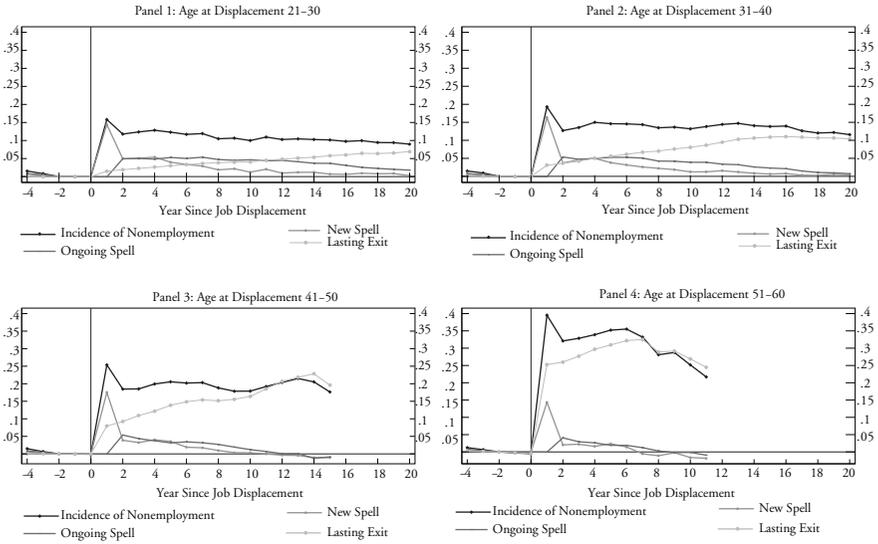
Notes: Authors' calculations based on 1 percent administrative data from Social Security Administration. Vertical lines drawn in recession years 1982, 1991, 2001, 2008.

Endnotes

[1]The empirical literature has argued that at least the initial weakness in the labor market during and after the Great Recession was mostly cyclical in nature (e.g., Elsby, Hobijn and Şahin 2010; Rothstein 2011; Lazear and Spletzer 2012), and hence was in important respects comparable to previous recessions.

[2]Workers are classified as unemployed in the CPS if in the week prior to the survey they do not have a job, are currently available for work and have actively looked for work in the prior four weeks (see *http://www.bls.gov/cps/documentation.htm*). A job search activity counts as "actively looking" if it has the potential to connect workers with potential employers. For example, asking friends and relatives counts as "actively looking," whereas browsing job advertisements does not, unless the worker contacts potential employers.

[3]See Clark and Summers (1979) and Flinn and Heckman (1983) for an early analysis based on younger workers, and Jones and Riddell (1999) and Schweitzer (2003) for a more general discussion.

[4]E.g., Kwok, Daly and Hobijn (2010); Aaronson, Davis and Hu (2012); Gordon (2013); Erceg and Levin (2013); Kudlyak and Schwartzman (2013); Davig and Mustre-del-Río (2013); Krueger, Cramer and Cho (2014); Smith (2014); Ravikumar and Shao (2014).

[5]Using an audit study, Kroft, Lange and Notowidigdo (2013) provide some evidence in favor of a negative effect of unemployment duration on call back to fictitious resumes, and Katz, Kroft, Lange and Notowidigdo (2014) show that negative duration dependence helps to explain employment flows in the Great Recession. Schmieder, von Wachter and Bender (2014) provide evidence that long-term nonemployment has a causal negative effect on re-employment wages in Germany using an instrumental variables strategy. Thus, there is some evidence in favor of the microeconomic pattern that can generate hysteresis.

[6]See Ball (2009) for a discussion of approaches to measure the extent of hysteresis based on cross-country time-series data. As an alternative approach, Katz, Kroft, Lange and Notowidigdo (2014) calibrate a general equilibrium matching model of the labor market that incorporates duration dependence and transitions in and out of the labor force. Hall (2014) and Ball (2014) measure the hysteresis in GDP arising from the Great Recession.

[7]It is worth noting that the main movements in the LTNE rate we find are driven by prime-age workers and are stronger for men, and hence are unlikely to be due to changes in retirement rates, disability rates, health or female labor force participation. We also find that the Great Recession particularly affected LTNE of younger workers, while workers nearing retirement age did not experience above-average increases.

[8]We follow the literature and define job displacements as the event of workers losing stable jobs from midsize to large firms during mass layoffs, as has been done

in Jacobson, Lalonde and Sullivan (1993); Couch and Placzek (2010); and Davis and von Wachter (2011); among others. This allows a very precise measurement of job loss and its consequences, but it should be borne in mind that our definition of job displacement does not capture all job losers, for whom the consequence of job loss in turn might differ, something we discuss below.

[9]We do find that long-term employment losses after job displacement are countercyclical for workers that are older or have high job tenure. Note that, as we explain below, a lasting exit in our case means that individuals are not observed to have earnings during our sample period that ends in 2012. Especially for younger displaced workers observed toward the end of our sample some re-entry is likely to occur. Lasting exit plays a more dominant role for those losing their jobs closer to retirement age, for most of which we can observe the entire remaining career.

[10]From peak to through, the decline in the EPOP rate for prime age in the Great Recession and early 1980s recession was 6.5 and 5 points, respectively. Three years after the trough, the gap shrank by 2 and 2.4 points, respectively. After six years from the trough in 1983, the EPOP rate for prime-age men was 1 point lower than at its peak.

[11]Averages over the full population can be expressed as weighted average of group-specific means, where the weights are equal to the shares of the respective group in the relevant population. To construct the reweighted series, we then recalculated the aggregate averages replacing the time-varying shares with shares that were fixed at their level in 1980. We split the population into 10-year age by gender groups, effectively holding the gender and age distribution in the population constant.

[12]Another alternative data source, longitudinal panel data sets, are either too short or have too small samples to generate reliable measures of nonemployment duration. Moreover, these surveys also potentially suffer from recall bias in recording past nonemployment spells.

[13]Employees receive a W-2 form from each employer stating their annual taxable income that was reported to the Internal Revenue Service. To measure annual earnings we sum over all W-2 forms received for a year. Note that although the Master Earnings File, from which our sample is drawn, starts in 1978, due to data inconsistencies in the first two years of the data we begin our analysis in 1980. The data is discussed extensively in Kopczuk, Saez and Song (2010).

[14]We count a worker as nonemployed if he had any positive earnings in year t-1, hence the maximum duration of nonemployment by the end of year t is 24 months minus, say, a day.

[15]Note that this does not correspond to the total labor force as usually measured by the BLS, since it does not include individuals that have longer nonemployment spells and declare themselves as unemployed, but includes those with a one-year employment gap that would not be counted as unemployed by the BLS.

[16]Since M_t and N_t are small with respect to E_t, excluding them from the denominator barely affects our results. An alternative way to normalize these measures would have been to use the total group of workers at risk of experiencing a nonemployment spell—those employed in *t-1*—as denominator. The resulting fraction would have been an estimate of the probability of experiencing a nonemployment spell of one to two calendar years (or two to three calendar years). We have replicated all of our findings with such a measure, and the results are unchanged but for small differences in timing.

[17]The SSA data also exclude some public sector employees that were not covered by SSA. As further discussed in Section IV, it appears that employees that are laid off only temporarily transit to nonstandard forms of employment, such as self-employment. Hence, in the short term, our measures of LTNE may overstate the level of nonemployment. In so far as these nonstandard transitions are countercyclical, we also may have somewhat overstated the degree of cyclicality.

[18]For example, entry of SSDI is a key source of permanent labor force exit particularly (but not only) for low-skilled men in their 50s. Yet, entries to SSDI were quite low during the early 1980s, a period that is sometimes referred to as SSDI "retrenchment," and then started growing rapidly after liberalization of access to SSDI in the mid-1980s, with a temporary acceleration in the early 1990s. Similarly, while it has been documented that retirement rates began to fall slightly in the early 1990s, they did not rise in the 2000s as our measures do. Moreover, retirement rates and SSDI entry cannot explain the patterns we find for prime-age workers.

[19]If a year belonged partially to an expansion and a recession, we weighted it by the fraction of months it contributed to recessions and expansions. Since we do not observe all yearly cohorts of nonemployed workers in an NBER-dated episode for the same duration, but we wanted to follow especially recent episodes as long as possible, we allowed the composition of the average to change with year since the initial gap (i.e., we simply drop the years we stop observing from the average). Hence, care has to be taken in interpreting the final point of each episode in Chart 6B.

[20]While a closer inspection of our data reveals decreases in the outflow probabilities in the 1991, 2001 and 2008 recessions, these changes are small relative to the secular changes and not proportional to the unemployment rate. As expected, this may be partly due to the (weak) amount of positive selection we find. The difference may also arise due to measurement error in standard measures of unemployment, since workers tend to underreport especially short unemployment spells in expansions, potentially leading to both a lower level and a shorter duration of unemployment.

[21]An analysis of finer age groups revealed that the patterns are broadly distinct for three groups—younger workers (age <25) prime age workers (ages 25-54), and workers close to retirement age (ages 55-59). We have not plotted LTNE rates for ages 60-64. This is much higher and less cyclical than for other age groups, clearly mainly reflecting permanent exit from the labor force. Appendix Charts A3 and A4 show the results separately by age and gender.

[22]Threshold of the larger kind have been used in other studies based on the same administrative data, such as Kopczuk, Saez and Song (2010). Krueger, Cramer and Cho (2014) define a return to stable employment from long-term unemployment as a work spell lasting at least four consecutive months.

[23]The numerator of $LTNE_t^1$ can be rewritten as $Nt=N_{t,1}+N_{t,2}+N_{t,3}+\ldots$, where $N_{t,s}$ is the number of people exiting nonemployment after s calendar years (i.e., whose nonemployment duration is between $s*12$ and $(s+1)*12$ months). Using our assumptions, we undercount $N_{t,1}$ by a factor of 6.5/12, which can be used to adjust both numerator and denominator. A similar strategy works for $LTNE_t^2$ and $LTNE_t^3$. We use a similar approach to adjust the effect of job displacement on employment in Section IV.v.

[24]A recent literature has shown that a decline in the outflow rates from unemployment may play a substantial role in explaining cyclical unemployment dynamics together with the inflow rate, which is more closely related to job loss (e.g., Elsby, Michaels and Solon 2009; Shimer 2012).

[25]We also present results for older men. In von Wachter, Song and Manchester (2011) and Davis and von Wachter (2011) we provide evidence that the earnings effects are similar for men and women.

[26]Tabulations in Davis, Faberman and Haltiwanger (2006) based on Business Employment Dynamics (BED) and Job Openings and Labor Turnover Survey (JOLTS) data indicate that most employment reductions are achieved through layoffs when firms contract by 30 percent or more. The 99 percent cutoff in the definition of mass-layoff events ensures that we do not capture spurious firm deaths due to broken longitudinal links. The last two conditions in the text exclude temporary fluctuations in firm-level employment.

[27]We include displacements that occur in *y+1* and *y+2* in the sample for displacement year y to raise the number of observations on displaced workers, and to align the inclusion windows for displaced and control group workers. Note that this approach smooths the estimated employment effects of job displacement from one displacement year to the next, which works against finding differences between recessions and expansions.

[28]Since our sample window stops in 2012, for displacement years after 1992 we do not observe 20 years of employment data after a displacement. For these years, the post-displacement dummies are included up to the maximum possible number of years.

[29]For 1980 (1981), the baseline is years five and six (six and seven) before displacement. We also drop the dummy variable for the first calendar year in each regression. These zero restrictions, two for the baseline and one for the first calendar year, resolve the potential collinearity among the dummy variables in (1).

[30]Chart 8B shows that there is a small pre-displacement difference in employment between the treatment and control group, which is partly controlled for by worker fixed effects.

[31]The three sources add up to be exactly the effect of nonemployment in every period after displacement.

[32]The adjustment factor is equal to the second derivative of the survivor curve relative to the first derivative minus 1. Since the slope of the survivor curves in our data quickly declines at higher durations and hence the second derivative is noisy. Hence, to implement our adjustment factor we imposed a log-specification of the survivor curve.

[33]The total number of separations S_t can be decomposed into layoffs L_t, quits Q_t, and retirements R_t, i.e., $S_t = L_t + Q_t + R_t$. The net employment change ΔE_t is equal to hires H_t minus separations ($\Delta E_t = H_t - S_t$). Hires in turn can be decomposed into hires from employment (HE_t) and hires from nonemployment (HNE_t). As a result, net employment changes can be expressed as $\Delta E_t = (HE_t - Q_t - L_t) + (HNE_t - R_t)$. If $L_t > HE_t - Q_t$, this implies that there are laid-off workers that are not rehired. As long as $HNE_t > R_t$, employment may still grow.

[34]To express job displacements in year y as a rate in Chart 14, we divide by the number of male workers 50 or younger in $y - 2$ with at least three years of job tenure at firms with 50 or more employees in the industries covered by Social Security throughout our sample period. These workers make up 31 to 36 percent of all male workers 50 or younger in industries continuously covered by the SSA from 1980 to 2008, depending on the year, 40 to 48 percent when we also restrict attention to those with three or more years of job tenure, and 70 to 74 percent when we further narrow the focus to firms with 50 or more employees.

[35]Note that these numbers differ slightly from those in Davis and von Wachter (2011) due to ongoing revisions in the administrative data.

[36]One potential difference may be that measures of job displacement from the DWS successfully exclude temporary layoffs, which were a more important phenomenon in the early 1980s. However, the DWS may also have substantial recall bias (e.g., von Wachter, Handwerker and Hildreth 2008).

[37]We have

$$epop_t \equiv \frac{Emp_t}{Pop_t} = \frac{Emp_t^{ND}}{Pop_t^{ND}} \cdot \frac{Pop_t^{ND}}{Pop_t} + \frac{Emp_t^{D}}{Pop_t^{D}} \cdot \frac{Pop_t^{D}}{Pop_t}, and \; \pi_t^{D} \equiv \frac{Pop_t^{D}}{Pop_t}, epop_t^{D} \equiv \frac{Emp_t^{D}}{Pop_t^{D}}, epop_t^{ND} \equiv \frac{Emp_t^{ND}}{Pop_t^{ND}}, and \; \delta_t^{D} \equiv epop_t^{D} - epop_t^{ND}.$$

Note that a more complete decomposition would allow the effect of displacement to differ over the short and the long run, and account for the fact that one observes different "cohorts" of displaced workers at any given point in time.

[38]The denominator in Farber (2011) is the sum of individuals employed at the survey date plus those that lost their job. Farber (2011) reports an 8.5 percent rate of job loss for the periods from 2003-05 and 2005-07. Aaronson and

Sullivan (1998) also provide bias-corrected numbers for job displacement based on the DWS. According to the JOLTS, about 36 million workers were laid off from December 2007 to May 2009. About 20 million workers were laid off on average during the years 2004 to 2007.

[39]See, e.g., Jones and Riddell (1999) and Schweitzer (2003). Standard measures of potential employment are based on estimates of the NAIRU (the Non-Accelerating Inflation Rate of Unemployment) and hence only based on unemployed workers as conventionally measured.

[40]Similarly, another important source of decline in employment during the Great Recession that our measures do not capture is the rise in the incidence and duration of spells of part-time employment.

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