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Three Essays on Labor Market Transitions

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Three Essays on Labor Market Transitions

Huanan Xu, PhD

University of Connecticut, 2016

Using individual-level CPS data matched across adjacent months from 1996 to 2013, my dissertation examines the differences in labor market transitions to changes in the business cycle by various demographic groups. The papers capture economic fluctuations by measuring deviations in local demand from national economic circumstances and examine monthly transitions among employment, unemployment, and nonparticipation. By relating the underlying transitions to the labor force aggregates, this dissertation aims to provide insights on the drivers of gaps in labor force aggregates. The first chapter examines the racial differences in cyclical sensitivities between the white, black, and Hispanic workers. The second chapter breaks the sample by young vs. old workers to examine labor market dynamics. The third chapter focuses on comparing the immigrant-native labor market performances. The main findings are minority and immigrant workers appear to be first-fired and first-hired over the business cycle, while younger workers are first-fired and last-hired. After controlling for the observable personal, skill, and employment characteristics, the remaining unemployment gap may be attributable to potential discrimination, different levels of U.S.-specific human capitals, and the eligibility for participation in public benefit programs. To test the structural change brought by the 2007 Great Recession, the papers find a secular shift in the base transition probability that would negatively affect all workers in the sample, and at the same time there is a decline in the cyclical volatility for less-advantaged workers in the post-Great Recession period.

Three Essays on Labor Market Transitions

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APPROVAL PAGE

Doctor of Philosophy Dissertation

Three Essays on Labor Market Transitions

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Introduction

My dissertation investigates labor market transitions over the business cycle for various demographic groups in the U.S. labor market. Applying a dynamic stochastic transition model, I examine the individual-level inflows and outflows of employment, unemployment, and nonparticipation from one month to the following. Looking at labor market transitions between different labor force states is important because variations in the stock level of labor force aggregates are fundamentally determined by fluctuations of the underlying entry and exit transition flows. For example, when we observe an increase in the aggregate unemployment rate in a month, the cause could be an increased number of people losing job in the month, or a reduced number of people being rehired. Thus, a close examination of the labor market transitions provides understandings to the driving forces of gaps in labor force aggregates between different demographic groups, and to their differentials in labor force sensitivities to the business cycle.

In the first chapter, I use individual-level Current Population Survey (CPS) data matched across adjacent months from 1996 to 2012 to examine the labor force transitions for Hispanics, African-Americans and whites. I construct a transition probability that is a stochastic process following a discrete-time Markov chain, and compare the monthly transition probabilities from one labor force state to another. Over the whole sample period, I first build a two-way model where only transitions within the labor force (between employment and unemployment) are considered, and then I expand the analysis to a three-way model where transitions across all the labor force states (among employment, unemployment, and nonparticipation) are examined. I find that minorities are more likely to be fired as business cycle conditions worsen and that minorities are also more likely to be hired when local demand is relatively weak. My findings suggest that the aggregate unemployment gap between minorities and their white counterparts is mainly due to minorities' higher rates of losing jobs. In order to investigate the structural

change from before to after the Great Recession, I conduct a test and find that during the Great Recession, the odds of losing a job increased for minorities although cyclical sensitivity of the transition declined. Odds of becoming re-employed declined dramatically for blacks, while the probability was unchanged for Hispanics. This particularly striking and consistent result across estimates suggests that the sharp decline in demand associated with the Great Recession overwhelmed normal processes of labor market dynamics, with blacks bearing the largest brunt of this impact through a reduced probability of being rehired.

In the second chapter of my dissertation, I study differences in labor force dynamics by age over the business cycle and explore prime-aged males' differential experiences through the Great Recession. The younger group is classified as males from ages 25 to 40 and the older group is defined as those ages 41 to 55. From the two-way transition model, I find that younger workers appear to be the first to lose their jobs in periods of slack demand, and that they have less chance of becoming re-employed when business cycle conditions worsen. When I include nonparticipants in the three-way transition model, this pattern is reinforced. Interestingly, I find different cyclical sensitivity patterns for lower skill workers in my first two chapters. Though minorities and younger workers both represent the less-skilled type of worker in the labor market, blacks and Hispanics are first-fired and first-hired while young men are first-fired and last-hired over the business cycle when controlling for a range of possible confounders. As the 2007 Great Recession was the longest contraction period since the Great Depression and the U.S. labor market experienced its deepest downturn since the postwar era, I again assessed workers' performances by comparing the two sub-periods (1996 to 2007 and 2008 to 2012). I find that there was a secular shift in the transition probabilities that would affect all workers in the sample negatively and this change was exaggerated for younger workers. However, the cyclical volatility was dampened for the young in the post-Great Recession period.

The third chapter is my job market paper. I use monthly matched data from CPS from 1996 to 2013, and the sample includes all males and females aged 20-64. In this paper, I analyze the cyclical sensitivities of immigrant versus native workers in the U.S. labor market. I find that immigrants are first-fired and first-hired over the business cycle, and that the immigrant-native unemployment gap is driven by immigrants' higher rates in the unemployment entry flow. I perform several robustness checks and this pattern remains unchanged after controlling for the cyclical influence of personal and job characteristics. I interpret the remaining gap in transitioning into unemployment as a result of potential discrimination and immigrants' lack of U.S.-specific human capital, and the gap in transitions into employment may be attributable to unfavorable public policies towards non-native born workers. For example, the 1996 federal welfare and immigration laws excluded most immigrants from eligibility for federal programs such as Medicare, non-emergency Medicaid, food stamps, and Supplemental Security Income (SSI). I also test for heterogeneity and conclude that immigrants with no more than a high school degree, working in construction, trade, or transportation industries drive the first-fired pattern, and the first-hired pattern is mainly driven by immigrants with characteristics such as residing in the West, holding less than college or masters (and above) degrees, or working in agricultural and financial industries.

My dissertation helps to understand two main important aspects of the U.S. labor market. First, despite the common belief to the contrary, minority ethnic groups and immigrant workers are the first hired as the economy improves. Thus, the underlying driver of the aggregate unemployment gap between minority and majority ethnic workers as well as the driver of the unemployment gap between immigrant and native workers lie in the unemployment entry rates. Second, although minorities, immigrants, and younger workers are often taken as a proxy of the lower productivity in the labor market due to their weaknesses in educational levels, labor market experiences, language and cognitive skills, etc., my

analysis presents that younger workers are more of a proxy for the lowest productivity since they are the only first-fired and last-hired group.

Chapter One
Racial Differences in Labor Market Transitions and the Great Recession

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February 2016

Abstract

Labor force transitions are empirically examined using CPS data matched across months from 1996-2012 for Hispanics, African-Americans and whites. Transition probabilities are contrasted prior to the Great Recession and afterwards. Estimates indicate that minorities are more likely to be fired as business cycle conditions worsen. Estimates also show that minorities are usually more likely to be hired when business cycle conditions are weak. During the Great Recession, the odds of losing a job increased for minorities although cyclical sensitivity of the transition declined. Odds of becoming re-employed declined dramatically for blacks, by 2-4 percent, while the probability was unchanged for Hispanics.

Introduction

Differences in unemployment rates between African-Americans and whites have long been the focus of popular concern. There are indeed persistent differences in the measured rates of unemployment across racial groups in the United States. The ratio of black-to-white unemployment rates has been roughly 2-to-1 for several decades since the 1950s (Fairlie and Sundstrom 1997, 1998). In Richard Freeman's (1973) classic study of racial patterns of labor market status from 1948 to 1972, he found that the level of employment for blacks was more volatile than that for whites and that the unemployment rate for blacks rises more than that for whites in percentage points when the economy weakens. Based on these findings, Freeman (1973) proposed a "last in, first out" pattern of black employment over the business cycle.

While much of the existing literature regarding the United States looks at increases and decreases in the unemployment rate to make inferences about rates of layoff and hiring over the business cycle (Allegretto and Lynch 2010; Bradbury 2000; Cattán 1988; Freeman 1973; Freeman and Rodgers 1999; Holzer and Offner 2006; Hoynes, Miller, and Schaller 2012), relatively few studies have examined the underlying transitions themselves (Couch and Fairlie 2010).¹ Changes in unemployment are driven by rates of layoff and hiring so that inferences based on the presumption that one transition alone drives the change in the level of unemployment may be inaccurate.

Similar to the earlier work of Freeman (1973), Cattán (1988) and Defreitas (1986) each document the growing presence of Hispanics in the U.S. work force in the 1980s. They show that the Hispanic unemployment rate is typically about 1.5 times higher than the rest of the population, and they are concentrated as a group in job categories especially vulnerable to business cycle downturns.

¹ Constant and Zimmerman (2014) and De la Rica and and Rebello-Sanz (2015) provide related analyses in the European contexts of Germany and Spain respectively.

While there is a sizeable literature (Abowd and Killingsworth 1984; Borjas and Tienda 1985; Hoynes 1999; Orrenius and Zavodny 2009) on the labor force status of Hispanics and Hispanic-white differences in the United States, to date, there has been no analysis of underlying labor market transitions that determine the unemployment rates of Hispanics. A better understanding of unemployment dynamics among this rapidly growing population group helps inform what the fundamental drivers are of changes in labor force aggregates. Hispanics now represent the largest minority group in the United States.

The National Bureau of Economic Research (NBER) dates the last recession as running from December 2007 to June 2009. At 18 months, it was the longest contraction period since the Great Depression. During this period the labor market also experienced its deepest downturn in the postwar era. The national unemployment rate rose 5 percentage points in only a year and a half, reaching a peak of 10 percent in October 2009. Because of these trends the recent recession was popularly dubbed the "Great Recession." Although much research has focused on unemployment and broader labor market conditions during the Great Recession, surprisingly previous research has not examined labor market transitions among blacks and Hispanics in the U.S. during this period and the subsequent period of slow employment growth.²

In this study, we use Current Population Survey (CPS) micro-data matched across adjacent months from 1996 to 2012 to examine two previously unanswered questions in the literature regarding unemployment dynamics. First, the paper examines differences between Hispanics and whites in addition to differences between blacks and whites in labor market transitions in relation to

² The continued period of poor labor market conditions are reflected in average unemployment rates that through the end of the sample period examined here, 2012, the unemployment rate among the civilian workforce was 8.2 percent.

the assertion that one would expect minorities to be the last hired at the end of growth periods and the first fired during recessions (Freeman 1973). Specifically, the rate at which minorities become employed should be pro-cyclical such that it should rise relative to that for whites when the economy grows and become most pronounced at the end of the expansion. The probability of becoming unemployed for minorities would be expected to be countercyclical such that it should rise relative to that for whites as the economy worsens. Such a pattern of labor market transitions would be consistent with the pattern often referred to as minorities being the last hired and first fired. The extension to consider Hispanics in the United States in this framework is new to this literature.³

Second, the paper is the first to examine racial differences in labor market transitions in the U.S. through the Great Recession. It makes use of monthly matched individual level CPS data from 1996 to 2012. This 17-year period is broken up into two sub-periods to provide a contrast between the experiences of different groups in the Great Recession versus prior years. This is the first detailed examination of changes in unemployment dynamics among Hispanics, blacks and whites in the United States brought on by the Great Recession.

The paper proceeds as follows. Section 1 briefly reviews the prior literature on the racial unemployment gap. Section 2 describes the data, sample selection and variable construction. Section 3 presents descriptive statistics and plots of the underlying transition rates between employment and unemployment. Sections 4 and 5 discuss the empirical model and results for transitions between unemployment and employment respectively. Section 6 extends the analysis to include transitions into and out of the labor force. Section 7 provides a test for changes across the pre-Great Recession period and afterwards. Section 8 contains a discussion of conclusions.

³ The analysis by de la Rica and Rebello-Sanz (2015) considers similar patterns among Spanish men and women.

1. Previous Literature

Richard Freeman (1973) first discussed “the widely asserted last in, first out pattern of black employment over the cycle” in his study of racial patterns of labor market status. Using annual data from 1948 to 1972, he explored the hypothesis by estimating separate regressions for labor market outcomes that included a trend variable and deviation of real gross national product from its trend by race. He found that the employment of blacks is strongly cyclical, rising relative to other groups in expansions and falling in recessions, and is of greater sensitivity, compared to whites, to short-run changes in GNP.

Studies of the business cycle and the relative employment status of blacks include Katherine Bradbury’s (2000) research on the gaps between disadvantaged groups and the rest of the economy from 1970 to 2000. She offered several explanations for historical patterns and provided some predictions as to how differences across groups in labor force status should respond to recessions or to an expansion like that of the 1990s. Her findings indicate that while virtually all groups see improvements in labor market outcomes during periods of growth, racial unemployment gaps had not been reduced to zero even during the sustained expansion of the 1990s.

Holzer and Offner (2006) used data from the CPS’s Outgoing Rotation Groups (CPS-ORG) to estimate the trends and cyclical rates of unemployment among young black men relative to other groups during the period from 1979 to 2000. Their findings suggested that employment trends among blacks were more negative over time than those of less-educated white or Hispanic men. Many other studies of the movement of labor force aggregates in response to business cycle conditions have similarly examined the movement of aggregate measures relative to demand and agree that employment and unemployment of blacks are more sensitive to business cycle conditions than for

whites (Bound and Freeman 1992; Clark and Summers 1981; Freeman and Rodgers 1999; Hoynes 1999).

Defreitas (1986) conducted a time-series study of the rapidly growing U.S. Hispanic labor force using quarterly CPS data from 1973 to 1985. The analysis reveals that the average unemployment rate of Hispanics is about 1.6 times that of whites and that the elasticity of the employment-to-population ratio with respect to aggregate demand is nearly twice that of the white population. Hoynes, Miller, and Schaller (2012) investigated movement of the employment rate, the unemployment rate, and the labor force participation rate by race-sex and education groups in the U.S. during the Great Recession and showed that the impacts of the Great Recession have been felt most strongly for black and Hispanic workers. They show that blacks and Hispanics experienced larger employment reductions and unemployment increases compared to whites. Their results show that the unemployment rate of blacks is more responsive to business cycle movements than the unemployment rate for Hispanics in the U.S., but the cyclicalities for both groups is greater than for whites.

The above studies have primarily examined the movement of aggregate measures of the labor force (employment and unemployment) relative to demand to try to infer underlying labor market transitions associated with the timing of hiring and firing. The shortcoming of this approach is that sources of fluctuations over time that are caused by changes in transition rates into and out of the labor force status cannot be revealed by changes in the level of an aggregate. A better understanding of whether unemployment is increasing primarily due to increased firing (transition out of employment) or reduced hiring (transition into employment), or the extent to which it is attributable to both requires a direct examination of the related transitions.

The studies of Badgett (1994), Blanchard and Diamond (1990), and Abraham and Shimer (2001)

developed a dynamic approach to explore differences in employment transitions and related these to movements of steady-state stocks of labor force aggregates over time. Badgett (1994) compared the effects of changing flows into and out of unemployment on the ratio of the black to the white unemployment rate. Using CPS data, the paper provides calculations of estimates of workers' net flows into and out of unemployment by comparing the stock of unemployed workers across months. Such dynamic analysis allows for more direct examination of the timing of hiring and firing patterns for racial groups over the business cycle.⁴

The papers of Blanchard and Diamond (1990) and Abraham and Shimer (2001) are important in developing theoretical frameworks that relate measures of the business cycle such as deviations of Gross Domestic Product from its potential level or local unemployment from a full employment level to both labor market transitions and steady state stocks of aggregate unemployment. Those papers provide a theoretical underpinning for studies such as this that are empirical in nature. One of the insights gained from those papers is that Markov transition probability matrices characterize the steady state stocks of labor force aggregates. In particular, inflows and outflows from any state determine its level.⁵

Extending these prior studies, Couch and Fairlie (2010) provided a detailed examination of labor market transitions for prime-age black and white men to examine the last hired, first fired hypothesis using monthly matched CPS data from 1989 to 2004. The study is important in modeling the relationship of underlying transitions that are elements of Markov transition probability matrices to

⁴ A similar study is conducted by Constant and Zimmermann (2014) in Germany. In the paper they examined the labor market transitions among self-employment, employment, and unemployment, focusing on the immigrant-native differential across the business cycle.

⁵ For example, in a two state model the level of either category is determined by the entry rate divided by the entry plus the exit rate.

aggregate rates of unemployment and explaining the cyclical movement of blacks relative to whites between employment, unemployment, and nonparticipation over the business cycle. Blacks are found to be the first fired as the business cycle weakens; however, no evidence was found that blacks are the last hired. The study might be summarized as supporting a pattern of blacks being first fired but also first hired in the period examined.

Two important questions, however, are not examined in the previous literature. First, what are the dynamic unemployment patterns of Hispanics in the U.S. relative to whites? Is the pattern of first fired, first hired over the business cycle found for blacks in the U.S. similar for Hispanics? Second, was the Great Recession associated in the U.S. with altered patterns of labor dynamics relative to earlier periods for Hispanics, blacks and whites, or were prior patterns even more pronounced in this severe economic downturn? Both questions are examined in this paper.

2. Data

2.1 Sample Selection

This paper uses individual-level records from matched monthly CPS data observations from 1996 to 2012 encompassing a 203-month time span. The CPS itself is a monthly survey of a probability sample of around 50,000 dwelling units a month. Instead of surveying a completely new set of housing units each month, the CPS re-samples households. The sample is divided into eight representative subsamples called rotation groups, and each month a new rotation group is added to the overall sample. Housing units in each rotation group are interviewed for four consecutive months, followed by an 8-month break, and then interviewed for four more months before exiting the survey.

This rotation pattern of the CPS makes it possible to match information on individuals across adjacent months by linking surveys.

The matching algorithm for the data is the same as the one used in Fairlie (2013), which is related to earlier work by Madrian and Lefgren (2000). Individuals present in the data in adjacent months have their data matched so that their labor market transitions can be directly observed. As the CPS data are the basis for calculation of the official U.S. unemployment rates, this matching procedure allows the labor market transitions of survey respondents to be related to aggregate unemployment at a monthly frequency.

After matching, the sample selected for this analysis consists of black, Hispanic and white males ages 25-55 to avoid modeling issues that would otherwise arise because of transitions associated with school enrollment, retirement, and childbearing. The white and black racial groups here are defined as white only and black only. The sample excludes any combined races such as White-Asian or Black-Asian. Hispanic in the sample is coded as an ethnicity and may be of any race. Thus, non-Hispanic whites, non-Hispanic blacks, and Hispanics are constructed as three mutually exclusive groups in the analysis. In the following part of this paper, minorities refer to the black and Hispanic groups as compared to the majority group that is represented by white males. As can be seen in Table 1, even when limiting the sample to prime-aged males, the sample sizes are still quite large. Roughly 3.3 million observations are available for the analysis. It would be interesting in future research to further disaggregate these categories into smaller groupings such as different countries of origin for the Hispanic portion of the sample.

2.2 Indicator for Labor Market Transition

To examine underlying transition probabilities, this paper first focuses on transitions between employment and unemployment⁶ by limiting the analysis sample to individuals who are in the labor force for any two consecutive months and excluding those who are not in the labor force. To better relate the underlying transitions to the aggregate stock of unemployment, the sample is expanded to include those not in the labor force in the second part of the analysis (Section 6). The linking of data across months makes it possible to create indicators for labor market transitions from one month to the next. The unemployment entry rate represents the probability that a person employed in one month will be unemployed in the following month. The unemployment exit rate represents the probability that a person unemployed in one month will be employed in the following month.

2.3 Business Cycle Measure

To measure business cycle conditions, a monthly state-level variable is constructed to capture demand in the labor market. The state-level business cycle control variable measures the deviation of the aggregate state unemployment rate from the national natural rate of unemployment (NRU). It captures shocks in state demand relative to a national measure of full employment. Variation in transitions in labor force status are driven in response to these different business cycle conditions across states. Data for the monthly aggregate state unemployment rate is retrieved from Bureau of Labor Statistics (BLS). The NRU applied in the analysis is 5.28 and was drawn from separate estimates of an expectations-augmented Phillips curve.⁷ A practical reason for using deviations of state level

⁶ The paper does not specify the influence of involuntary job leavers separately from voluntary job leavers because involuntary job leavers, those who quit to become unemployed, account for a small percentage of job leavers within each racial group defined in the sample (less than 5 percent in a typical year in the sample and less than 10 percent in a recent post-recession year).

⁷ The NRU of 5.28 is taken from the prior research of Couch and Fairlie (2010). More detail on its estimation

unemployment from a national NRU as the measure of local business cycle activity is that other measures that might be used are not available at a monthly frequency.

3. Transition Rates in the Sample Period and Trends over Time

Table 1 reports estimates of the unemployment rate as well as transition probabilities between employment and unemployment of blacks, Hispanics, and whites for the whole sample period. These figures were constructed by taking the individual matched CPS data observations and tabulating weighted transition probabilities to enter into the probability matrix in the table. Over the period from 1996-2012, the unemployment rate was 4.26 percentage points higher for blacks than for whites, and 1.97 percentage points higher for Hispanics than for whites. For both blacks and Hispanics, more than 2% of employed men were unemployed by the following month, whereas only 1.07% of employed white men were unemployed by the following month. The monthly probability of becoming re-employed was quite different for blacks and Hispanics when compared to whites. The unemployment exit rate for black men was 24.43% showing that unemployed blacks were less likely to become reemployed by the following month than unemployed whites who had an unemployment exit rate of 29.58%. However, with a higher unemployment exit rate of 37.02%, unemployed Hispanics in the sample were more likely to become reemployed in the following month than unemployed whites. Overall, Hispanics have more churning into and out of unemployment.

To compare patterns before and after the Great Recession, Table 2 provides similarly constructed estimates except that the unemployment rates and transition probabilities for different racial groups are reported for a period prior to the beginning of the Great Recession and afterwards. The racial

can be found there (p. 232). Also, that prior work considered time varying NRU as a possibility and found that estimations similar to those carried out in this analysis were robust to that alternative procedure.

unemployment gaps of blacks and Hispanics relative to whites stood at 6.28 and 2.51 percentage points respectively after the Great Recession. The unemployment gaps of blacks and Hispanics almost doubled relative to where they stood compared to whites (3.33 and 1.32 percentage points respectively) before the Great Recession. The magnitude of racial differences in transition rates into unemployment is also smaller in the period of 1996-2007 and larger in the period of 2008-2012 when compared to estimates in Table 1.

Table 1. Unemployment and Transition Rates by Race: Matched Current Population Surveys, 1996-2012

	White(%)	N	Black(%)	N	Hispanic(%)	N	White-Black Difference(%)	White-Hispanic Difference(%)
Unemployment Rate	3.62	2,647,856	7.88	259,816	5.59	379,156	-4.26	-1.97
Unemployment Entry Rate	1.07	2,555,860	2.08	239,806	2.09	358,332	-1.01	-1.02
Unemployment Exit Rate	29.58	91,996	24.43	20,010	37.02	20,824	5.15	-7.44

Notes: The sample consists of males aged 25-55 who are in the labor force for any two consecutive months. All estimates are calculated using sample weights provided by the CPS.

Table 2. Unemployment and Transition Rates by Race: Matched Current Population Surveys

	White(%)	N	Black(%)	N	Hispanic(%)	N	White-Black Difference(%)	White-Hispanic Difference(%)
1996-2007								
Unemployment Rate	2.79	1,928,630	6.12	183,697	4.11	253,275	-3.33	-1.32
Unemployment Entry Rate	0.96	1,875,443	1.91	172,495	1.76	242,832	-0.95	-0.8
Unemployment Exit Rate	35.22	53,187	30.4	11,202	43.7	10,443	4.82	-8.48
2008-2012								
Unemployment Rate	5.74	719,226	12.02	76,119	8.25	125,881	-6.28	-2.51
Unemployment Entry Rate	1.36	680,417	2.51	67,311	2.71	115,500	-1.15	-1.35
Unemployment Exit Rate	22.55	38,809	17.26	8,808	31.04	10,381	5.29	-8.49

Notes: The sample consists of males aged 25-55 who are in the labor force for any two consecutive months. All estimates are calculated using sample weights provided by the CPS.

Another strong pattern in Table 2 is large within groups changes in transition rates in the period after the Great Recession relative to before it began. For example, among whites, blacks, and Hispanics, rates of entry into unemployment increased from .96 to 1.36, 1.91 to 2.51, and 1.76 to 2.71 percent respectively. Movements in the transition rates from unemployment to employment changed more dramatically. Among whites, blacks and Hispanics, rates of re-employment fell from 35.2 to 22.6, 30.4 to 17.26 and 43.7 to 31.0 percent respectively. These dramatic reductions in rates of re-employment across all groups are a key factor in explaining increased unemployment during the Great Recession.

The seasonally adjusted aggregate unemployment rate and the underlying transitions are plotted in Figures 1-3 to show their variation over the business cycle. Figure 1 shows the unemployment rates of blacks, Hispanics, and whites from 1996 to 2012. The gaps between minorities and whites were the smallest in the sample period of the late 1990s near the conclusion of a prolonged period of economic expansion. After 2000 the gaps widen and then remain roughly constant until the economy entered the recession in 2008.⁸ The racial unemployment gaps were greatest in the period following the initiation of the Great Recession.

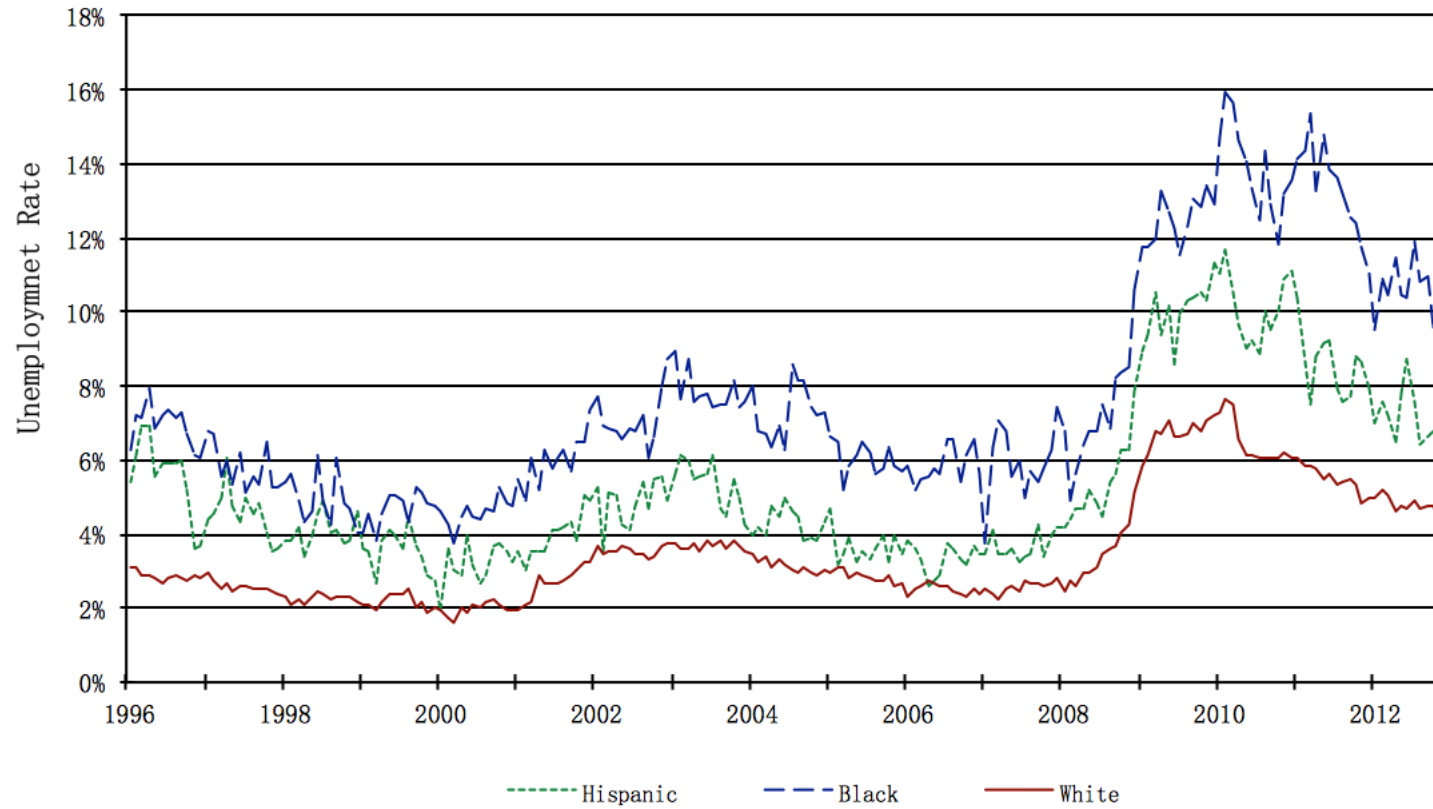
Figure 2 shows the movement of unemployment entry rates by race from 1996 to 2012. The transition rates from employment to unemployment are typically doubled for blacks and Hispanics relative to whites during the sample period. The racial gaps between minorities and whites appear to be most narrow in the years 1999 and 2000 when the business cycle peaked. The gaps have become visibly more pronounced since the Great Recession began.

Figure 3 shows the movement of unemployment exit rates by race from 1996 to 2012. There is

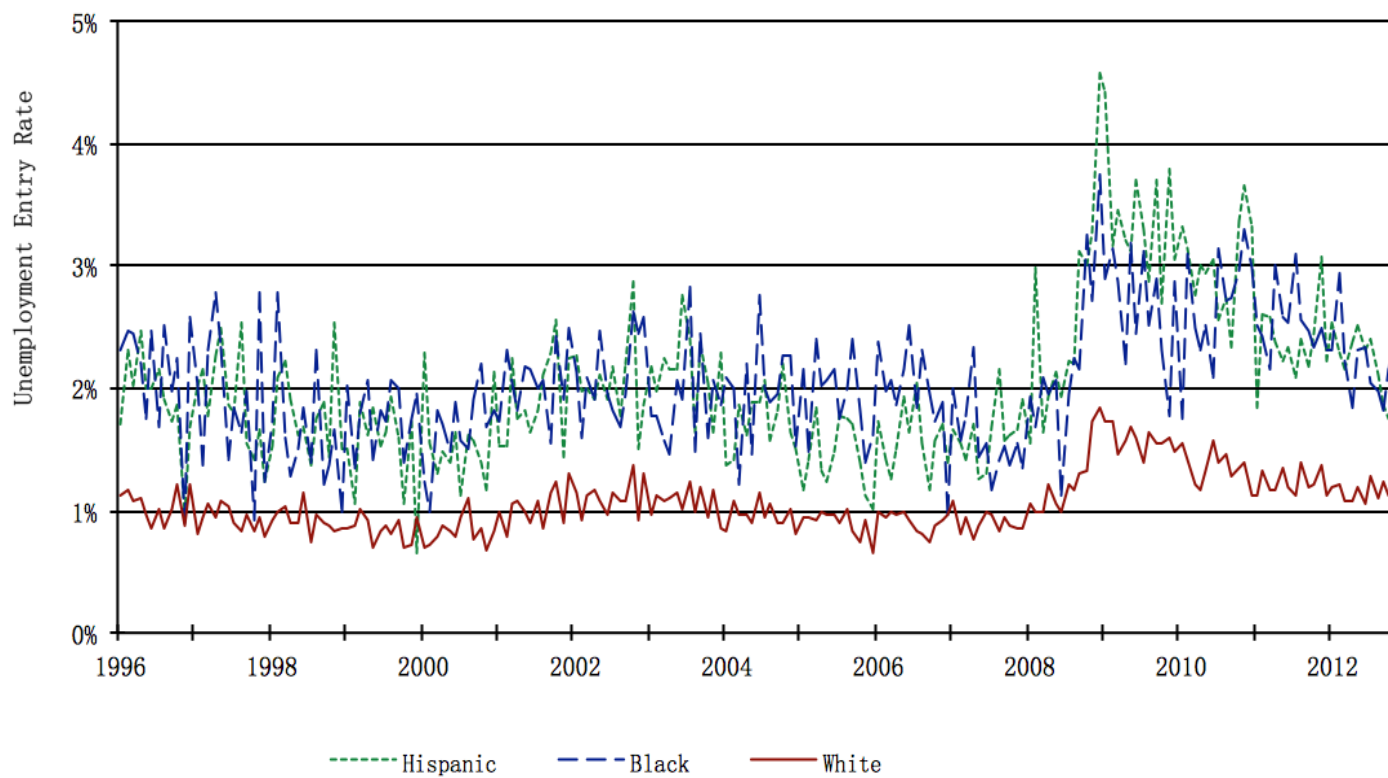
⁸ The Great Recession officially began in December of 2007. Thus, 2008 was the first full recessionary year.

not a large gap in the black and white series while the Hispanic exit rate from unemployment exceeds that of whites for most of the sample period. All series appear to be strongly associated with the business cycle such that peaks appear around the growth period of late 1990s and troughs appear after the 2008 Great Recession.

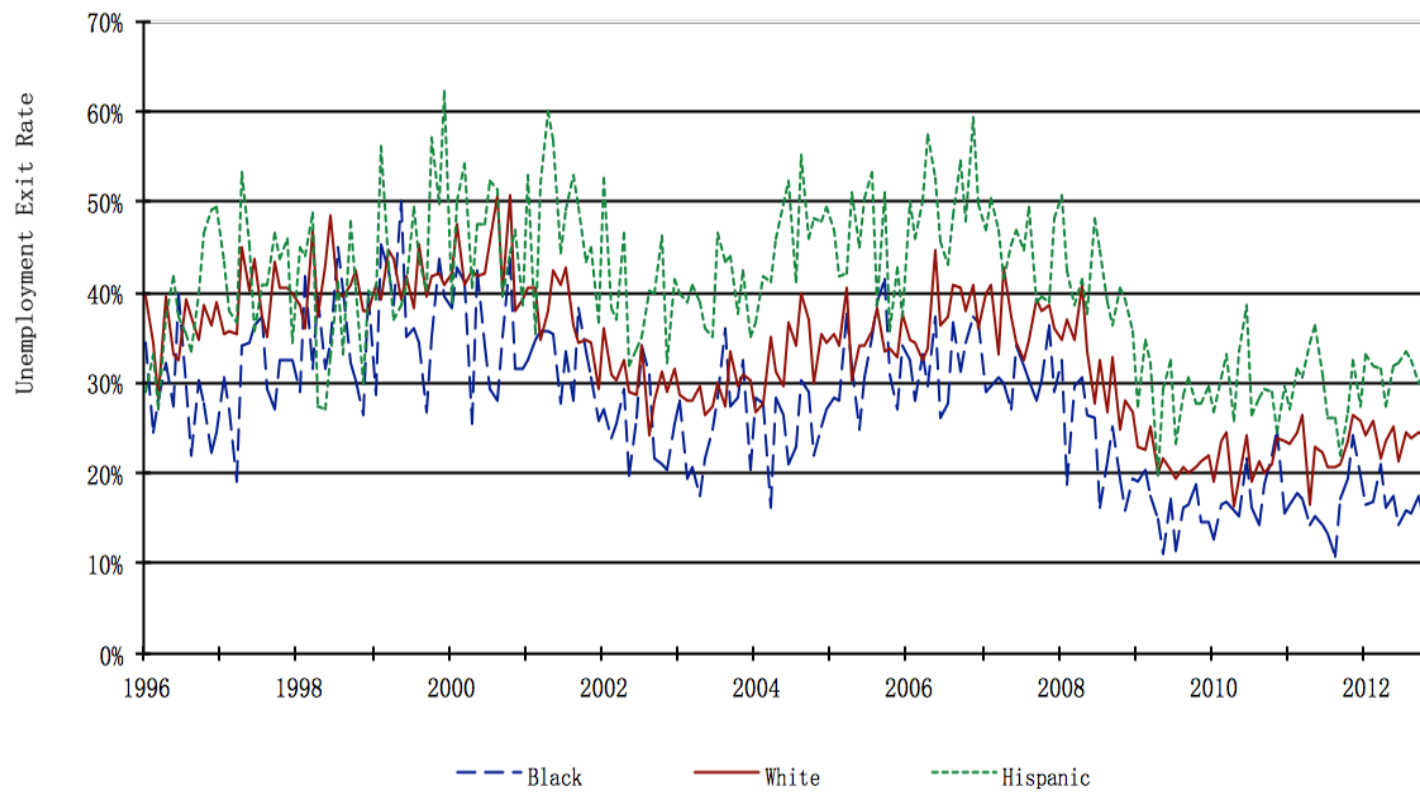
**Figure 1. Seasonally Adjusted Monthly Unemployment Rates by Race for Men Aged 25-55:
Current Population Surveys, 1996-2012**



**Figure 2. Seasonally Adjusted Monthly Unemployment Entry Rates by Race for Men Aged 25-55:
Current Population Surveys, 1996-2012**



**Figure 3. Seasonally Adjusted Monthly Unemployment Exit Rates by Race for Men Aged 25-55:
Current Population Surveys, 1996-2012**



In examining these series, the relatively large rate at which blacks and Hispanics enter unemployment relative to the fairly similar rates at which all groups exit unemployment shows that the transition from employment to unemployment is more important in explaining their relatively high unemployment rates. Blacks as a group have the lowest exit rates from unemployment to employment which also contributes to their relatively high unemployment rate. Hispanics have the most rapid exit rates from unemployment which is why their group rate of unemployment (Figure 1) is always below that of Blacks.

4. Model

To examine racial differences in the transition probabilities with respect to business cycle conditions, a linear probability model (LPM) estimated by ordinary least squares (OLS) that controls for individual and job characteristics is used in all of the multivariate estimations. The regression framework in the empirical model is as follows:

$$\begin{aligned}
T_{pqist} = & \beta_0 + \beta_1 Black_{ist} + \beta_2 Hispanic_{ist} + \beta_3 Undiff_{st} + \beta_4 Undiff_{st} \times Black_{ist} \\
& + \beta_5 Undiff_{st} \times Hispanic_{ist} + \beta_6 Undiff_{st} \times Rising(Falling)_t + \beta_7 Undiff_{st} \\
& \times Rising(Falling)_t \times Black_{ist} + \beta_7 Undiff_{st} \times Rising(Falling)_t \times Hispanic_{ist} \\
& + \chi_{ist} \delta + \alpha_s + \gamma_t + \epsilon_{ist}
\end{aligned}$$

where i references the individual, s their state, and t the month. The dependent variable T (transition probability) is a binary variable representing the probability that a person in state p (U, E, or NLF) in one month will be in state q (U, E, or NLF) in the following month, where U is unemployment, E is employment, and NLF is not in the labor force. *Black* is a dummy variable indicating whether an individual is black. *Hispanic* is a dummy variable indicating whether an individual is Hispanic. *Undiff*

is the business cycle control variable measuring the deviation of the state demand relative to a national measure of full employment, which is equal to the state-level aggregate unemployment rate minus the national natural rate of unemployment (NRU).

Rising (Falling) is a dummy variable for whether it is a period of rising (falling) aggregate unemployment⁹. X is a set of control variables including age, age-squared, marital status, education, and two-digit occupation and industry codes. α and γ represent state and month fixed effects, respectively. ε is the error term. The main coefficients of interest are β_4 and β_5 , which measure the sensitivity of blacks and Hispanics to business cycle conditions. Standard errors are calculated using methods that account for clustering due to multiple observations per individual.

5. Empirical Results for the Unemployment Transitions

5.1 Transition Probability from Employment to Unemployment

Panel A of Table 3 shows OLS estimates for the transition probability from employment to unemployment for the period from 1996-2012. Specification 1 reports estimates for the dummy variable for black and Hispanic and the business cycle control from a model that also includes measures of age and its square, marital status, education, occupation, industry, and state and month fixed effects. The black-white differential in the transition probability is 0.97 percentage points. The Hispanic-white differential is 0.34 percentage points. The parameter for the business cycle control indicates that the probability of moving from employment to unemployment increases as demand weakens for all workers. Appendix Tables A.1, A.2, and A.3 contain descriptive statistics for the

⁹ *Rising (falling)* takes the value 1 for a month when the state-level unemployment rate in the following month is higher (lower) than the unemployment rate in the current month, and takes the value 0 for a month when the state-level unemployment rate in the following month is lower (higher) or the same as that in the current month.

variables used in the regressions when transitions among those in the labor force are considered (between the states of unemployment and employment).

Specification 2 includes the interactions between the dummy variables for black and Hispanic, and the business cycle control variable along with the same regressors contained in Specification 1. Blacks and Hispanics have a somewhat higher base probability of entering unemployment than whites, 0.009 and 0.002 respectively. The estimate for the business cycle control variable indicates that as the unemployment rate increases by 1 percentage point, all men have a 0.12 percentage point higher probability of entering unemployment. The interaction terms indicate that both black and Hispanic men have a stronger cyclical response than whites. The interaction term between being black and the business cycle variable indicates that for each percentage-point increase in unemployment, the transition probability for blacks rises by 0.07 of a percentage point more than for whites. And the interaction term between being Hispanic and the business cycle shows that for each percentage-point increase in unemployment, the transition probability for Hispanics rises by 0.12 of a percentage point more than for whites. Both of these results are statistically significant at conventional levels across all specifications of the model.

Specification 3 drops the extra control variables included in Specification 2 to examine their influence on the parameter estimates. Comparing these two columns, one can see that the parameter estimates associated with the interactions between the indicators for minority status and the business cycle barely change. Thus, the inclusion or exclusion of the control variables has little influence on the relationship between the movement of blacks and Hispanics into unemployment and the business cycle.

Specification 4 includes an interaction between the business cycle control variable, a dummy

variable for whether it is a period of rising aggregate unemployment, and the dummy variables for minority status to test whether the unemployment entry rate among minorities responds more strongly when the labor market is becoming more slack. The interaction term for blacks is statistically insignificant and does not provide any evidence that blacks respond differently to business cycle conditions in periods of rising unemployment, whereas the relevant parameter for Hispanics is positive and statistically significant showing that unemployment transitions for Hispanics increase more sharply in periods of rising unemployment relative to other months. Overall, the results from Panel A are consistent with the view that minorities are first fired during a recession.

Panel A of Tables 4 and 5 report additional OLS estimates of a linear probability model for the unemployment entry rate for the sample periods of 1996-2007 and 2008-2012, respectively (before the Great Recession and afterwards). Panel A of Table 4 shows that both blacks and Hispanics have higher monthly transition probabilities from employment to unemployment than whites. The transition probability also increases more for them than for whites for each percentage-point increase in unemployment based on the estimates for the interaction between minority status and the business cycle. However, their rates of transition into unemployment also do not respond more strongly to business cycle conditions in periods of rising unemployment. These estimates before the Great Recession provide evidence that is consistent with the evidence reported for blacks in the earlier period from 1989 to 2004 by Couch and Fairlie (2010).¹⁰ This estimates from Panel A of Table 4 are also largely consistent with parameter estimates found in Panel A of Table 3 for the entire sample period.

Panel A of Table 5 reports the estimation results for the period from 2008-2012, the portion of the

¹⁰ Unemployment patterns for Hispanics were not examined in this study.

overall sample occurring after the initiation of the Great Recession. The results for Hispanics show that they are more likely to enter unemployment than whites, that their unemployment entry rate is more sensitive to business cycle conditions, and that there is an even stronger cyclical response when the labor market is becoming weaker (as *Undiff* increases). The results for blacks reveal a higher unemployment entry rate than whites but no group cyclical response beyond that for whites. In terms of cyclical response, the first fired hypothesis in the Great Recession is only supported by findings in the Hispanic-white comparison after the Great Recession. Thus, the finding that all minorities are the first fired over the entire sample period and prior to the Great Recession is not found for blacks in the post-recessionary period although all of the parameter estimates remain positive.

Table 3. Labor Force Transitions Using Matched Current Population Surveys: 1996-2012

Regressor	Specification			
	(1)	(2)	(3)	(4)
Panel A. Linear Regressions for Probability of Employment-to-Unemployment Transition				
Black	0.00973*** (0.000355)	0.00931*** (0.000351)	0.0104*** (0.000350)	0.00931*** (0.000351)
Hispanic	0.00335*** (0.000310)	0.00213*** (0.000312)	0.00902*** (0.000297)	0.00211*** (0.000312)
Undiff	0.00150*** (0.0000469)	0.00122*** (0.0000472)	0.00119*** (0.0000473)	0.00109*** (0.0000554)
Undiff*Black		0.000692*** (0.000184)	0.000627*** (0.000185)	0.000560** (0.000218)
Undiff*Hispanic		0.00118*** (0.000143)	0.00119*** (0.000144)	0.000925*** (0.000166)
Undiff*Rising				0.000388*** (0.0000877)
Undiff*Rising*Black				0.000385 (0.000373)
Undiff*Rising*Hispanic				0.000805*** (0.000282)
Sample size	3,150,683	3,150,683	3,150,683	3,150,683
Mean of dependent variable	0.01319	0.01319	0.01319	0.01319
Panel B. Linear Regressions for Probability of Unemployment-to-Employment Transition				
Black	-0.0511*** (0.00429)	-0.0549*** (0.00537)	-0.0576*** (0.00535)	-0.0550*** (0.00537)
Hispanic	0.0674*** (0.00498)	0.0605*** (0.00621)	0.0815*** (0.00605)	0.0605*** (0.00621)
Undiff	-0.0324*** (0.000669)	-0.0335*** (0.000783)	-0.0335*** (0.000785)	-0.0334*** (0.000878)
Undiff*Black		0.00232 (0.00161)	0.00160 (0.00162)	0.00131 (0.00184)
Undiff*Hispanic		0.00335** (0.00166)	0.00330** (0.00168)	0.00262 (0.00188)
Undiff*Falling				-0.000451 (0.00116)
Undiff*Falling*Black				0.00290 (0.00242)
Undiff*Falling*Hispanic				0.00198 (0.00234)
Sample size	131,761	131,761	131,761	131,761
Mean of dependent variable	0.30102	0.30102	0.30102	0.30102

Notes: The sample consists of males aged 25-55 who are in the labor force for any two consecutive months. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. All specifications also included a constant, age, age squared, marital status, education, occupation and industry, and state and month fixed effects except Specification 3, which excludes age, marital status, education, occupation and industry.

*p< 0.1; **p< 0.05; ***p< 0.01

Table 4. Labor Force Transitions Using Matched Current Population Surveys: 1996-2007

Regressor	Specification			
	(1)	(2)	(3)	(4)
Panel A. Linear Regressions for Probability of Employment-to-Unemployment Transition				
Black	0.00900*** (0.000398)	0.00943*** (0.000434)	0.0107*** (0.000434)	0.00944*** (0.000435)
Hispanic	0.00201*** (0.000343)	0.00218*** (0.000350)	0.00839*** (0.000336)	0.00218*** (0.000350)
Undiff	0.00176*** (0.000104)	0.00148*** (0.000104)	0.00142*** (0.000104)	0.00149*** (0.000114)
Undiff*Black		0.00123*** (0.000367)	0.00119*** (0.000368)	0.00117*** (0.000424)
Undiff*Hispanic		0.00127*** (0.000315)	0.00149*** (0.000317)	0.00138*** (0.000376)
Undiff*Rising				-0.0000343 (0.000143)
Undiff*Rising*Black				0.000188 (0.000680)
Undiff*Rising*Hispanic				-0.000339 (0.000628)
Sample size	2,287,455	2,287,455	2,287,455	2,287,455
Mean of dependent variable	0.01160	0.01160	0.01160	0.01160
Panel B. Linear Regressions for Probability of Unemployment-to-Employment Transition				
Black	-0.0504*** (0.00617)	-0.0504*** (0.00616)	-0.0531*** (0.00607)	-0.0505*** (0.00615)
Hispanic	0.0625*** (0.00725)	0.0615*** (0.00727)	0.0845*** (0.00695)	0.0616*** (0.00727)
Undiff	-0.0482*** (0.00257)	-0.0499*** (0.00290)	-0.0512*** (0.00294)	-0.0486*** (0.00333)
Undiff*Black		0.000462 (0.00561)	-0.000540 (0.00567)	-0.00218 (0.00697)
Undiff*Hispanic		0.00944 (0.00616)	0.0115* (0.00626)	0.0131* (0.00749)
Undiff*Falling				-0.00338 (0.00446)
Undiff*Falling*Black				0.00687 (0.0102)
Undiff*Falling*Hispanic				-0.00944 (0.0114)
Sample size	74,251	74,251	74,251	74,251
Mean of dependent variable	0.35787	0.35787	0.35787	0.35787

Notes: The sample consists of males aged 25-55 who are in the labor force for any two consecutive months. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. All specifications also included a constant, age, age squared, marital status, education, occupation and industry, and state and month fixed effects except Specification 3, which excludes age, marital status, education, occupation and industry.

*p < 0.1; **p < 0.05; ***p < 0.01

Table 5. Labor Force Transitions Using Matched Current Population Surveys: 2008-2012

Regressor	Specification			
	(1)	(2)	(3)	(4)
Panel A. Linear Regressions for Probability of Employment-to-Unemployment Transition				
Black	0.0116*** (0.000742)	0.0106*** (0.00116)	0.0111*** (0.00117)	0.0105*** (0.00116)
Hispanic	0.00527*** (0.000625)	0.00271*** (0.000960)	0.0122*** (0.000935)	0.00242** (0.000960)
Undiff	0.00103*** (0.000106)	0.000844*** (0.000106)	0.000776*** (0.000107)	0.000704*** (0.000111)
Undiff*Black		0.000353 (0.000342)	0.000380 (0.000344)	0.000214 (0.000363)
Undiff*Hispanic		0.000769*** (0.000247)	0.000650*** (0.000249)	0.000575** (0.000261)
Undiff*Rising				0.000527*** (0.000105)
Undiff*Rising*Black				0.000425 (0.000431)
Undiff*Rising*Hispanic				0.000820*** (0.000307)
Sample size	863,228	863,228	863,228	863,228
Mean of dependent variable	0.01713	0.01713	0.01713	0.01713
Panel B. Linear Regressions for Probability of Unemployment-to-Employment Transition				
Black	-0.0516*** (0.00582)	-0.0828*** (0.0124)	-0.0856*** (0.0124)	-0.0830*** (0.0124)
Hispanic	0.0732*** (0.00676)	0.0721*** (0.0134)	0.0902*** (0.0133)	0.0722*** (0.0134)
Undiff	-0.0234*** (0.00155)	-0.0249*** (0.00170)	-0.0251*** (0.00171)	-0.0248*** (0.00175)
Undiff*Black		0.00849*** (0.00285)	0.00796*** (0.00286)	0.00764** (0.00298)
Undiff*Hispanic		0.000295 (0.00281)	0.0000608 (0.00285)	-0.000281 (0.00298)
Undiff*Falling				-0.000597 (0.00124)
Undiff*Falling*Black				0.00263 (0.00247)
Undiff*Falling*Hispanic				0.00154 (0.00239)
Sample size	57,510	57,510	57,510	57,510
Mean of dependent variable	0.23487	0.23487	0.23487	0.23487

Notes: The sample consists of males aged 25-55 who are in the labor force for any two consecutive months. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. All specifications also included a constant, age, age squared, marital status, education, occupation and industry, and state and month fixed effects except Specification 3, which excludes age, marital status, education, occupation and industry.

*p < 0.1; **p < 0.05; ***p < 0.01

5.2 Transitions from Unemployment to Employment

Panel B of Table 3 reports OLS estimates of the LPM for moving from unemployment to employment during the sample period from 1996 to 2012. Specification 1 reports estimates for the base equation, which includes a dummy variable for black and Hispanic along with the business cycle control. Specification 2 includes the interactions between the dummy variable for black or Hispanic and the business cycle control. Results from these two models indicate that blacks are less likely than whites to move from unemployment to employment while Hispanics are more likely than whites to move from unemployment to employment after controlling for education, occupation, industry, and other individual characteristics. The parameter estimates associated with the business cycle variable indicate that all the workers in the sample have less chance of moving from unemployment to employment when demand conditions are weak. The parameter associated with the interaction between the business cycle control variable and the dummy variable for Hispanic is positive and statistically significant showing that Hispanic men are more likely to be reemployed than whites when demand conditions are relatively weak. The parameter associated with the interaction between the business cycle control variable and the dummy for black is positive and statistically insignificant indicating that black men do not differ from white men in their cyclical responsiveness to changes in the tightness of labor markets. For both blacks and Hispanics there are no findings over the full sample period that suggest minority groups are last hired throughout the business cycle.¹¹

Specification 3 again excludes the controls for personal and job characteristics. By contrasting the results with those in Specification 2, it can be seen that the exclusion of those controls has little

¹¹ In another set of regressions, we exclude the self-employed people from the employed workers, and blacks are found to be more likely to be reemployed than whites while Hispanic workers do not respond differently from white men. The conclusion is again there are no findings supporting the minority groups being last hired throughout the business cycle.

impact on the reported parameter estimates. Specification 4 includes an interaction between the business cycle control variable, a dummy variable for whether it is a period of falling aggregate unemployment, and the dummy variable for minority to test whether the unemployment exit rate among minorities responds more strongly when the labor market is in a period of growing demand. Since the relevant interaction terms are statistically insignificant, there is no evidence that minorities have a different degree of responsiveness than white men to periods of falling unemployment in terms of the probability of being reemployed. Thus, the parameter estimates of the association of the business cycle to the probability of moving from unemployment to employment appear to be symmetric during periods of rising and falling aggregate demand.

Panel B of Tables 4 and 5 respectively report similar OLS parameter estimates for the LPM in sample periods prior to the Great Recession and afterwards. Panel B of Table 4 contains estimates for the period from 1996-2007. The parameters associated with the dummy variables for being black or Hispanic (similar to those in Panel B of Table 3) show that blacks are less likely to be reemployed and Hispanics are more likely to be reemployed in the following month. In specifications (3) and (4), similar to the entire sample, Hispanics are found to be more likely to transition from unemployment to employment when business cycle conditions are weak while blacks do not have a differential responsiveness to business cycle conditions relative to whites. Also, there is no evidence of differential responsiveness of blacks or Hispanics to periods of rising or falling unemployment. Thus, in the period of the sample prior to the Great Recession, there is no evidence that blacks or Hispanics are hired later in a business cycle recovery than whites in response to improving demand conditions.

Panel B of Table 5 reports the estimation results for the unemployment exit rate from 2008 to 2012. The base transition probabilities (parameters for the black and Hispanic dummies) remain

similar for blacks and Hispanics in comparison to the earlier sample period (Panel B Table 4). The interaction between the business cycle control variable and the dummy for blacks is positive and statistically significant across specifications (2), (3), and (4) which indicates that blacks are hired more quickly when demand conditions are weak. This result is inconsistent with the last hired hypothesis. Also, across specifications (2), (3), and (4) there is no evidence of a differential responsiveness of Hispanics to business cycle conditions in making the transition from unemployment to employment than whites. There is also no evidence in specification (4) that blacks and Hispanics respond stronger to business cycles in periods of falling unemployment.

For all the above estimates related to the transition from unemployment to employment, the last hired hypothesis is not supported when comparing blacks or Hispanics to whites either in the entire sample or the two sub-periods examined. On the other hand, black men actually had a higher probability of being reemployed in the sample period after the Great Recession, and Hispanics were more likely to be reemployed than whites in the sample period of 1996-2012.

6. Empirical Results for Transitions into and out of the Labor Force

6.1 Monthly Transition Probabilities

The last hired, first fired hypothesis cannot be fully examined without considering transitions involved with nonparticipation in the labor force. As the economy worsens, it is likely that an increasing portion of the labor force would move directly from being employed to nonparticipation. Also as the economy recovers, it is more likely that the probability of movement from nonparticipation to employment would rise. Here the analysis is expanded to include movements into and out of the labor force. Figure 4 shows the pattern of the proportion of the civilian population older than 16 NILF (Not in the Labor Force) over the sample period of 1996-2012. The NILF rates are relatively stable for all the racial groups over the sample years, as compared with the unemployment rates in Figure 1, and the unemployment entry and exit rates in Figures 2 and 3. Black workers are more likely to be NILF than Hispanic or white workers, with group rates for blacks ranging roughly from 15 to 20 percent. The proportions NILF for Hispanic and white men range from about 7 to 10 percent over the sample period. Thus, this suggests that the additional margin of being out of the labor force may be important in considering disaggregated transitions, particularly for blacks.

Table 6 provides a preview of monthly transition probabilities between employment, unemployment, and nonparticipation of blacks, Hispanics, and whites over the entire sample period from 1996-2012. These figures were tabulated from all of the matched monthly observations of CPS data. The average probability of moving from employment to not in the labor force for all males in the sample is 0.011. This probability is slightly lower for whites and slightly higher for Hispanics. Blacks move from employment to nonparticipation at a much higher rate of 0.021, almost double the probability for whites and Hispanics. Comparing the transition probabilities of moving from employment to not in the labor force and from employment to unemployment, it can be seen that there is a roughly same likelihood between the two for blacks and whites (0.021 and 0.020 for blacks; 0.009 and 0.011 for whites). For Hispanics, these two probabilities are .016 and .021 respectively – closer to those of blacks than whites. Thus, it would be an important omission to

exclude the transition from employment to not in the labor force from the analysis.

Another important transition in interpreting the racial differences in labor force behavior over the business cycle is the movement from not in the labor force directly to employment. Hispanics are more likely than whites and blacks to move from nonparticipation to employment the following month: 14% of Hispanic men move from not in the labor force to employment monthly compared with 8% of white and black men. Comparing the probability of moving from not in the labor force to employment and the probability of moving from unemployment to employment, the transition from being out of the labor force accounts for about half of all entry into employment. Thus, it is also important to include this transition in explaining hiring patterns.

To provide descriptive evidence of the changes in transition rates before and after the Great Recession, Table 7 provides tabulations constructed in the same way as those presented in Table 6 for the periods of the sample prior to the Great Recession and afterwards. Comparing the pre- and post-Great Recession periods, the probability of entering employment directly from out of the labor force decreased from 8.3% to 6.5% for blacks, 8.6% to 6.9% for whites, and 15% to 12.5% for Hispanics. These reduced prospects of moving from nonparticipation to employment in addition to the smaller probabilities of moving from unemployment to employment already documented in Table 1 contribute to the drop in re-employment that is a key factor in increasing aggregate unemployment among all groups in the post-Great Recession period.

**Figure 4. Seasonally Adjusted Monthly NILF (Not in the Labor Force) Rates by Race for Men Aged 25-55:
Current Population Surveys, 1996-2012**

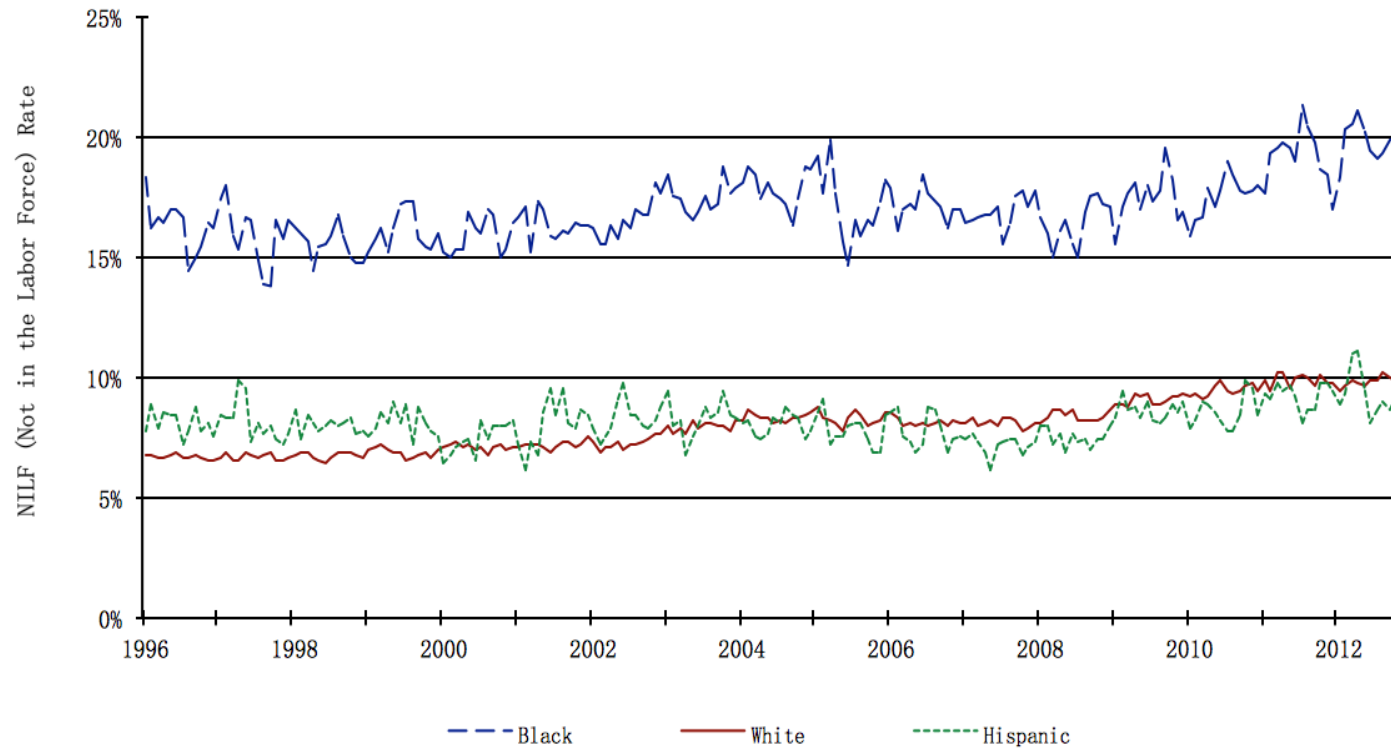


Table 6. Monthly Transition Probabilities: Matched Current Population Surveys, 1996-2012

Sample and Status This Month	Status Next Month		
	Employed	Unemployed	Not in the Labor Force
Males Aged 25-55			
Employed	0.9758	0.013	0.0112
Unemployed	0.2584	0.6013	0.1402
Not in the Labor Force	0.0874	0.0603	0.8523
Black Males Aged 25-55			
Employed	0.9585	0.0204	0.0212
Unemployed	0.1979	0.6122	0.1899
Not in the Labor Force	0.0769	0.0719	0.8512
White Males Aged 25-55			
Employed	0.9804	0.0106	0.009
Unemployed	0.2583	0.6147	0.1271
Not in the Labor Force	0.0803	0.0538	0.8659
Hispanic Males Aged 25-55			
Employed	0.9639	0.0206	0.0155
Unemployed	0.322	0.5479	0.1302
Not in the Labor Force	0.1401	0.077	0.7829

Notes: The sample consists of males aged 25-55. All estimates are calculated using sample weights provided by the CPS.

**Table 7. Monthly Transition Probabilities: Matched Current Population Surveys
1996-2007**

Sample and Status This Month	Status Next Month		
	Employed	Unemployed	Not in the Labor Force
Males Aged 25-55			
Employed	0.9776	0.0115	0.011
Unemployed	0.3048	0.5479	0.1472
Not in the Labor Force	0.0932	0.0521	0.8548
Black Males Aged 25-55			
Employed	0.9604	0.0187	0.021
Unemployed	0.2427	0.5556	0.2017
Not in the Labor Force	0.0831	0.0619	0.855
White Males Aged 25-55			
Employed	0.9817	0.0095	0.0088
Unemployed	0.3062	0.5632	0.1306
Not in the Labor Force	0.0861	0.0473	0.8665
Hispanic Males Aged 25-55			
Employed	0.9672	0.0173	0.0155
Unemployed	0.3747	0.4826	0.1427
Not in the Labor Force	0.1496	0.0637	0.7867
2008-2012			
Males Aged 25-55			
Employed	0.9712	0.0169	0.0118
Unemployed	0.2032	0.6648	0.132
Not in the Labor Force	0.0761	0.0764	0.8475
Black Males Aged 25-55			
Employed	0.9538	0.0246	0.0217
Unemployed	0.1423	0.6823	0.1753
Not in the Labor Force	0.0646	0.0918	0.8436
White Males Aged 25-55			
Employed	0.9769	0.0135	0.0096
Unemployed	0.1979	0.6795	0.1226
Not in the Labor Force	0.0688	0.0666	0.8647
Hispanic Males Aged 25-55			
Employed	0.9578	0.0267	0.0154
Unemployed	0.2736	0.6078	0.1186
Not in the Labor Force	0.1249	0.0982	0.7769

Notes: The sample consists of males aged 25-55. All estimates are calculated using sample weights provided by the CPS

It is obvious that the employment situation before the Great Recession period is better than afterwards; however, in the later period the increase in the exit from employment occurs mostly in the movement from employment to unemployment rather than the movement from employment to not in the labor force. This suggests that those who became unemployed had a stronger attachment to the labor market. Comparing the transitions from employment to nonparticipation for blacks, whites, and Hispanics, there is not much difference between the pre- and post-Great Recession period (0.021 and 0.022 for blacks; 0.009 and 0.010 for whites; 0.016 and 0.015 for Hispanics). This indicates that most people who exit from employment become unemployed instead of leaving the labor force.

6.2 Estimated Transitions across Labor Force States

To examine whether the movement into and out of the labor force would alter or reinforce the evidence presented in Section 5 regarding the last hired, first fired hypothesis, in this section transitions between all three labor force states are examined (employment, unemployment, NILF). Panel A of Table 8 reports OLS estimates of the possible transitions in a transition probability matrix from LPM across the three labor force states for the whole sample period 1996-2012. All specifications include the dummy variable for black, Hispanic, the business cycle control, and their interactions, comparable to Specification 2 in Table 3. Appendix Tables A.4, A.5, and A.6 provide descriptive statistics for the dependent and independent variables used in carrying out these estimates for the full sample, the pre-recessionary and post-recessionary periods respectively.

In Panel A of Table 8, the OLS coefficients obtained from the LPM for the transition from employment to unemployment are similar to those reported in Panel A of Table 3. For both blacks and Hispanics, the coefficients (*Undiff*Black* and *Undiff*Hispanic*) are small, positive, and statistically

significant, confirming minorities being more sensitive to the business cycle than whites. The regression coefficients ($Undiff*Black$ and $Undiff*Hispanic$) for the transition from employment to nonparticipation are statistically insignificant for both blacks and Hispanics, providing no evidence of apparent relationship with the business cycle. Combining the evidence regarding different routes of leaving employment, it confirms that minorities have a stronger cyclical response to the business cycle than whites. Results from the inclusion of transitions across all labor force states are consistent with minorities being first fired, i.e. being more likely to exit employment when demand conditions weaken. Column 3 in Table 8 Panel A reports the OLS estimates of the LPM for moving from unemployment to employment, similar to those in Panel B of Table 3. Both blacks and Hispanics have a higher rate of transition from unemployment into employment than whites when demand conditions are relatively weak. The racial differences in the transition rate is unchanged for Hispanics compared to the estimate when only two labor force states are considered while the coefficient for blacks become larger and statistically significant.¹² The findings from the unemployment to employment transition are consistent with minorities being first hired during periods of growth. When considering the movement from nonparticipation to employment, there is no apparent evidence from the OLS estimates of Hispanics being more sensitive to business cycle conditions than whites. However, black men appear to have a differential response to the business cycle relative to white men. When business cycle conditions are poor, black men are less likely to move from nonparticipation to employment, which partially offsets the positive coefficient in the unemployment-to-employment transition. The

¹² Similar to the two-way transitions in Section 5, we run another set of estimates in the three-way transition model here, excluding the self-employed workers. In this set of alternative estimates, Hispanic workers do not respond significantly different to the business cycle conditions than white workers in terms of the unemployment to employment transitions. The loss of significance in the unemployment to employment transition when excluding the self-employed workers indicates that many unemployed Hispanic workers choose to open a business on their own rather than staying unemployed.

overall effect for blacks entering employment would be attenuated by this effect but the combined effect of the estimate parameters of moving into employment from either being unemployed or out of the labor force would be positive, consistent with the interpretation that blacks are more likely to be hired when demand is weak over the entire sample examined.

Panels B and C of Table 8 include variables capturing periods of rising and falling unemployment, respectively, and interactions with the race dummy and the business cycle control. These specifications are used to test whether the transition probabilities are symmetric over the business cycle. With very few significant results in the newly adding interaction terms, the evidence supports symmetric movements in transition rates in periods of rising or falling unemployment.

Panel A of Table 9 provides a set of OLS estimates from a LPM comparable to those in Table 8 but instead focuses on the pre-Great Recession period from 1996 to 2007. For movements out of employment, the estimates reveal a similar pattern to those observed in Table 8 with both blacks and Hispanics experiencing a higher probability of transitioning from employment to unemployment when local demand conditions are weak. Again, the evidence reinforces the assertion that minorities are the first fired when the economy is slack. Turning to movements into employment, column 5 of Panel A shows that black men are less likely to move from nonparticipation to employment in the following month when the unemployment rate is increasing while Hispanic men are more likely to move from nonparticipation to employment than whites. The movement directly from nonparticipation to employment is different in the sample period before the Great Recession with blacks having a lower probability of being reemployed when unemployment is high while Hispanics are more likely to be reemployed. Panels B and C of Table 9 again provide estimates that allow for a test for a symmetric response over the business cycle. As was found in Table 8, there is no appreciable evidence of a

differential response in making the transitions examined in periods of rising or falling unemployment.

Table 10 provides additional OLS estimates of the LPM focusing on the sample period after the start of the Great Recession, from 2008 to 2012. For blacks, the parameters associated with leaving employment do not show a different response than whites to business cycle conditions. For Hispanics, there is a pro-cyclical response to weak economic conditions in terms of the probability of moving from employment to unemployment. Compared to the pre-Great Recession period when both blacks and Hispanics reveal a tendency of being first fired, only the Hispanic group preserves this pattern in the post Great Recession period. For transitions into employment, the last hired hypothesis is not supported for blacks as it was in the sample period prior to the Great Recession. Instead, black men have a higher probability of being reemployed from the labor force (from the unemployed) in the sample period after the Great Recession. For Hispanics there is no pattern indicating that they are last hired. The tests for symmetric response found in Panels C and D provide no evidence of differential responsiveness in making the transitions examined in periods of rising or falling unemployment.

Table 8. Estimated Transitions across Labor Force Status: Matched CPS Data, 1996-2012

Regressor	Transition					
	Employed to Unemployed	Employed to Not in Labor Force	Unemployed to Employed	Unemployed to Not in Labor Force	Not in Labor Force to Employed	Not in Labor Force to Unemployed
Panel A. Linear Regressions Assuming Symmetric Responses Over the Business Cycle Transition						
Black	0.00896*** (0.000344)	0.0106*** (0.000361)	-0.0629*** (0.00453)	0.0498*** (0.00390)	0.000929 (0.00182)	0.0150*** (0.00153)
Hispanic	0.00209*** (0.000307)	0.00234*** (0.000293)	0.0529*** (0.00552)	-0.00156 (0.00393)	0.0555*** (0.00288)	0.00923*** (0.00196)
Undiff	0.00121*** (0.0000467)	0.000187*** (0.0000395)	-0.0282*** (0.000699)	-0.00417*** (0.000541)	-0.00389*** (0.000338)	0.00557*** (0.000317)
Undiff*Black	0.000660*** (0.000180)	-0.000000446 (0.000171)	0.00417*** (0.00137)	-0.00202 (0.00129)	-0.00137** (0.000674)	0.00238*** (0.000746)
Undiff*Hispanic	0.00116*** (0.000140)	-0.000114 (0.000108)	0.00351** (0.00149)	-0.000937 (0.00107)	-0.000809 (0.00102)	0.00441*** (0.000892)
N	3,184,345	3,184,345	152,433	152,433	322,671	322,671
R ²	0.009	0.006	0.045	0.015	0.026	0.017
Panel B. Linear Regressions Testing Symmetric Response Over the Business Cycle						
Black	0.00896*** (0.000344)	0.0106*** (0.000361)	-0.0629*** (0.00453)	0.0498*** (0.00390)	0.000925 (0.00182)	0.0151*** (0.00153)
Hispanic	0.00207*** (0.000307)	0.00234*** (0.000293)	0.0531*** (0.00552)	-0.00146 (0.00393)	0.0555*** (0.00289)	0.00918*** (0.00196)
Undiff	0.00107*** (0.0000549)	0.000171*** (0.0000468)	-0.0288*** (0.000779)	-0.00317*** (0.000632)	-0.00394*** (0.000391)	0.00485*** (0.000367)
Undiff*Black	0.000531** (0.000213)	0.00000437 (0.000209)	0.00488*** (0.00153)	-0.00318** (0.00152)	-0.00199*** (0.000773)	0.00333*** (0.000885)
Undiff*Hispanic	0.000907*** (0.000163)	-0.0000895 (0.000126)	0.00472*** (0.00164)	-0.00166 (0.00120)	0.000282 (0.00116)	0.00453*** (0.00102)
Undiff*Rising	0.000383*** (0.0000869)	0.0000459 (0.0000731)	0.00153 (0.00102)	-0.00280*** (0.000834)	0.000147 (0.000558)	0.00211*** (0.000579)
Undiff*Rising*Black	0.000378 (0.000365)	-0.0000133 (0.000325)	-0.00198 (0.00212)	0.00325 (0.00217)	0.00183 (0.00117)	-0.00276** (0.00136)
Undiff*Rising*Hispanic	0.000789*** (0.000277)	-0.0000721 (0.000205)	-0.00370* (0.00221)	0.00192 (0.00164)	-0.00340** (0.00165)	-0.000203 (0.00162)
N	3,184,345	3,184,345	152,433	152,433	322,671	322,671

R^2	0.009	0.006	0.045	0.015	0.026	0.017
Panel C. Linear Regressions Testing Symmetric Response Over the Business Cycle						
Black	0.00896*** (0.000344)	0.0106*** (0.000361)	-0.0629*** (0.00453)	0.0498*** (0.00390)	0.000926 (0.00182)	0.0150*** (0.00153)
Hispanic	0.00208*** (0.000307)	0.00234*** (0.000293)	0.0530*** (0.00552)	-0.00156 (0.00393)	0.0555*** (0.00288)	0.00921*** (0.00196)
Undiff	0.00131*** (0.0000562)	0.000178*** (0.0000474)	-0.0279*** (0.000787)	-0.00489*** (0.000610)	-0.00358*** (0.000392)	0.00599*** (0.000380)
Undiff*Black	0.000625*** (0.000220)	0.0000205 (0.000204)	0.00293* (0.00157)	-0.000685 (0.00148)	-0.00164** (0.000789)	0.00203** (0.000889)
Undiff*Hispanic	0.00134*** (0.000173)	-0.000201 (0.000130)	0.00265 (0.00170)	0.000368 (0.00123)	-0.00144 (0.00119)	0.00446*** (0.00108)
Undiff*Falling	-0.000283*** (0.0000864)	0.0000262 (0.0000730)	-0.000802 (0.00104)	0.00214** (0.000882)	-0.000864 (0.000560)	-0.00118** (0.000563)
Undiff*Falling*Black	0.0000973 (0.000351)	-0.0000586 (0.000333)	0.00359* (0.00207)	-0.00390* (0.00216)	0.000760 (0.00114)	0.000989 (0.00135)
Undiff*Falling*Hispanic	-0.000486* (0.000263)	0.000231 (0.000200)	0.00236 (0.00213)	-0.00365** (0.00161)	0.00168 (0.00163)	-0.0000199 (0.00154)
N	3,184,345	3,184,345	152,433	152,433	322,671	322,671
R^2	0.009	0.006	0.045	0.015	0.026	0.017

Notes: The sample consists of males aged 25-55. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. All specifications also included a constant, age, age squared, marital status, education, occupation and industry, and state and month fixed effects. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 9. Estimated Transitions across Labor Force Status: Matched CPS Data, 1996-2007

Regressor	Transition					
	Employed to Unemployed	Employed to Not in Labor Force	Unemployed to Employed	Unemployed to Not in Labor Force	Not in Labor Force to Employed	Not in Labor Force to Unemployed
Panel A. Linear Regressions Assuming Symmetric Responses Over the Business Cycle Transition						
Black	0.00908*** (0.000425)	0.0107*** (0.000428)	-0.0593*** (0.00519)	0.0522*** (0.00448)	-0.000342 (0.00206)	0.0145*** (0.00180)
Hispanic	0.00213*** (0.000345)	0.00274*** (0.000337)	0.0543*** (0.00643)	-0.000385 (0.00463)	0.0580*** (0.00326)	0.00959*** (0.00222)
Undiff	0.00146*** (0.000103)	0.000253*** (0.0000981)	-0.0402*** (0.00258)	-0.00856*** (0.00185)	-0.00326*** (0.00102)	0.00642*** (0.000763)
Undiff*Black	0.00118*** (0.000359)	0.0000971 (0.000371)	0.00414 (0.00466)	-0.00211 (0.00412)	-0.00532*** (0.00178)	0.00182 (0.00156)
Undiff*Hispanic	0.00124*** (0.000310)	0.000196 (0.000286)	0.00907 (0.00555)	-0.000655 (0.00371)	0.00682** (0.00301)	0.00778*** (0.00206)
N	2,311,516	2,311,516	86,434	86,434	217,833	217,833
R ²	0.008	0.006	0.035	0.016	0.028	0.014
Panel B. Linear Regressions Testing Symmetric Response Over the Business Cycle						
Black	0.00909*** (0.000426)	0.0107*** (0.000428)	-0.0595*** (0.00520)	0.0523*** (0.00449)	-0.000236 (0.00206)	0.0146*** (0.00180)
Hispanic	0.00212*** (0.000345)	0.00272*** (0.000336)	0.0544*** (0.00643)	-0.000477 (0.00463)	0.0580*** (0.00326)	0.00958*** (0.00223)
Undiff	0.00147*** (0.000113)	0.000281*** (0.000109)	-0.0402*** (0.00292)	-0.0107*** (0.00210)	-0.00364*** (0.00114)	0.00621*** (0.000845)
Undiff*Black	0.00113*** (0.000415)	-0.000259 (0.000430)	0.00648 (0.00538)	-0.00273 (0.00492)	-0.00640*** (0.00207)	0.00116 (0.00177)
Undiff*Hispanic	0.00134*** (0.000371)	0.000539 (0.000341)	0.00661 (0.00658)	0.000685 (0.00439)	0.00686* (0.00352)	0.00797*** (0.00244)
Undiff*Rising	-0.0000311 (0.000141)	-0.0000847 (0.000139)	-0.00000223 (0.00410)	0.00686** (0.00304)	0.00123 (0.00153)	0.000689 (0.00117)
Undiff*Rising*Black	0.000166 (0.000667)	0.00114 (0.000694)	-0.00786 (0.00927)	0.00251 (0.00810)	0.00357 (0.00330)	0.00216 (0.00290)
Undiff*Rising*Hispanic	-0.000301 (0.000619)	-0.00107* (0.000583)	0.00779 (0.0106)	-0.00418 (0.00755)	-0.000154 (0.00564)	-0.000604 (0.00406)
N	2,311,516	2,311,516	86,434	86,434	217,833	217,833

R^2	0.008	0.006	0.035	0.016	0.028	0.014
Panel C. Linear Regressions Testing Symmetric Response Over the Business Cycle						
Black	0.00908*** (0.000425)	0.0107*** (0.000428)	-0.0594*** (0.00519)	0.0523*** (0.00448)	-0.000321 (0.00206)	0.0145*** (0.00180)
Hispanic	0.00213*** (0.000345)	0.00274*** (0.000336)	0.0544*** (0.00643)	-0.000383 (0.00463)	0.0580*** (0.00326)	0.00955*** (0.00222)
Undiff	0.00139*** (0.000113)	0.000151 (0.000109)	-0.0396*** (0.00299)	-0.00750*** (0.00214)	-0.00212* (0.00116)	0.00684*** (0.000878)
Undiff*Black	0.00104** (0.000429)	0.000320 (0.000455)	0.00104 (0.00580)	0.000666 (0.00512)	-0.00516** (0.00213)	0.000827 (0.00185)
Undiff*Hispanic	0.00125*** (0.000386)	0.0000195 (0.000349)	0.0132* (0.00677)	-0.00265 (0.00461)	0.00815** (0.00360)	0.00592** (0.00251)
Undiff*Falling	0.000191 (0.000141)	0.000276** (0.000137)	-0.00158 (0.00403)	-0.00282 (0.00294)	-0.00309** (0.00149)	-0.00111 (0.00111)
Undiff*Falling*Black	0.000389 (0.000645)	-0.000597 (0.000687)	0.00804 (0.00864)	-0.00720 (0.00786)	-0.000448 (0.00319)	0.00265 (0.00273)
Undiff*Falling*Hispanic	-0.0000277 (0.000600)	0.000462 (0.000571)	-0.0107 (0.0104)	0.00518 (0.00732)	-0.00356 (0.00541)	0.00499 (0.00394)
N	2,311,516	2,311,516	86,434	86,434	217,833	217,833
R^2	0.008	0.006	0.035	0.016	0.028	0.014

Notes: The sample consists of males aged 25-55. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. All specifications also included a constant, age, age squared, marital status, education, occupation and industry, and state and month fixed effects. *p< 0.1; **p< 0.05; ***p< 0.01

Table 10. Estimated Transitions across Labor Force Status: Matched CPS Data, 2008-2012

Regressor	Transition					
	Employed to Unemployed	Employed to Not in Labor Force	Unemployed to Employed	Unemployed to Not in Labor Force	Not in Labor Force to Employed	Not in Labor Force to Unemployed
Panel A. Linear Regressions Assuming Symmetric Responses Over the Business Cycle Transition						
Black	0.0102*** (0.00114)	0.0102*** (0.00116)	-0.0793*** (0.0104)	0.0317*** (0.01000)	0.000679 (0.00487)	0.0212*** (0.00500)
Hispanic	0.00271*** (0.000946)	0.00119 (0.000788)	0.0682*** (0.0120)	-0.0169** (0.00858)	0.0512*** (0.00717)	0.00929 (0.00579)
Undiff	0.000832*** (0.000105)	0.000208** (0.0000880)	-0.0203*** (0.00151)	-0.00632*** (0.00120)	-0.000553 (0.000703)	0.00617*** (0.000668)
Undiff*Black	0.000326 (0.000335)	0.0000315 (0.000322)	0.00757*** (0.00241)	0.00200 (0.00236)	-0.00127 (0.00122)	0.000892 (0.00138)
Undiff*Hispanic	0.000753*** (0.000244)	0.00000944 (0.000188)	-0.000513 (0.00253)	0.00265 (0.00183)	-0.000562 (0.00173)	0.00423*** (0.00155)
N	872,829	872,829	65,999	65,999	104,838	104,838
R ²	0.012	0.005	0.035	0.014	0.022	0.017
Panel B. Linear Regressions Testing Symmetric Response Over the Business Cycle						
Black	0.0101*** (0.00114)	0.0102*** (0.00116)	-0.0792*** (0.0105)	0.0314*** (0.01000)	0.000518 (0.00487)	0.0215*** (0.00500)
Hispanic	0.00242** (0.000946)	0.00116 (0.000790)	0.0696*** (0.0120)	-0.0170** (0.00861)	0.0520*** (0.00718)	0.00879 (0.00580)
Undiff	0.000694*** (0.000110)	0.000177* (0.0000919)	-0.0209*** (0.00154)	-0.00518*** (0.00123)	-0.000659 (0.000732)	0.00537*** (0.000695)
Undiff*Black	0.000189 (0.000355)	0.000120 (0.000351)	0.00806*** (0.00247)	0.000823 (0.00250)	-0.00174 (0.00127)	0.00209 (0.00148)
Undiff*Hispanic	0.000563** (0.000258)	0.00000685 (0.000198)	0.000577 (0.00259)	0.00166 (0.00189)	0.000323 (0.00181)	0.00447*** (0.00161)
Undiff*Rising	0.000520*** (0.000104)	0.000102 (0.0000862)	0.00184* (0.00106)	-0.00391*** (0.000886)	0.000283 (0.000605)	0.00262*** (0.000654)
Undiff*Rising*Black	0.000421 (0.000422)	-0.000267 (0.000367)	-0.00141 (0.00215)	0.00341 (0.00225)	0.00148 (0.00125)	-0.00361** (0.00150)
Undiff*Rising*Hispanic	0.000800*** (0.000303)	0.0000316 (0.000221)	-0.00409* (0.00226)	0.00285* (0.00169)	-0.00327* (0.00173)	-0.000219 (0.00174)
N	872,829	872,829	65,999	65,999	104,838	104,838
R ²	0.012	0.005	0.035	0.014	0.023	0.018

Panel C. Linear Regressions Testing Symmetric Response Over the Business Cycle						
Black	0.0102** (0.00114)	0.0102*** (0.00116)	-0.0795*** (0.0104)	0.0320*** (0.0100)	0.000640 (0.00487)	0.0211*** (0.00500)
Hispanic	0.00260*** (0.000945)	0.00121 (0.000788)	0.0683*** (0.0120)	-0.0170** (0.00858)	0.0513*** (0.00717)	0.00892 (0.00580)
Undiff	0.00103*** (0.000111)	0.000224** (0.0000931)	-0.0200*** (0.00155)	-0.00714*** (0.00123)	-0.000426 (0.000728)	0.00670*** (0.000706)
Undiff*Black	0.000316 (0.000367)	0.00000493 (0.000341)	0.00656*** (0.00254)	0.00313 (0.00244)	-0.00158 (0.00129)	0.000640 (0.00148)
Undiff*Hispanic	0.000943*** (0.000268)	-0.0000819 (0.000204)	-0.00134 (0.00268)	0.00418** (0.00195)	-0.00127 (0.00186)	0.00451*** (0.00169)
Undiff*Falling	-0.000586*** (0.000108)	-0.0000480 (0.0000897)	-0.00107 (0.00111)	0.00265*** (0.000958)	-0.000384 (0.000621)	-0.00161** (0.000657)
Undiff*Falling*Black	0.0000334 (0.000406)	0.0000761 (0.000379)	0.00309 (0.00212)	-0.00352 (0.00225)	0.000892 (0.00122)	0.000766 (0.00151)
Undiff*Falling*Hispanic	-0.000424 (0.000288)	0.000238 (0.000215)	0.00224 (0.00217)	-0.00423** (0.00166)	0.00175 (0.00171)	-0.000393 (0.00165)
N	872,829	872,829	65,999	65,999	104,838	104,838
R ²	0.012	0.005	0.035	0.014	0.023	0.017

Notes: The sample consists of males aged 25-55. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. All specifications also included a constant, age, age squared, marital status, education, occupation and industry, and state and month fixed effects. *p< 0.1, **p< 0.05, ***p< 0.01

7. Test of Structural Change before and after the Great Recession

Table 11 reports changes in estimation parameters from the Linear Probability Model (LPM) in the Great Recession period relative to the entire sample. The tests are performed by interacting every variable in the LPM estimates in Table 3 with a new dummy for observations that are after the start of the Great Recession. Thus, the reported coefficients reflect the changes in relative parameters from the sample period of 1996-2007 to 2008-2013. All specifications include a constant, age, age squared, marital status, education, occupation and industry, and state and month fixed effects except Specification 3, which excludes age, marital status, education, occupation and industry. Standard errors correct for clustering of individual observations.

Panel A reports changes in the OLS estimates of the LPM for the unemployment entry rate from before to after the Great Recession. Specification 1 shows that the black-white differential in transition rates increased significantly by 0.26 of a percentage point from the pre-Great Recession period, and that the Hispanic-white differential in transition rates increased significantly by 0.29 of a percentage point from the pre-Great Recession period. The results indicate that minorities experienced a structurally higher probability in moving from employment to unemployment after the initiation of the Great Recession. Compared to the pre-Great Recession period, the heightened probability of blacks (relative to whites) to enter unemployment as demand weakens is reduced in the post-Great Recession period, shown by a reduction of 0.08 of a percentage point in Specification 2 and 0.09 of a percentage point in Specification 4. The heightened probability of Hispanics (relative to whites) to enter unemployment as demand conditions weaken is also moderated after the initiation of the Great Recession, shown by a significant decrease of 0.10 of a percentage point in Specification 3 and 0.09 of a percentage point in Specification 4. These estimates demonstrate that the probability of minorities

to be laid off increased across the board during the great recession but the cyclical effect was dampened relative to other periods.

Panel B reports whether the OLS parameter estimates for the LPM models for the unemployment exit rate changed significantly from before to after the Great Recession. In terms of moving from unemployment to employment, the black-white differential in transition rates (parameters for the black dummy) decreased significantly from the pre-Great Recession period as shown in Specifications 2, 3, and 4, indicating that black men faced an even lower chance (more than 3 percentage points) of moving from unemployment to employment after the Great Recession. There is no evidence that the base probability of being re-employed changed for Hispanics relative to whites or that the cyclical responsiveness of the probability of re-employment changed for minorities during the Great Recession.

In summary, in the two-state model that only considers changes between employment and unemployment, the greatest changes during the Great Recession appeared to be (1) an increase in the probability of becoming unemployed for minorities (blacks and Hispanics) relative to whites along with an attenuation in its cyclical responsiveness and (2) a sizeable (more than 3 percentage points) reduction in the probability of becoming re-employed for blacks.

We also examine changes in the parameter estimates in the three-state model (employment, unemployment, out of the labor force) to see whether significant changes occurred after initiation of the Great Recession. The tests are performed by interacting each variable in the Linear Probability Models in Table 8 with a dummy for observations that are after the start of the Great Recession. Changes in estimated transitions are reported in Table 12.

Table 11. Test for Changes in Estimation Parameters from before to after the Great Recession

	Specification			
	(1)	(2)	(3)	(4)
Panel A. Linear Regressions for Probability of Employment-to-Unemployment Transition				
Black	0.00261*** (0.000826)	0.00110 (0.00122)	0.000385 (0.00123)	0.00105 (0.00122)
Hispanic	0.00292*** (0.000679)	0.000428 (0.000989)	0.00348*** (0.000964)	0.000163 (0.000989)
Undiff	-0.000521*** (0.000118)	-0.000409*** (0.000118)	-0.000447*** (0.000118)	-0.000591*** (0.000132)
Undiff*Black		-0.000836* (0.000496)	-0.000767 (0.000499)	-0.000912* (0.000554)
Undiff*Hispanic		-0.000624 (0.000395)	-0.000961** (0.000398)	-0.000934** (0.000453)
Undiff*Rising				0.000521*** (0.000176)
Undiff*Rising*Black				0.000241 (0.000805)
Undiff*Rising*Hispanic				0.00114 (0.000699)
Sample size	3,150,683	3,150,683	3,150,683	3,150,683
Panel B. Linear Regressions for Probability of Unemployment-to-Employment Transition				
Black	-0.00306 (0.00810)	-0.0353*** (0.0134)	-0.0338** (0.0133)	-0.0355*** (0.0134)
Hispanic	0.00383 (0.00921)	-0.00314 (0.0145)	-0.00582 (0.0144)	-0.00287 (0.0145)
Undiff	0.0221*** (0.00234)	0.0212*** (0.00273)	0.0225*** (0.00276)	0.0201*** (0.00321)
Undiff*Black		0.00877 (0.00613)	0.00868 (0.00618)	0.0106 (0.00745)
Undiff*Hispanic		-0.00366 (0.00663)	-0.00564 (0.00673)	-0.00760 (0.00794)
Undiff*Falling				0.00300 (0.00459)
Undiff*Falling*Black				-0.00430 (0.0105)
Undiff*Falling*Hispanic				0.0101 (0.0116)
Sample size	131,761	131,761	131,761	131,761

Notes: The sample period covers 1996-2012. The reported coefficients are the changes in parameters for 2008-2012 relative to the entire sample. The sample consists of males aged 25-55 who are in the labor force for any two consecutive months. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. All specifications also included a constant, age, age squared, marital status, education, occupation and industry, and state and month fixed effects except Specification 3, which excludes age, marital status, education, occupation and industry.

*p < 0.1; **p < 0.05; ***p < 0.01

Table 12. Test for Changes in Estimation Parameters from before to after the Great Recession

	Transition					
	Employed to Unemployed	Employed to Not in Labor Force	Unemployed to Employed	Unemployed to Not in Labor Force	Not in Labor Force to Employed	Not in Labor Force to Unemployed
Panel A. Linear Regressions Assuming Symmetric Responses Over the Business Cycle Transition						
Black	.0010798 (.0011985)	.0001054 (.0012188)	-.0210487* (.0112047)	-.0226343** (.0106897)	.0052039 (.0050838)	.0061431 (.0051699)
Hispanic	.0004475 (.0009745)	-.0004243 (.0008175)	.0052524 (.0129882)	-.0225826** (.0091557)	-.0042519 (.0074886)	-.0000159 (.0058335)
Undiff	-.0004094** (.0001167)	.0000467 (.0001043)	.0180516*** (.0024386)	.0001472 (.001786)	.0022981** (.001018)	-.0012632 (.0008483)
Undiff*Black	-.0008114* (.0004863)	-.0001447 (.0004845)	.0039419 (.005101)	.0049231 (.004633)	.0037366* (.0021034)	-.0003527 (.0020399)
Undiff*Hispanic	-.0006085 (.0003886)	-.0002879 (.0004845)	-.0050595 (.0059785)	.0034388 (.0040319)	-.0072253** (.0034161)	-.0038504 (.0025352)
N	3,184,345	3,184,345	152,433	152,433	322,671	322,671
R ²	0.0099	0.0056	0.0469	0.0152	0.0265	0.0173
Panel B. Linear Regressions Testing Symmetric Response Over the Business Cycle						
Black	.0010243 (.0011999)	.0000993 (.0012183)	-.0207284* (.0112188)	-.0230345** (.0106907)	.0049534 (.0050864)	.006325 (.0051701)
Hispanic	.0001885 (.0009748)	-.0004228 (.0008193)	.0063767 (.0130326)	-.0225615** (.0091835)	-.0034297 (.0074968)	-.0003735 (.0058402)
Undiff	-.0005883*** (.0001307)	-.0000137 (.0001183)	.0172674*** (.0028046)	.0037417* (.0020592)	.0027266** (.0011565)	-.0018025* (.0009455)
Undiff*Black	-.0008929 (.0005424)	.0003029 (.000549)	.0020192 (.0058094)	.0043847 (.0054276)	.004318* (.0023798)	.0014795 (.0022675)
Undiff*Hispanic	-.0009022** (.0004463)	-.0006305 (.000389)	-.0016683 (.0069641)	.0009706 (.0046819)	-.0063552 (.0039126)	-.0037495 (.0028878)
Undiff*Rising	.0005111*** (.0001745)	.0001805 (.0001619)	.0023085 (.00422)	-.0109142*** (.0031588)	-.0013591 (.0016432)	.0015242 (.0013323)
Undiff*Rising*Black	.0002589 (.000789)	-.0014074* (.0007852)	.0066861 (.0095172)	.0007799 (.0084108)	-.0020412 (.0035282)	-.0056781* (.0032609)
Undiff*Rising*Hispanic	.001087 (.0006888)	.0010789* (.0006226)	-.0111146 (.0108661)	.0071841 (.0077295)	-.0031688 (.005897)	.0001322 (.0044201)
N	3,184,345	3,184,345	152,433	152,433	322,671	322,671

R^2	0.01	0.0056	0.047	0.0154	0.0265	0.0174
Panel C. Linear Regressions Testing Symmetric Response Over the Business Cycle						
Black	.0010808 (.0011984)	.0001004 (.001219)	-.0211489* (.0112034)	-.0224481** (.0106978)	.005151 (.0050843)	.0061204 (.0051701)
Hispanic	.0003693 (.0009742)	-.000401 (.0008176)	.0054857 (.0129947)	-.0226987** (.0091586)	-.0041634 (.0074898)	-.0002135 (.0058342)
Undiff	-.0001871 (.0001313)	.0001443 (.0001184)	.0176819*** (.002884)	-.0016309 (.0020998)	.0011977 (.0011794)	-.0011785 (.0009794)
Undiff*Black	-.0006778 (.0005604)	-.0003929 (.0005622)	.0060205 (.0062053)	.0032475 (.0055709)	.003299 (.0024426)	.0003754 (.0023322)
Undiff*Hispanic	-.000414 (.0004654)	-.0002121 (.0003976)	-.0098708 (.0071826)	.0070404 (.0049112)	-.0092664** (.003997)	-.0017555 (.0029979)
Undiff*Falling	-.0006298*** (.000174)	-.0002644 (.0001614)	.0009126 (.0041485)	.0050965* (.0030711)	.0029265* (.0016032)	-.0003412 (.001276)
Undiff*Falling*Black	-.0003556 (.000762)	.00067 (.0007843)	-.0050037 (.0088956)	.003801 (.0081699)	.001247 (.0034139)	-.0018816 (.0031202)
Undiff*Falling*Hispanic	-.0004578 (.0006649)	-.000201 (.0006105)	.0124042 (.0106159)	-.0096565 (.0074915)	.0053293 (.0056664)	-.0053183 (.0042762)
N	3,184,345	3,184,345	152,433	152,433	322,671	322,671
R^2	0.0099	0.0056	0.047	0.0153	0.0265	0.0173

Notes: Reported coefficients are changes in parameters from 2008-2012 relative to the entire sample. The sample is males ages 25-55. All estimates employ CPS sample weights. Standard errors adjust for clustering. All specifications also included a constant, age, age squared, marital status, education, occupation and industry, and state and month fixed effects. *p< 0.1; **p< 0.05; ***p< 0.01

Similar to the tests in the two state model, there is a decrease in the unemployment-to-employment transition rate for blacks of about 2.1 percentage points from the pre-Great Recession period to afterwards, as shown in column 3 of Panel A. For both blacks and Hispanics, there is also a decrease in the base probability of moving from unemployment to not in the labor force in the post-Great Recession period. For each percentage point increase in the unemployment rate, black men are 0.08 of a percentage point less likely to move from employment to unemployment, and are 0.37 of a percentage point more likely to move from nonparticipation to employment in the post-Great Recession period than in the pre-Great Recession period. This pattern is generally consistent with findings from the two-state model in Table 11 where the cyclical responsiveness of the probability of moving into unemployment was attenuated although the base probability of becoming unemployed increased.

8. Conclusion

Using matched monthly observations from the *Current Population Survey* from 1996 to 2012, this paper examines labor market transitions most closely associated with the assertion that minorities are last hired during periods of strong economic growth and first fired during recessions focusing on the experiences of both blacks and Hispanics. The analysis also decomposes the sample into periods prior to and after the initiation of the Great Recession and provides tests of changes in patterns of labor market transitions across periods.

The analysis initially examines probabilities of transitioning between employment and unemployment over the entire sample (1996-2012), providing evidence that both blacks and Hispanics have a higher probability of being unemployed in the following month than whites and that this probability increases as business conditions worsen. This pattern among minorities (blacks and Hispanics) is consistent with the hypothesis that minorities are the first fired when the economy weakens. For the period of 2008-2012, blacks do not behave differently than whites in their responsiveness to economic downturns in terms of their unemployment entry rate; however, it is important that their rate of entry into unemployment along with that of Hispanics structurally increased during the Great Recession.

For transitions from unemployment to being employed, considerable evidence shows that transition rates for Hispanics during weak business cycle conditions rise more rapidly than for whites over the entire sample period of 1996-2012 and for blacks in the sample period from 2008-2012. In these periods, the evidence would support the conclusion that minorities are first hired.

While only considering the transitions between employment and unemployment, the most important finding in comparing the period after the initiation of the Great Recession to the overall sample period is the size of the estimated decrease in the probability of being re-employed from one month to the next for blacks. Estimates indicate that the chance of re-employment declined by about 2 percentage points while remaining structurally unchanged for other groups. Thus, black unemployment rates would be expected to rise above those of other groups due to this reduction in the odds of becoming re-employed.

The analysis is then further expanded to include transitions across all three labor force states. Adding transitions into and out of the labor force, the first fired pattern is reinforced for blacks and Hispanics over the entire sample period of 1996-2012, for both groups in the 1996-2007 period, and for Hispanics from 2008-2012. Thus, these results support and strengthen conclusions that might be drawn from the two-way transition model. The pattern of being first hired is supported for blacks and Hispanics over the entire sample period but are not as clear in either sub-period. There is little evidence that minorities are last hired.

In considering three possible labor market transitions, the finding from the two-state transition model is confirmed: one of the most important changes that occurred in labor market dynamics in the Great Recession was a sizeable decrease in the base probability of moving from being unemployed to employed among blacks. The probability of making this transition, independent of business cycle conditions decreased by more than 2 percentage points while controlling for a range of possible confounders. This particularly striking and consistent result across estimates suggests that the sharp decline in demand associated with the Great Recession overwhelmed normal processes of labor market dynamics, with blacks bearing the largest brunt of this impact through a reduced probability of being rehired.

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Appendix

Table A.1 Descriptive Statistics of Two-way Transitions, Sample Period: 1996-2012

	Employment-to-Unemployment Transition (N=3,150,683)		Unemployment-to-Employment Transition (N=131,761)	
	Mean	S.D.	Mean	S.D.
<i>Outcome Variables</i>				
Employment-to-Unemployment Probability	0.01	0.11		
Unemployment-to-Employment Probability			0.31	0.46
<i>Explanatory Variables</i>				
Black (1=Black)	0.08	0.27	0.15	0.36
Hispanic (1=Hispanic)	0.11	0.32	0.16	0.36
Undiff	0.37	2.03	1.41	2.43
Age	40.39	8.60	39.26	8.89
Age Squared	1704.97	692.79	1620.64	706.56
Marital Status (1=Married)	0.69	0.46	0.48	0.50
Education 1 (1=Less than High School)	0.09	0.29	0.19	0.39
Education 2 (1=High School)	0.32	0.46	0.40	0.49
Education 3 (1=Some College No Degree)	0.23	0.42	0.22	0.41
Education 4 (1=College and Above)	0.36	0.48	0.20	0.40
Type of Worker 1 (1=Government)	0.13	0.34	0.05	0.22
Type of Worker 2 (1=Private)	0.73	0.44	0.89	0.32
Type of Worker 3 (1=Self-employed)	0.14	0.35	0.06	0.24
Industry 1 (1=Agriculture)	0.03	0.16	0.02	0.16
Industry 2 (1=Mining)	0.01	0.11	0.01	0.11
Industry 3 (1=Construction)	0.13	0.34	0.26	0.44
Industry 4 (1=Manufacturing)	0.17	0.38	0.17	0.37
Industry 5 (1=Wholesale & Retail)	0.14	0.35	0.12	0.32
Industry 6 (1=Transportation & Utilities)	0.08	0.27	0.06	0.24
Industry 7 (1=Information)	0.03	0.16	0.03	0.16
Industry 8	0.06	0.23	0.04	0.19

(1=Financial Activities)				
Industry 9				
(1=Professional and Business Services)	0.11	0.31	0.12	0.33
Industry 10				
(1=Educational and Health Services)	0.10	0.30	0.05	0.21
Industry 11				
(1=Leisure and Hospitality)	0.05	0.22	0.07	0.26
Industry 12				
(1=Other Services)	0.04	0.20	0.04	0.19
Industry 13				
(1=Public Administration)	0.06	0.23	0.02	0.13

Notes: Undiff = the state-level unemployment rate – the national natural rate of unemployment.

Table A.2 Descriptive Statistics of Two-way Transitions, Sample Period: 1996-2007

	Employment-to-Unemployment Transition (N=2,287,455)		Unemployment-to-Employment Transition (N=74,251)	
	Mean	S.D.	Mean	S.D.
<i>Outcome Variables</i>				
Employment-to-Unemployment Probability	0.01	0.10		
Unemployment-to-Employment Probability			0.36	0.48
<i>Explanatory Variables</i>				
Black (1=Black)	0.08	0.26	0.15	0.36
Hispanic (1=Hispanic)	0.11	0.31	0.14	0.35
Undiff	-0.45	1.12	-0.13	1.12
Age	40.25	8.50	38.98	8.70
Age Squared	1692.50	683.98	1595.25	689.06
Marital Status (1=Married)	0.70	0.46	0.49	0.50
Education 1 (1=Less than High School)	0.10	0.29	0.19	0.39
Education 2 (1=High School)	0.32	0.47	0.39	0.49
Education 3 (1=Some College No Degree)	0.23	0.42	0.22	0.41
Education 4 (1=College and Above)	0.35	0.48	0.20	0.40
Type of Worker 1 (1=Government)	0.13	0.34	0.05	0.23
Type of Worker 2 (1=Private)	0.73	0.45	0.89	0.32
Type of Worker 3 (1=Self-employed)	0.14	0.35	0.06	0.23
Industry 1 (1=Agriculture)	0.03	0.16	0.03	0.16
Industry 2 (1=Mining)	0.01	0.11	0.01	0.11
Industry 3 (1=Construction)	0.13	0.34	0.24	0.43
Industry 4 (1=Manufacturing)	0.18	0.39	0.18	0.38
Industry 5 (1=Wholesale & Retail)	0.14	0.35	0.12	0.33
Industry 6 (1=Transportation & Utilities)	0.08	0.27	0.06	0.24
Industry 7 (1=Information)	0.03	0.16	0.03	0.16
Industry 8 (1=Financial Activities)	0.06	0.23	0.04	0.18
Industry 9	0.10	0.30	0.12	0.33

(1=Professional and Business Services)				
Industry 10				
(1=Educational and Health Services)	0.10	0.29	0.05	0.21
Industry 11				
(1=Leisure and Hospitality)	0.05	0.22	0.07	0.25
Industry 12				
(1=Other Services)	0.04	0.20	0.04	0.19
Industry 13				
(1=Public Administration)	0.05	0.23	0.02	0.13
<hr/>				
<i>Notes:</i> Undiff = the state-level unemployment rate – the national natural rate of unemployment.				

Table A.3 Descriptive Statistics of Two-way Transitions, Sample Period: 2008-2012

	Employment-to-Unemployment Transition (N=863,228)		Unemployment-to-Employment Transition (N=57,510)	
	Mean	S.D.	Mean	S.D.
<i>Outcome Variables</i>				
Employment-to-Unemployment Probability	0.02	0.12		
Unemployment-to-Employment Probability			0.24	0.43
<i>Explanatory Variables</i>				
Black (1=Black)	0.08	0.27	0.15	0.36
Hispanic (1=Hispanic)	0.13	0.34	0.18	0.38
Undiff	2.55	2.28	3.40	2.21
Age	40.74	8.84	39.63	9.12
Age Squared	1738.00	714.56	1653.41	727.22
Marital Status (1=Married)	0.66	0.47	0.47	0.50
Education 1 (1=Less than High School)	0.09	0.28	0.18	0.38
Education 2 (1=High School)	0.31	0.46	0.40	0.49
Education 3 (1=Some College No Degree)	0.22	0.42	0.22	0.42
Education 4 (1=College and Above)	0.38	0.49	0.20	0.40
Type of Worker 1 (1=Government)	0.13	0.34	0.05	0.21
Type of Worker 2 (1=Private)	0.74	0.44	0.89	0.32
Type of Worker 3 (1=Self-employed)	0.13	0.34	0.06	0.25
Industry 1 (1=Agriculture)	0.02	0.15	0.02	0.15
Industry 2 (1=Mining)	0.01	0.12	0.01	0.11
Industry 3 (1=Construction)	0.13	0.34	0.28	0.45
Industry 4 (1=Manufacturing)	0.15	0.36	0.15	0.36
Industry 5 (1=Wholesale & Retail)	0.13	0.34	0.12	0.32
Industry 6 (1=Transportation & Utilities)	0.08	0.27	0.06	0.23
Industry 7 (1=Information)	0.03	0.16	0.02	0.15
Industry 8 (1=Financial Activities)	0.06	0.24	0.04	0.20
Industry 9 (1=Professional and Business Services)	0.12	0.32	0.12	0.33

Industry 10 (1=Educational and Health Services)	0.10	0.30	0.05	0.21
Industry 11 (1=Leisure and Hospitality)	0.06	0.24	0.07	0.26
Industry 12 (1=Other Services)	0.04	0.20	0.04	0.19
Industry 13 (1=Public Administration)	0.06	0.23	0.01	0.12

Notes: Undiff = the state-level unemployment rate – the national natural rate of unemployment.

Table A.4 Descriptive Statistics of Three-way Transitions, Sample Period: 1996-2012

	Employment-to-Unemployment & Employment-to-Nonparticipation Transitions (N=3,184,345)		Unemployment-to-Employment & Unemployment-to-Nonparticipation Transitions (N=152,433)		Nonparticipation-to-Employment & Nonparticipation-to-Unemployment Transitions (N=322,671)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
<i>Outcome Variables</i>						
Employment-to-Unemployment Probability	0.01	0.11				
Employment-to-Nonparticipation Probability	0.01	0.10				
Unemployment-to-Employment Probability			0.27	0.44		
Unemployment-to-Nonparticipation Probability			0.14	0.34		
Nonparticipation-to-Employment Probability					0.09	0.28
Nonparticipation-to-Unemployment Probability					0.06	0.23
<i>Explanatory Variables</i>						
Black (1=Black)	0.08	0.27	0.16	0.37	0.17	0.38
Hispanic (1=Hispanic)	0.11	0.32	0.15	0.36	0.11	0.31
Undiff	0.38	2.03	1.39	2.42	0.74	2.15
Age	40.38	8.61	39.23	8.92	42.59	9.15
Age Squared	1704.58	693.34	1618.72	708.72	1897.38	748.79
Marital Status (1=Married)	0.68	0.47	0.47	0.50	0.43	0.49
Education 1 (1=Less than High School)	0.09	0.29	0.19	0.39	0.24	0.43
Education 2 (1=High School)	0.32	0.47	0.40	0.49	0.38	0.49
Education 3 (1=Some College No Degree)	0.23	0.42	0.22	0.41	0.21	0.41
Education 4 (1=College and Above)	0.36	0.48	0.19	0.40	0.17	0.38
Type of Worker 1 (1=Government)	0.13	0.34	0.05	0.22		
Type of Worker 2 (1=Private)	0.73	0.44	0.88	0.32		
Type of Worker 3 (1=Self-employed)	0.14	0.35	0.06	0.24		
Industry 1 (1=Agriculture)	0.03	0.16	0.02	0.16		
Industry 2 (1=Mining)	0.01	0.11	0.01	0.11		
Industry 3	0.13	0.34	0.25	0.43		

(1=Construction)				
Industry 4				
(1=Manufacturing)	0.17	0.38	0.16	0.37
Industry 5				
(1=Wholesale & Retail)	0.14	0.35	0.12	0.33
Industry 6				
(1=Transportation & Utilities)	0.08	0.27	0.06	0.24
Industry 7				
(1=Information)	0.03	0.16	0.02	0.16
Industry 8				
(1=Financial Activities)	0.06	0.23	0.04	0.19
Industry 9				
(1=Professional and Business Services)	0.11	0.31	0.12	0.33
Industry 10				
(1=Educational and Health Services)	0.10	0.30	0.05	0.21
Industry 11				
(1=Leisure and Hospitality)	0.05	0.22	0.07	0.26
Industry 12				
(1=Other Services)	0.04	0.20	0.04	0.19
Industry 13				
(1=Public Administration)	0.06	0.23	0.02	0.13

Notes: The industry and occupation variables are not present in the samples which contain the Nonparticipation-to-Employment and the Nonparticipation-to-Unemployment transitions because these groups contain individuals whose labor force states start as not in the labor force. The industry and occupation code are only observed for people who are in the labor force, i.e. samples that contain the Employment-to-Unemployment, the Employment-to-Nonparticipation, the Unemployment-to-Employment, and the Unemployment-to-Nonparticipation transitions.

*Undiff = the state-level unemployment rate – the national natural rate of unemployment.

Table A.5 Descriptive Statistics of Three-way Transitions, Sample Period: 1996-2007

	Employment-to-Unemployment & Employment-to-Nonparticipation Transitions (N=2,311,516)		Unemployment-to-Employment & Unemployment-to-Nonparticipation Transitions (N=86,434)		Nonparticipation-to-Employment & Nonparticipation-to-Unemployment Transitions (217,833)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
<i>Outcome Variables</i>						
Employment-to-Unemployment Probability	0.01	0.10				
Employment-to-Nonparticipation Probability	0.01	0.10				
Unemployment-to-Employment Probability			0.31	0.46		
Unemployment-to-Nonparticipation Probability			0.14	0.35		
Nonparticipation-to-Employment Probability					0.09	0.29
Nonparticipation-to-Unemployment Probability					0.05	0.22
<i>Explanatory Variables</i>						
Black (1=Black)	0.08	0.27	0.16	0.37	0.17	0.38
Hispanic (1=Hispanic)	0.11	0.31	0.14	0.35	0.10	0.30
Undiff	-0.45	1.12	-0.13	1.12	-0.29	1.11
Age	40.25	8.51	38.97	8.74	42.64	9.00
Age Squared	1692.19	684.53	1595.04	691.74	1899.28	738.61
Marital Status (1=Married)	0.69	0.46	0.48	0.50	0.44	0.50
Education 1 (1=Less than High School)	0.10	0.30	0.20	0.40	0.25	0.43
Education 2 (1=High School)	0.32	0.47	0.39	0.49	0.37	0.48
Education 3 (1=Some College No Degree)	0.23	0.42	0.22	0.41	0.21	0.41
Education 4 (1=College and Above)	0.35	0.48	0.20	0.40	0.17	0.37
Type of Worker 1 (1=Government)	0.13	0.34	0.06	0.23		
Type of Worker 2 (1=Private)	0.73	0.45	0.88	0.32		
Type of Worker 3 (1=Self-employed)	0.14	0.35	0.06	0.24		
Industry 1 (1=Agriculture)	0.03	0.16	0.03	0.16		
Industry 2 (1=Mining)	0.01	0.10	0.01	0.11		
Industry 3	0.13	0.34	0.23	0.42		

(1=Construction)				
Industry 4				
(1=Manufacturing)	0.18	0.39	0.17	0.38
Industry 5				
(1=Wholesale & Retail)	0.14	0.35	0.12	0.33
Industry 6				
(1=Transportation & Utilities)	0.08	0.27	0.06	0.24
Industry 7				
(1=Information)	0.03	0.16	0.03	0.16
Industry 8				
(1=Financial Activities)	0.06	0.23	0.03	0.18
Industry 9				
(1=Professional and Business Services)	0.10	0.31	0.12	0.33
Industry 10				
(1=Educational and Health Services)	0.09	0.29	0.05	0.21
Industry 11				
(1=Leisure and Hospitality)	0.05	0.22	0.07	0.26
Industry 12				
(1=Other Services)	0.04	0.20	0.04	0.20
Industry 13				
(1=Public Administration)	0.05	0.23	0.02	0.13

Notes: The industry and occupation variables are not present in the samples which contain the Nonparticipation-to-Employment and the Nonparticipation-to-Unemployment transitions because these groups contain individuals whose labor force states start as not in the labor force. The industry and occupation code are only observed for people who are in the labor force, i.e. samples that contain the Employment-to-Unemployment, the Employment-to-Nonparticipation, the Unemployment-to-Employment, and the Unemployment-to-Nonparticipation transitions.

*Undiff = the state-level unemployment rate – the national natural rate of unemployment.

Table A.6 Descriptive Statistics of Three-way Transitions, Sample Period: 2008-2012

	Employment-to-Unemployment & Employment-to-Nonparticipation Transitions (N=872,829)		Unemployment-to-Employment & Unemployment-to-Nonparticipation Transitions (N=65,999)		Nonparticipation-to-Employment & Nonparticipation-to-Unemployment Transitions (N=104,838)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
<i>Outcome Variables</i>						
Employment-to-Unemployment Probability	0.02	0.12				
Employment-to-Nonparticipation Probability	0.01	0.10				
Unemployment-to-Employment Probability			0.21	0.41		
Unemployment-to-Nonparticipation Probability			0.13	0.33		
Nonparticipation-to-Employment Probability					0.08	0.26
Nonparticipation-to-Unemployment Probability					0.07	0.26
<i>Explanatory Variables</i>						
Black (1=Black)	0.08	0.27	0.16	0.37	0.17	0.37
Hispanic (1=Hispanic)	0.13	0.34	0.18	0.38	0.12	0.32
Undiff	2.55	2.28	3.38	2.21	2.88	2.20
Age	40.73	8.85	39.57	9.15	42.48	9.44
Age Squared	1737.39	715.13	1649.73	729.20	1893.44	769.50
Marital Status (1=Married)	0.66	0.47	0.46	0.50	0.40	0.49
Education 1 (1=Less than High School)	0.09	0.29	0.18	0.38	0.22	0.41
Education 2 (1=High School)	0.31	0.46	0.41	0.49	0.40	0.49
Education 3 (1=Some College No Degree)	0.22	0.42	0.22	0.42	0.21	0.41
Education 4 (1=College and Above)	0.38	0.49	0.19	0.39	0.17	0.38
Type of Worker 1 (1=Government)	0.13	0.34	0.05	0.22		
Type of Worker 2 (1=Private)	0.74	0.44	0.88	0.32		
Type of Worker 3 (1=Self-employed)	0.13	0.34	0.07	0.25		
Industry 1 (1=Agriculture)	0.02	0.15	0.02	0.15		
Industry 2 (1=Mining)	0.01	0.12	0.01	0.11		
Industry 3 (1=Construction)	0.13	0.34	0.27	0.45		
Industry 4 (1=Manufacturing)	0.15	0.36	0.15	0.36		
Industry 5	0.13	0.34	0.12	0.32		

(1=Wholesale & Retail)				
Industry 6				
(1=Transportation & Utilities)	0.08	0.27	0.06	0.23
Industry 7				
(1=Information)	0.03	0.16	0.02	0.15
Industry 8				
(1=Financial Activities)	0.06	0.24	0.04	0.19
Industry 9				
(1=Professional and Business Services)	0.12	0.32	0.12	0.33
Industry 10				
(1=Educational and Health Services)	0.10	0.30	0.05	0.21
Industry 11				
(1=Leisure and Hospitality)	0.06	0.24	0.08	0.27
Industry 12				
(1=Other Services)	0.04	0.20	0.04	0.19
Industry 13				
(1=Public Administration)	0.06	0.23	0.02	0.12

Notes: The industry and occupation variables are not present in the samples which contain the Nonparticipation-to-Employment and the Nonparticipation-to-Unemployment transitions because these groups contain individuals whose labor force states start as not in the labor force. The industry and occupation code are only observed for people who are in the labor force, i.e. samples that contain the Employment-to-Unemployment, the Employment-to-Nonparticipation, the Unemployment-to-Employment, and the Unemployment-to-Nonparticipation transitions.

†Undiff = the state-level unemployment rate – the national natural rate of unemployment.

Chapter Two
The Business Cycle, Labor Market Transitions by Age, and the Great Recession

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Abstract

Using matched monthly CPS data, this paper studies differences in labor force transitions by age over business cycles focusing on differential experiences during the Great Recession. Monthly transitions across the three labor force states, employment, unemployment, and nonparticipation of 25-55 years old males are examined from 1996 to 2012. For transitions between employment and unemployment, considerable evidence shows that young men are more likely to be laid off in periods of slack demand, and that they have less chance of becoming re-employed when business cycle conditions worsen. Estimates including nonparticipants reinforced this pattern that young workers appear to be the first to lose their jobs when demand conditions are weak, and that they appear to have a less rapidly increasing chance of becoming re-employed when business cycle conditions are improving. Test of comparing the periods before and after the start of the Great Recession suggests that there was a noticeable increase in the baseline probability of unemployment for all workers and this change was exaggerated for younger workers. At the same time, cyclical volatility of the transition from employment to unemployment declined for the young.

I. Introduction

An issue of public concern and interest among economists is the extent to which unemployment varies over the business cycle and the differences in labor market experiences by various demographic groups. Previous work has established that the sensitivity of employment to business cycle conditions varies across age groups (Smith, Vanski, and Holt 1974; Clark and Summers 1981; Moser 1986; and Jaimovich and Siu 2009) with the young experiencing much greater volatility of employment over the business cycle and bearing a disproportionate share of cyclical fluctuations in the U.S. labor market. The greater cyclical sensitivity of employment among younger workers is consistent with early theoretical work by Oi (1962) that argues firms have incentives to retain their more experienced and productive workers during downturns. This paper uses Current Population Survey (CPS) data matched across adjacent months from 1996 to 2012 to investigate the differences in the sensitivity of relatively young and older prime-aged men to business cycle conditions.

Although prior studies have established that younger workers who typically are less experienced are more likely to experience unemployment, the Great Recession, which was characterized by unusually high employment among all groups may have altered these underlying patterns. Further, while previous studies have most often related labor force aggregates to the business cycle, here we examine the underlying transitions across labor force states and whether the Great Recession brought about changes in long-standing employment patterns.

In prior studies (Elsby, Michaels, and Solon 2009; Eran 2007; Fujita and Ramey 2006, 2009; Shimer 2012) of the movement of labor force aggregates across groups with different labor market skills in response to business cycle conditions, more and more attention has been given to transitions between the states of employment, unemployment, and being out of the labor force rather than

examining the aggregate stocks alone. This dynamic approach was developed in the work of Blanchard et al. (1990), Badgett (1994), and Abraham and Shimer (2001) in order to explore cross-group differences in unemployment transitions and the relationship between these cyclical variations and the movements of steady-state stocks of labor force aggregates over time.

The papers of Blanchard et al. (1990) and Abraham and Shimer (2001) are important in developing theoretical frameworks that relate measures of the business cycle to both labor market transitions and steady-state stocks of aggregate unemployment. The papers provide a theoretical underpinning for studies such as this that are more empirical in nature. Badgett (1994) provides estimates of workers' net flows into and out of unemployment by comparing the stock of unemployed workers across months. Such dynamic analysis allows for more direct examination of the timing of hiring and firing patterns over the business cycle.

The dynamic framework of this paper builds on the work of Couch and Fairlie (2010), which extended the previous discussed studies and provided the first detailed examination of labor market transitions by race for prime-age men using monthly matched CPS data from 1989 to 2004. Couch and Fairlie's (2010) study is important in empirically modeling the relationship of underlying transitions to aggregate rates of unemployment and explaining the cyclical movements between employment, unemployment, and nonparticipation over the business cycle.

Using CPS data, this paper similarly examines the labor market transitions between employment, unemployment, and nonparticipation by age. These transition rates are related to a locally exogenous measure of the business cycle to gauge the sensitivity of labor market transitions by age to aggregate demand. Further, the paper assess whether the responsiveness of labor market transitions across groups were altered by the Great Recession.

In his dynamic macroeconomic model of labor market fluctuations over the business cycle, Shimer (2005) proposed treating unemployment inflows as acyclical, which contradicts conventional wisdom, built around research by Darby et al. (1985, 1986), Blanchard et al. (1989, 1990), Davis and Haltiwanger (1990, 1992), and Bleakley, Ferris, and Fuhrer (1999). Their research shows that for the average worker changes in the exit rate from employment are the more dominant cyclical phenomenon than fluctuations in the entry rate. Shimer (2005) argues that while there are substantial fluctuations in the job finding rate at business cycle frequencies, fluctuations in unemployment entry rates are quantitatively irrelevant over the cycle. Ultimately, understanding whether the unemployment inflow or outflow rate contributes more to cyclical unemployment of different groups in the labor market is an empirical question. Accordingly, this paper empirically studies dynamic hiring and firing patterns by age by examining disaggregated monthly worker flows and concludes that both factors change considerably over the business cycle and influence rising rates of unemployment across groups as the economy worsens and reductions in unemployment as the business cycle improves.

The paper proceeds by describing the data used in the analysis, the sample chosen, and the construction of measures. Section 3 then provides a description of the monthly transition rates between employment and unemployment in the sample period, and presents a plot of the unemployment entry and exit trends over time. Sections 4 and 5 discuss the empirical estimates and results, respectively, for transitions among those who remain in the labor force across adjacent months between unemployment and employment. Section 6 extends the analysis to include transitions among all the labor force states. A test for structural change in labor force dynamics from before to after the Great Recession is provided in Section 7, and Section 8 concludes the paper.

2. Data

2.1 Sample Selection

The analysis makes use of individual-level data drawn from the *Current Population Survey* (CPS). The observations are matched monthly across adjacent months from January 1996 to December 2012. The matching algorithm for the data is based on the work of Madrian and Lefgren (2000) as employed by Couch and Fairlie (2010). The sample consists of all males from ages 25 to 55 to avoid modeling issues that would otherwise arise because of transitions associated with school enrollment, retirement, and childbearing. The younger group is classified as males from ages 25 to 40 and the older group is defined as those ages 41 to 55.

The CPS itself is a monthly survey of a probability sample of around 50,000 dwelling units a month. Instead of surveying a completely new set of housing units each month, the CPS re-samples households. The CPS sample in any single month consists of eight representative subsamples called rotation groups: each month a new rotation group is added to the overall sample while one moves out of the sample. Housing units in each rotation group are interviewed for four consecutive months, followed by an 8-month break, and then interviewed for four more months before exiting the survey. This rotational interview pattern of the CPS makes it possible to match information on individuals across adjacent months by linking surveys. Individuals present in the data in adjacent months have their data matched so that their labor market transitions can be directly observed. As the CPS data are the basis for calculation of the official U.S. unemployment rates, this matching procedure allows the labor market transitions of survey respondents to be related to aggregate unemployment at a monthly frequency.

2.2 Indicator for Labor Market Transition

To examine underlying transition probabilities, the paper first focuses on transitions between employment and unemployment among the younger and older workers by limiting the analytical sample to individuals who are in the labor force for any two consecutive months and excluding those who are not in the labor force. To better relate the underlying transitions to the aggregate stock of unemployment, the sample is expanded to include those not in the labor force in the second part of the analysis. The linking of data across months makes it possible to create indicators for labor market transitions from one month to the next. The unemployment entry rate represents the probability that a person employed in one month will be unemployed in the following month. The unemployment exit rate represents the probability that a person unemployed in one month will be employed in the following month.

2.3 Business Cycle Measure

To measure local business cycle conditions that deviate from the national economy, a monthly state-level variable is constructed to capture local demand in the labor market. The state-level business cycle control variable measures the deviation of the aggregate state unemployment rate from the national natural rate of unemployment (NRU). It captures state demand relative to a national measure of full employment. Thus, this variable empirically allows us to relate the deviations in local economic conditions relative to full employment to changes in labor market transitions. Data for the monthly aggregate state unemployment rate is retrieved from Bureau of Labor Statistics (BLS). The NRU applied in this paper is the same estimation as employed by Couch and Fairlie's (2010) analysis,

5.28 percent.¹³

3. Transition Rates and Trends

Table 1 summarizes the unemployment rates and the transition probabilities between employment and unemployment for the two age groups from 1996 to 2012. Over the sample period, the unemployment rate for young men was 0.82 of a percentage point higher than for old men. Young men have both a higher unemployment entry and exit rate. 1.49 percent of employed young men became unemployed the following month while only 1.12 percent of employed old men became unemployed. 31.81 percent of the unemployed young men became employed the following month when compared to 27.39 percent of the old. The young-old difference in transition from employment to unemployment was 0.37 percentage points, which is about 30 percent of the old men's transition rate and 25 percent of the young men's. The young-old difference in the unemployment exit rate is 4.42 percentage points, which is about 15 percent of the transition rates from unemployment to employment for both the young and the old. Based on the magnitude of the young-old differences in the two transition probabilities, the difference in entering unemployment appears to be a more dominant factor in the unemployment rate gap than the difference in exiting.

The transition rates can be converted into steady-state stocks of unemployment by applying the equation, $\text{stock} = (\text{entry} / (\text{entry} + \text{exit}))$.¹⁴ In order to assess which factor leads to a higher unemployment rate of the young than the old, the young-old gap in the unemployment rate at steady state is decomposed into portions due to differences in unemployment entry and exit rates. Using the

¹³ The NRU of 5.28 is taken from the prior research of Couch and Fairlie (2010). More detail on its estimation can be found there (p. 232).

¹⁴ The gap in equilibrium stock unemployment rates can be decomposed into portions due to differences in unemployment entry and exit rates (Abraham and Shimer, 2001).

observed transition rates in Table 1, the calculated unemployment rate at steady state for younger and older workers are 4.47 and 3.93 percent, respectively. If younger workers are assigned the old unemployment entry rate, their steady-state rate falls to 3.4 percent. This rate rises to 5.16 percent if they are assigned the old exit rate. This contrast of predicted and observed rates for the younger group also suggests that the relatively high rate of unemployment of the young is primarily due to their higher chance of becoming unemployed.

Table 1. Unemployment and Transition Rates by Age: Matched Current Population Surveys, 1996-2012

	Young(%)	N	Old(%)	N	Young-Old Difference(%)
Unemployment Rate	4.74	1,764,246	3.92	1,760,574	0.82
Unemployment Entry Rate	1.49	1,685,485	1.12	1,695,471	0.37
Unemployment Exit Rate	31.81	78,761	27.39	65,103	4.42

Notes: The sample consists of males aged 25-55. All estimates are calculated using sample weights provided by the CPS.

Table 2. Unemployment and Transition Rates by Age: Matched Current Population Surveys

	Young(%)	N	Old(%)	N	Young-Old Difference(%)
1996-2007					
Unemployment Rate	3.67	1,280,882	2.92	1,246,234	0.75
Unemployment Entry Rate	1.32	1,235,292	0.98	1,210,722	0.34
Unemployment Exit Rate	37.62	45,590	32.73	35,512	4.89
2008-2012					
Unemployment Rate	7.4	483,364	6.19	514,340	1.21
Unemployment Entry Rate	1.94	450,193	1.44	484,749	0.5
Unemployment Exit Rate	24.66	33,171	21.67	29,591	0.99

Notes: The sample consists of males aged 25-55. All estimates are calculated using sample weights provided by the CPS.

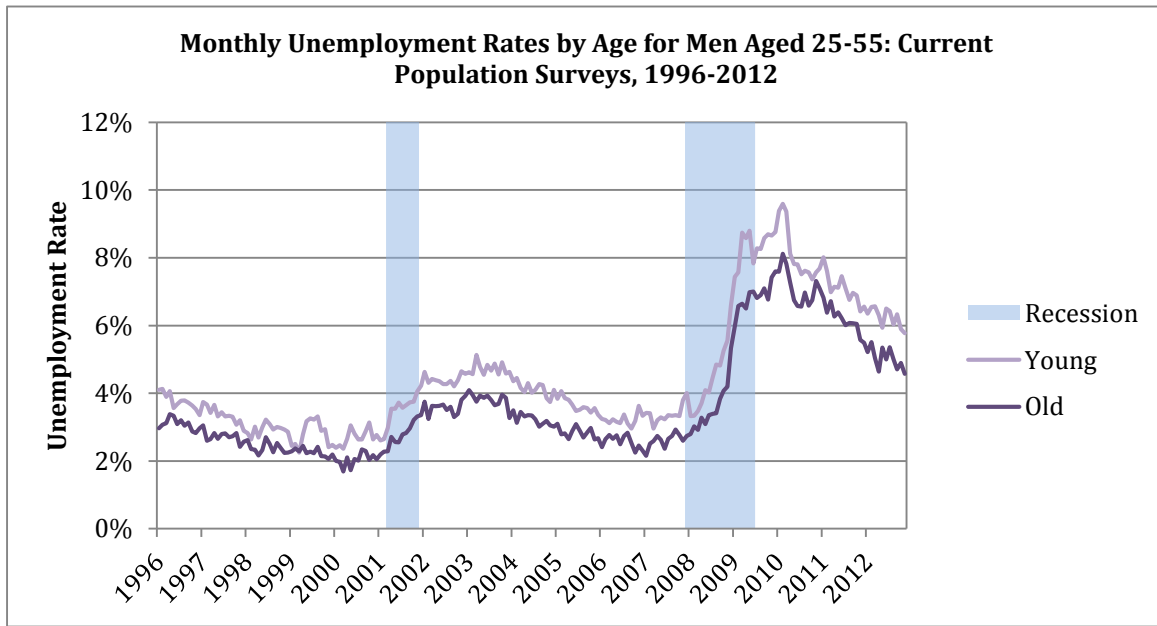
Table 2 reports similar estimates to those contained in Table 1 but the sample is divided into two time periods. The first sample period is from 1996 to 2007, before the Great Recession, and the second period is after the beginning of the Great Recession, from 2008 to 2012. The unemployment rates for the young and old were 7.4 and 6.19 percent respectively in the period of the Great Recession, almost double those before it (3.67 percent for the young and 2.92 for the old).

Similarly, both younger and older workers experienced more adverse labor market transitions in the period after the beginning of the Great Recession than before. There was a 47 percent increase in the rates of entry into unemployment, from 1.32 to 1.94 percent for the young and 0.98 to 1.44 percent for the old. And the rates of leaving unemployment dropped from 37.62 to 24.66 percent for the younger group and from 32.73 to 21.67 percent for the older group in the later period, which is a 34 percent decrease for both groups. It is noticeable that the young-old difference in the unemployment exit rate lessened largely in the latter period, a decrease from 4.89 to 0.99 percent, which suggests that older workers lost some of their advantage in finding a job during the Great Recession.

By decomposing the steady-state stock unemployment rate into entry and exit rates, $\text{stock} = (\text{entry} / (\text{entry} + \text{exit}))$, comparisons can be made across the two periods regarding which factor was most responsible for the increased unemployment rate. For the younger group, the observed unemployment rate at steady state is 3.4 percent for the Pre-Great Recession period and 7.3 percent for the Post-Great Recession period. If the young entered unemployment at the same rate as before the Great Recession, their predicted unemployment rate in the latter period would fall to 5.08 percent. Staying with the same entry rate, a Pre-Great Recession exit rate would reduce the steady state level to 4.9 percent. While both transition rates contributed to a higher unemployment rate in the Post-Great Recession period, the greater chance of becoming reemployed contributed slightly more to the

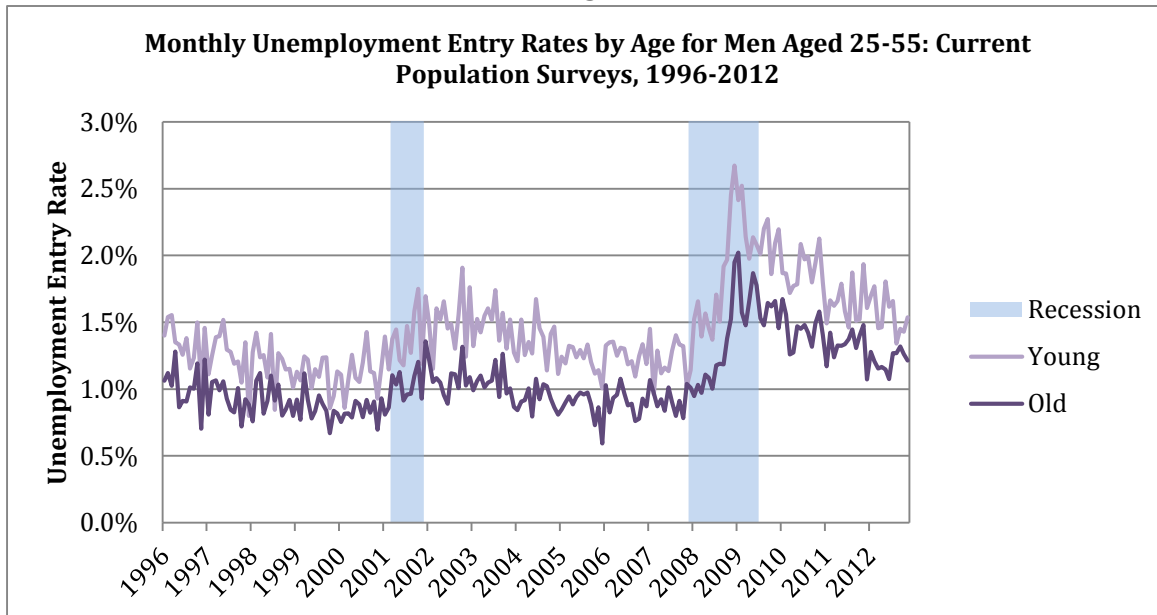
difference. The same pattern is observed for the older group. The stock level of unemployment is 2.9 percent before the recession and 6.2 percent after it. If the old entered unemployment at the same rate as before, their predicted unemployment rate would fall to 4.3 percent. With the same exiting rate as before, their predicted rate falls to 4.2 percent. Thus, the drop of the unemployment-to-employment transition rate appears to play a relatively more important role in raising unemployment for both groups in the Great Recession. It is notable that changes in both the entry and exit rates during Great Recession raised unemployment rates of both younger and older workers.

Figure 1



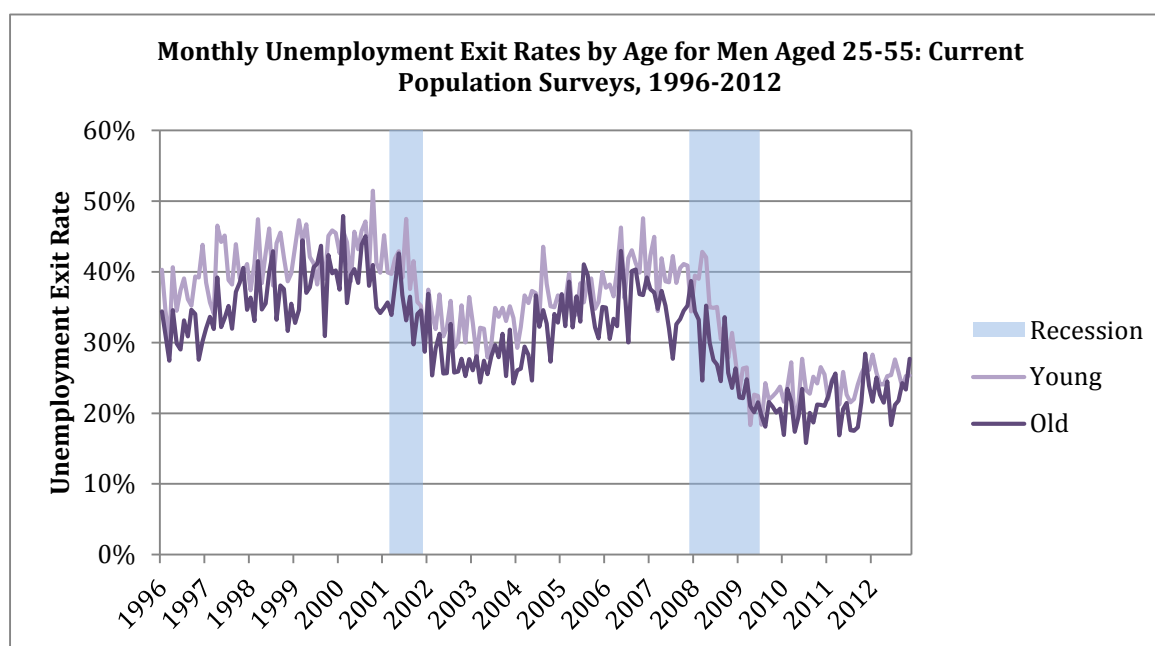
Notes: Monthly unemployment rates are calculated by author using the CPS data. All data are seasonally adjusted. Shaded area represents recession as determined by the National Bureau of Economic Research (NBER).

Figure 2



Notes: Monthly unemployment entry rates are calculated by author using the CPS data. All data are seasonally adjusted. Shaded area represents recession as determined by the National Bureau of Economic Research (NBER).

Figure 3



Notes: Monthly unemployment exit rates are calculated by author using the CPS data. All data are seasonally adjusted. Shaded area represents recession as determined by the National Bureau of Economic Research (NBER).

Figures 1-3 show the movement of the seasonally adjusted aggregate unemployment rates and the underlying transitions through the whole sample period from 1996 to 2012. The shaded vertical bars in the figures indicated recessionary periods during the sample period. Figure 1 shows the unemployment rates of the young and old over the business cycle. While young men experience a higher unemployment rate than the old throughout the entire sample period, the magnitude of the gap appears similar across many years, consistent with the summary information contained in Table 2.

Figure 2 contains a plot of the unemployment entry rates for younger and older men from 1996 to 2012. The probability of losing a job is consistently higher for younger than older workers throughout the period of the sample but is highest during and immediately after recessions. The differences between the two data series for younger and older workers tend to narrow over periods of growth following recessions. For example, in the period of growth in the first decade of the century and again

following the Great Recession, there is a visible narrowing between the transition rates for younger relative to older workers.

Figure 3 similarly contains a plot of the unemployment exit rates across the two age groups from 1996 to 2012. While the unemployment exit rate of the younger members of the sample exceeds that of the older group for most of the sample period, the gap is not large and in many periods, the rates of the two groups appear similar. Both series clearly appear positively correlated with the business cycle although the probability of transitioning from unemployment to employment has trended downward secularly throughout the sample period. It is also notable that both series reach their minimum points at the Great Recession.

4. Model

To examine differences in the transition probabilities with respect to business cycle conditions, a Linear Probability Model (LPM) that controls for individual and job characteristics is used. The corresponding results for transitions between employment and unemployment (and non-participation as the model is extended) are reported from ordinary least squares (OLS) estimates of linear probability models. The regression framework in the empirical model is as follows,

$$\begin{aligned}
T_{pqist} = & \beta_0 + \beta_1 Young_{ist} + \beta_2 Undiff_{st} + \beta_3 Undiff_{st} \times Young_{ist} + \beta_4 Undiff_{st} \\
& \times Rising(Falling)_t + \beta_5 Undiff_{st} \times Rising(Falling)_t \times Young_{ist} + \mathbf{X}_{ist} \delta + \alpha_s \\
& + \gamma_t + \varepsilon_{ist}
\end{aligned}$$

where i references the individual, s their state, and t the month. The dependent variable T (transition

probability) is a binary variable representing the probability that a person in state p (U, E, or NLF) in one month will be in state q (U, E, or NLF) in the following month, where U is unemployment, E is employment, and NLF is not in the labor force. The transition is a stochastic process following a discrete-time Markov chain.

Young is a dummy variable indicating whether an individual is young (1 for young and 0 for old). *Undiff* is the business cycle control variable measuring the deviation of the state demand relative to a national measure of full employment, which is equal to the state-level aggregate unemployment rate minus the national natural rate of unemployment. *Rising (Falling)* is a dummy variable for whether it is a period of rising (falling) aggregate unemployment. X is a set of control variables including age, age-squared, marital status, education, occupation and industry. α and γ represent state and month fixed effects, respectively. ε is the error term. Standard errors are calculated using methods that account for clustering due to multiple observations per individual.

The key parameters in the equation are β_1 , β_2 , and β_3 . β_1 measures whether the younger workers have an increased probability of making a transition. The estimate of β_2 indicates the extent to which the transition is influenced by the business cycle. The estimate of β_3 indicates whether the influence of the business cycle is greater for younger relative to older workers.

5. Empirical Results for Transitions between Employment and Unemployment

5.1 Transitions from Employment to Unemployment

Panel A of Table 3 reports the estimates from the linear probability models for employment to unemployment transitions for the period of 1996-2012. Specification 1 reports parameter estimates associated with the dummy variable for young men and the business cycle control variable from a

model that also includes measures of marital status, education, occupation, industry¹⁵, and state and month fixed effects. In this model, employed young men are 0.143 percentage points more likely to become unemployed in the following month than the old. The parameter for the business cycle control indicates that members of the sample are 0.148 percentage points more likely to become unemployed in the following month when the state-level unemployment rate increases by one percentage point.

Specification 2 includes the interaction between the dummy variable for young and the business cycle control, along with the other regressors. Young men have a 0.115 percentage points higher base probability to enter unemployment in the following month than the old. Both young and old are 0.125 percentage points more likely to being unemployed in the following month when there is a one percentage point increase in the local unemployment rate. The interaction term indicates that the younger workers are more affected by cyclical changes than the old. For each percentage-point increase in the local unemployment rate relative to the NRU, the transition probability of entering unemployment is 0.04 percentage points higher for the young. This is consistent with the view that older workers embody more workplace skills on average and are less likely to be laid off during a recession.

Specification 3 excludes marital status, education, occupation and industry. Young men are more likely to enter unemployment in the following month than the old, and a stronger effect of cyclical variations is observed for them relative to the older workers. Thus, the basic results are not sensitive to inclusion or exclusion of these controls.

Specification 4 includes interactions between the business cycle control variable, a dummy variable for whether it is a period of rising aggregate unemployment, and the dummy variable for the

¹⁵ The model controls for marital status (married = 1; 0 otherwise), three educational levels, three types of occupation, and fourteen types of industry.

young. The purpose of these estimates is to see if responses are symmetric when demand is rising and falling. The corresponding results show that in periods of rising unemployment, the transition probability for all men rises by 0.042 percentage point with a one percentage-point increase in the local unemployment rate and the young do not have a stronger response in periods of rising unemployment. Estimates from specification 2-4 provide evidence that the young are more likely to be fired in periods of slack demand.

Table 4 reports a similar set of estimates except that the sample period is restricted to the years before the Great Recession. The results in Panel A of Table 4 are similar to those contained in Panel A of Table 3. Young men have higher monthly transition rates in moving from employment to unemployment than the old and this probability is higher in specification 3 when the control variables are excluded. The underlying transition probability rises more for the young than for the old for each percentage-point increase in the local unemployment rate relative to the NRU. The unemployment entry rate of the younger workers is not more responsive to business cycle conditions when the labor market is becoming more slack. In summary, evidence from Panel A of Table 4 shows that the young men are more sensitive to business cycle conditions than older ones in terms of their unemployment entry rates in the pre-Great Recession period.

Panel A of Table 5 reports the linear regression estimates for the unemployment entry rate for the sample period of 2008-2012. In the post-Great Recession period, young men have a greater likelihood of entering unemployment in the following month. And the probability of all workers to enter unemployment increases when the economy worsens. These two results can be seen in the statistically significant parameters for both the dummy variable for being a younger member of the sample and for the business cycle variable (*Undiff*) across the four specifications of the sample. However, in contrast

to Table 4 Panel A which considered the employment to unemployment transition before the great recession, Table 5 Panel A shows that there is no longer a statistically significant relationship between being young and having a larger response to all business cycle conditions in the time period after the beginning of the Great Recession (interaction of *Young* and *Undiff*). However, all workers are found to have a significantly larger response to rising unemployment (interaction of *Undiff* and *Rising*) in the recessionary period and that younger workers (additional interaction with *Young*) had the most adverse response to worsening business cycle conditions during the Great Recession.

Table 3. Labor Force Transitions Using Matched Current Population Surveys: 1996-2012

Regressor	Specification			
	(1)	(2)	(3)	(4)
Panel A. Linear Regressions for Probability of Employment-to-Unemployment Transition				
Young	0.00143*** (0.000153)	0.00115*** (0.000148)	0.00358*** (0.000145)	0.00114*** (0.000148)
Undiff	0.00148*** (0.0000448)	0.00125*** (0.0000555)	0.00130*** (0.0000557)	0.00111*** (0.0000659)
Undiff*Young		0.000445*** (0.0000815)	0.000405*** (0.0000821)	0.000355*** (0.0000976)
Undiff*Rising				0.000422*** (0.000108)
Undiff*Rising*Young				0.000261 (0.000166)
Sample size	3,377,350	3,377,350	3,377,350	3,377,350
Mean of dependent variable	0.0131152	0.0131152	0.0131152	0.0131152
Panel B. Linear Regressions for Probability of Unemployment-to-Employment Transition				
Young	0.0471*** (0.00298)	0.0529*** (0.00368)	0.0454*** (0.00368)	0.0529*** (0.00368)
Undiff	-0.0314*** (0.000647)	-0.0296*** (0.000868)	-0.0290*** (0.000874)	-0.0302*** (0.000980)
Undiff* Young		-0.00329*** (0.00112)	-0.00375*** (0.00113)	-0.00254** (0.00129)
Undiff*Falling				0.00170 (0.00125)
Undiff*Falling* Young				-0.00216 (0.00175)
Sample size	142,564	142,564	142,564	142,564
Mean of dependent variable	0.2998316	0.2998316	0.2998316	0.2998316

Notes: The sample consists of males aged 25-55. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. All specifications also included a constant, marital status, education, occupation and industry, and state and month fixed effects except Specification 3, which excludes, marital status, education, occupation and industry.

*p< 0.1; **p< 0.05; ***p< 0.01

Table 4. Labor Force Transitions Using Matched Current Population Surveys: 1996-2007

Regressor	Specification			
	(1)	(2)	(3)	(4)
Panel A. Linear Regressions for Probability of Employment-to-Unemployment Transition				
Young	0.000975*** (0.000168)	0.00115*** (0.000184)	0.00363*** (0.000182)	0.00114*** (0.000184)
Undiff	0.00176*** (0.000101)	0.00148*** (0.000119)	0.00139*** (0.000119)	0.00145*** (0.000133)
Undiff*Young		0.000536*** (0.000150)	0.000637*** (0.000151)	0.000618*** (0.000175)
Undiff*Rising				0.000102 (0.000183)
Undiff*Rising*Young				-0.000256 (0.000277)
Sample size	2,442,408	2,442,408	2,442,408	2,442,408
Mean of dependent variable	0.0115706	0.0115706	0.0115706	0.0115706
Panel B. Linear Regressions for Probability of Unemployment-to-Employment Transition				
Young	0.0557*** (0.00421)	0.0557*** (0.00421)	0.0486*** (0.00419)	0.0558*** (0.00421)
Undiff	-0.0482*** (0.00249)	-0.0485*** (0.00324)	-0.0496*** (0.00328)	-0.0514*** (0.00385)
Undiff* Young		0.000447 (0.00381)	0.000438 (0.00385)	0.00717 (0.00468)
Undiff*Falling				0.00768 (0.00528)
Undiff*Falling* Young				-0.0176** (0.00719)
Sample size	80,390	80,390	80,390	80,390
Mean of dependent variable	0.3566506	0.3566506	0.3566506	0.3566506

Notes: The sample consists of males aged 25-55. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. All specifications also included a constant, marital status, education, occupation and industry, and state and month fixed effects except Specification 3, which excludes, marital status, education, occupation and industry.

*p< 0.1; **p< 0.05; ***p< 0.01

Table 5. Labor Force Transitions Using Matched Current Population Surveys: 2008-2012

Regressor	Specification			
	(1)	(2)	(3)	(4)
Panel A. Linear Regressions for Probability of Employment-to-Unemployment Transition				
Young	0.00277*** (0.000331)	0.00232*** (0.000483)	0.00434*** (0.000481)	0.00227*** (0.000483)
Undiff	0.000968*** (0.000101)	0.000893*** (0.000115)	0.000799*** (0.000115)	0.000760*** (0.000122)
Undiff*Young		0.000149 (0.000146)	0.000178 (0.000147)	0.0000245 (0.000158)
Undiff*Rising				0.000518*** (0.000125)
Undiff*Rising*Young				0.000379** (0.000193)
Sample size	934,942	934,942	934,942	934,942
Mean of dependent variable	.016907	.016907	.016907	.016907
Panel B. Linear Regressions for Probability of Unemployment-to-Employment Transition				
Young	0.0366*** (0.00416)	0.0429*** (0.00832)	0.0331*** (0.00839)	0.0429*** (0.00832)
Undiff	-0.0228*** (0.00150)	-0.0219*** (0.00177)	-0.0223*** (0.00179)	-0.0221*** (0.00183)
Undiff* Young		-0.00166 (0.00189)	-0.00144 (0.00191)	-0.00129 (0.00200)
Undiff*Falling				0.000562 (0.00131)
Undiff*Falling* Young				-0.00110 (0.00180)
Sample size	62,174	62,174	62,174	62,174
Mean of dependent variable	0.234065	0.234065	0.234065	0.234065

Notes: The sample consists of males aged 25-55. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. All specifications also included a constant, marital status, education, occupation and industry, and state and month fixed effects except Specification 3, which excludes, marital status, education, occupation and industry.

*p< 0.1; **p< 0.05; ***p< 0.01

5.2 Transitions from Unemployment to Employment

Panel B of Table 3 reports estimates of the linear probability models for unemployment-to-employment transitions from 1996 to 2012. In all the specifications, young men are more likely to be employed in the following month at conventional levels of significance. The transitions for both young and old are also statistically significantly cyclical related to the business cycle control variable. When the local unemployment rate rises, it significantly lowers the probability of movement from unemployment to employment for all men. Considering the interaction term between the business cycle measure and the categorical dummy variable for the young, the results show that young men have less of a chance of moving from unemployment to employment than the older men when there is an increase in the local unemployment rate. For both groups, there is no finding suggesting they have a differential responsiveness to periods of falling unemployment in terms of the probability of being reemployed.

Panel B of Tables 4 and 5 report the estimation results for the LPM of unemployment exit rates for the sample periods prior to the Great Recession and afterwards, respectively. Panel B of Table 4 shows the set of parameter estimates for the period of 1996-2007. In the pre-Great Recession period, the young have a (statistically significant) higher base transition probability from unemployment to employment in all specifications. The parameter associated with the business cycle control variable also indicates that all men are less likely to be reemployed in the following month when there is low cyclical demand. However, in the pre-recession period, the re-employment probability of younger workers does not appear to have a greater sensitivity to business cycle conditions than for older workers. Similarly, the relationship over the sample period between business cycle conditions and chances of re-employment does not appear to be closely related to rising or falling demand.

Panel B of Table 5 reports the LPM estimates for unemployment exit rates from 2008 to 2012. Consistent with Panel B of Table 4, the young are observed having a higher probability (parameter on Young) than older workers of being re-employed, although the parameters are smaller in magnitude. The parameter estimates for the business cycle control variables are negative and statistically significant, indicating that all men are about 2.2 percentage points less likely of being reemployed in response to one percentage-point increase in local unemployment in the post-Great Recession period. The interaction terms between the business cycle control variable and the dummy variable for the young are negative and statistically insignificant, indicating that young men do not differ from the old in their responsiveness to changes in the tightness of labor market. And for both groups, there is no evidence showing that they respond differently to business cycles in periods of falling unemployment.

6. Empirical Results for Transitions across the Labor Force

6.1 Descriptive Statistics

Prior research has established that in addition to movements of individuals between employment and unemployment, substantial numbers of people also move in and out of the labor force over the business cycle and these patterns are associated with basic demographic characteristics such as race (Couch and Fairlie 2010). Thus, for a better overall depiction of the labor market dynamics in the sample, the analysis is expanded to include transitions into and out of the labor force.

Table 6 provides a preview of monthly transition probabilities across all three labor force states of the young and old summing them over the complete sample period from 1996-2012. The average probability of moving from employment to not in the labor force for all males in the sample is 0.0115. This probability for young men is higher than the sample average at 0.0122 and it is slightly lower for

the old at 0.0107. Comparing the transition probabilities of moving from employment to not in the labor force and employment to unemployment shows that there is roughly the same likelihood for each of these transitions for both the young and old (0.012 and 0.015 for the young; 0.011 and 0.011 for the old) groups within the sample. Thus, it would be an important omission to exclude the transition of employment to not in the labor force from the analysis.

Similarly, another important transition in observing the entire cyclical behavior of flows of workers is movement from not in the labor force directly to employment. The average probability of moving from not in the labor force to employment the following month for the whole sample is 0.089. Young men appear to have a higher probability than the sample average and old men appear to have a lower probability of moving from nonparticipation to employment. 12% of young men who are not in the labor force move to employment the following month and 7% of old men move from not in the labor force to employment monthly. Comparing the probability of moving from not in the labor force to employment and the probability of moving from unemployment to employment, the former approaches half of the latter (0.12 and 0.27) for the young and exceeds a quarter of the latter (0.07 and 0.24) for the old. Thus, it is also important to include this transition in explaining hiring behavior.

To compare the transitions among different labor force states before and after the Great Recession, Table 7 provides estimated probabilities similar to those contained in Table 6 except that the monthly transition rates for different age groups are reported for periods before the beginning of the Great Recession and afterwards. The chance of moving from unemployment to employment dropped sharply in the post-Great Recession period, from 32% to 21% for the young and 28% to 19% for the old. In addition to the reduced chance of moving from unemployment to employment, lower probabilities of moving from nonparticipation to employment also contribute to the drop in re-

employment associated with the Great Recession. Comparing the two periods, rates of entry into employment directly for those out of the labor force decreased from 13% to 10% for the young, and from 7% to 6% for the old.

Comparing the changes in transition probabilities for the movement from employment to nonparticipation with those for the transition from employment to unemployment in the two periods, there is no substantial increase in movement from employment to nonparticipation (0.012 to 0.013 for the young; 0.011 to 0.011 for the old); however, there is an observable increase in the probability of moving from employment to unemployment (0.013 to 0.019 for the young; 0.010 to 0.014 for the old). This indicates that the increase in people leaving employment associated with the Great Recession was primarily associated with a rise in movements from employment to unemployment rather than exits from the labor force.

Table 7 also shows that between the two sample periods (pre-recession; Great Recession) there was also a considerable increase in the transition rate from nonparticipation into unemployment. 7.5% of the young men who were not in the labor force moved into unemployment before the Great Recession, compared to 10.5% after the Great Recession. 3.7% of the older men who were not in the labor force had transitioned to being unemployed (presumably by initiating a job search) before the Great Recession, compared to 5.5% in the later period. This indicates that there was an increased chance in the post-Great Recession period that people entered the labor force from nonparticipation but stayed unemployed. Together with the fact that most people exiting from employment became unemployed instead of leaving the labor force, these two dynamics contributed to the increasing aggregate unemployment for both young and old after the Great Recession.

Table 6. Monthly Transition Probabilities: Matched Current Population Surveys, 1996-2012

Sample and Status This Month	Status Next Month		
	Employed	Unemployed	Not in the Labor Force
Males Aged 25-55			
Employed	0.9756	0.013	0.0115
Unemployed	0.2563	0.6011	0.1426
Not in the Labor Force	0.0889	0.061	0.8501
Young Males Aged 25-40			
Employed	0.9731	0.0147	0.0122
Unemployed	0.2719	0.583	0.1452
Not in the Labor Force	0.1215	0.0855	0.7931
Old Males Aged 41-55			
Employed	0.9783	0.011	0.0107
Unemployed	0.2357	0.6251	0.1392
Not in the Labor Force	0.0656	0.0434	0.891

Notes: The sample consists of males aged 25-55. All estimates are calculated using sample weights provided by the CPS.

Table 7. Monthly Transition Probabilities: Matched Current Population Surveys

Sample and Status This Month	Status Next Month		Not in the Labor Force
	Employed	Unemployed	
1996-2007			
Males Aged 25-55			
Employed	0.9773	0.0114	0.0112
Unemployed	0.3025	0.5475	0.15
Not in the Labor Force	0.0949	0.053	0.8522
Young Males Aged 25-40			
Employed	0.9751	0.013	0.0119
Unemployed	0.3196	0.5298	0.1506
Not in the Labor Force	0.1307	0.0752	0.7941
Old Males Aged 41-55			
Employed	0.9798	0.0097	0.0106
Unemployed	0.2784	0.5723	0.1493
Not in the Labor Force	0.0695	0.0372	0.8933
2008-2012			
Males Aged 25-55			
Employed	0.9712	0.0167	0.0121
Unemployed	0.2019	0.6642	0.1338
Not in the Labor Force	0.0775	0.0763	0.8462
Young Males Aged 25-40			
Employed	0.9678	0.0191	0.0131
Unemployed	0.2125	0.6491	0.1384
Not in the Labor Force	0.1041	0.1047	0.7912
Old Males Aged 41-55			
Employed	0.9747	0.0143	0.0111
Unemployed	0.189	0.6829	0.1281
Not in the Labor Force	0.0581	0.0554	0.8865

Notes: The sample consists of males aged 25-55. All estimates are calculated using sample weights provided by the CPS.

6.2 Estimated Transitions across Labor Force States

Table 8 contains estimates of the LPM for the transitions across all three labor force states for the entire sample period of 1996 to 2012. All specifications include the dummy variable for the young, the business cycle control variable, their interactions, and the controls for personal and job characteristics, comparable to Specification 2 in Table 3. That set of controls and estimation results is used as a baseline reference model from the examination of two transitions (employment to unemployment) in comparison to the extension to three (including not in the labor force) to see how this addition impacts the estimates.

Columns (1) and (2) in Panel A of Table 8, contain the results for transitions from employment to unemployment (1) and not in the labor force (2). Compared with the baseline model (Model 2, Panel A, Table 3), the parameter estimate for the interaction term between the business cycle (*Undiff*) and the dummy for being a younger worker (*Young*) for the employment-to-unemployment transition (column (1)) is similar here (0.0004). It is small, positive, and statistically significant, indicating that the young are more likely to be laid off than the old when the local demand for labor is low. The same interaction term (column (2)) in the model for the movement from employment to nonparticipation is also small, positive, and statistically significant, which indicates that the young are more likely to exit employment when the local demand is weak. Combining the evidence of leaving employment, it confirms that the young have a stronger cyclical response to the business cycle than the old. In the prior literature, this would have been termed as evidence that the young are the first-fired when the business cycle weakens.

The regression coefficients from the LPM for the transitions into employment from being unemployed or Not in the Labor Force are contained in columns (3) and (5). Column (3) reports the

transition estimates from unemployment to employment, and when compared to the baseline specification (Model 2, Panel B, Table 3), the results are similar here. The estimated parameter associated with the interaction of being a younger worker and the business cycle is negative (-0.003) and statistically significant, indicating that when demand conditions are weak, younger workers are less likely to move from unemployment to employment. Also, as shown by the negative and statistically significant coefficient in column (5), young men have a lower chance of being hired from out of the labor force when business cycle conditions are weak. In considering either transitions from being unemployed or not in the labor force, young men are less likely to re-enter employment when business cycle conditions are weak relative to older workers. Thus, described in the way the prior literature summarized these patterns, on average they appear to be the last hired.

Panels B and C of Table 8 include an additional variable for periods of rising (Panel B) or falling (Panel C) unemployment rates, respectively, and its interaction with the young dummy and the business cycle control (*Undiff*). The inclusion of these two panels is to test whether there are symmetrical responses during periods of rising or falling demand. With very few significant results in the newly added interaction terms, the evidence supports the idea that for the most part, changes in transition rates captured by the key variables from the baseline specification describe symmetric movements of transition rates in periods of both rising and falling unemployment.

Table 8. Estimated Transitions across Labor Force Status: Matched CPS Data, 1996-2012

Regressor	Transition					
	Employed to Unemployed	Employed to Not in Labor Force	Unemployed to Employed	Unemployed to Not in Labor Force	Not in Labor Force to Employed	Not in Labor Force to Unemployed
Panel A. Linear Regressions Assuming Symmetric Responses Over the Business Cycle Transition						
Young	0.00114*** (0.000146)	-0.000329** (0.000142)	0.0485*** (0.00322)	-0.0100*** (0.00248)	0.0617*** (0.00142)	0.0375*** (0.00108)
Undiff	0.00124*** (0.0000548)	0.0000908* (0.0000484)	-0.0239*** (0.000766)	-0.00627*** (0.000624)	-0.00262*** (0.000314)	0.00535*** (0.000303)
Undiff* Young	0.000433*** (0.0000805)	0.000186*** (0.0000685)	-0.00320*** (0.000995)	0.00225*** (0.000803)	-0.00351*** (0.000553)	0.00333*** (0.000543)
N	3,414,899	3,414,899	165,686	165,686	356,113	356,113
R ²	0.009	0.005	0.038	0.012	0.019	0.013
Panel B. Linear Regressions Testing Symmetric Response Over the Business Cycle						
Young	0.00114*** (0.000146)	-0.000329** (0.000142)	0.0485*** (0.00322)	-0.0101*** (0.00248)	0.0617*** (0.00142)	0.0375*** (0.00108)
Undiff	0.00110*** (0.0000652)	0.0000644 (0.0000575)	-0.0243*** (0.000844)	-0.00543*** (0.000716)	-0.00259*** (0.000364)	0.00518*** (0.000356)
Undiff* Young	0.000344*** (0.0000964)	0.000219*** (0.0000831)	-0.00237** (0.00113)	0.00161* (0.000940)	-0.00347*** (0.000645)	0.00257*** (0.000636)
Undiff*Rising	0.000417*** (0.000106)	0.0000765 (0.0000911)	0.00142 (0.00113)	-0.00247*** (0.000954)	-0.0000929 (0.000522)	0.000521 (0.000538)
Undiff*Rising* Young	0.000259 (0.000164)	-0.0000961 (0.000136)	-0.00242 (0.00158)	0.00189 (0.00133)	-0.0000978 (0.000973)	0.00225** (0.00103)
N	3,414,899	3,414,899	165,686	165,686	356,113	356,113
R ²	0.009	0.005	0.038	0.012	0.019	0.013
Panel C. Linear Regressions Testing Symmetric Response Over the Business Cycle						
Young	0.00114*** (0.000146)	-0.000329** (0.000142)	0.0485*** (0.00322)	-0.0100*** (0.00248)	0.0617*** (0.00142)	0.0375*** (0.00108)
Undiff	0.00135*** (0.0000668)	0.000103* (0.0000584)	-0.0243*** (0.000869)	-0.00665*** (0.000704)	-0.00260*** (0.000364)	0.00544*** (0.000358)
Undiff* Young	0.000486*** (0.0000999)	0.000136 (0.0000838)	-0.00260** (0.00114)	0.00256*** (0.000924)	-0.00317*** (0.000654)	0.00400*** (0.000661)

Undiff*Falling	-0.000300*** (0.000105)	-0.0000353 (0.0000906)	0.00133 (0.00112)	0.00109 (0.000966)	-0.0000696 (0.000530)	-0.000226 (0.000542)
Undiff*Falling* Young	-0.000144 (0.000160)	0.000141 (0.000135)	-0.00172 (0.00156)	-0.000874 (0.00134)	-0.000928 (0.000953)	-0.00184* (0.000995)
N	3,414,899	3,414,899	165,686	165,686	356,113	356,113
R ²	0.009	0.005	0.038	0.012	0.019	0.013

Notes: The sample consists of males aged 25-55. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. All specifications also included a constant, marital status, education, occupation and industry, and state and month fixed effects except specification 5 and 6, which exclude occupation and industry.

*p< 0.1,**p< 0.05,***p< 0.01

Table 9. Estimated Transitions across Labor Force Status: Matched CPS Data, 1996-2007

Regressor	Transition					
	Employed to Unemployed	Employed to Not in Labor Force	Unemployed to Employed	Unemployed to Not in Labor Force	Not in Labor Force to Employed	Not in Labor Force to Unemployed
Panel A. Linear Regressions Assuming Symmetric Responses Over the Business Cycle Transition						
Young	0.00115*** (0.000182)	-0.000480*** (0.000174)	0.0519*** (0.00369)	-0.0113*** (0.00284)	0.0635*** (0.00165)	0.0379*** (0.00129)
Undiff	0.00146*** (0.000117)	0.000152 (0.000119)	-0.0370*** (0.00283)	-0.0122*** (0.00222)	-0.00310*** (0.000928)	0.00601*** (0.000697)
Undiff* Young	0.000524*** (0.000149)	0.000147 (0.000146)	-0.00129 (0.00333)	0.00542** (0.00254)	-0.00235 (0.00146)	0.00481*** (0.00114)
N	2,469,204	2,469,204	94,091	94,091	240,366	240,366
R ²	0.007	0.005	0.028	0.012	0.020	0.010
Panel B. Linear Regressions Testing Symmetric Response Over the Business Cycle						
Young	0.00114*** (0.000182)	-0.000494*** (0.000174)	0.0521*** (0.00369)	-0.0112*** (0.00284)	0.0635*** (0.00165)	0.0379*** (0.00129)
Undiff	0.00143*** (0.000132)	0.0000593 (0.000135)	-0.0344*** (0.00325)	-0.0135*** (0.00256)	-0.00379*** (0.00104)	0.00582*** (0.000777)
Undiff* Young	0.000601*** (0.000173)	0.000353** (0.000172)	-0.00524 (0.00397)	0.00436 (0.00307)	-0.00177 (0.00171)	0.00448*** (0.00133)
Undiff*Rising	0.000100 (0.000181)	0.000290 (0.000191)	-0.00825* (0.00483)	0.00421 (0.00400)	0.00221 (0.00143)	0.000625 (0.00109)
Undiff*Rising* Young	-0.000243 (0.000274)	-0.000645** (0.000275)	0.0125* (0.00661)	0.00343 (0.00524)	-0.00186 (0.00277)	0.00105 (0.00219)
N	2,469,204	2,469,204	94,091	94,091	240,366	240,366
R ²	0.007	0.005	0.028	0.013	0.020	0.010
Panel C. Linear Regressions Testing Symmetric Response Over the Business Cycle						
Young	0.00114*** (0.000182)	-0.000483*** (0.000174)	0.0519*** (0.00369)	-0.0113*** (0.00284)	0.0635*** (0.00165)	0.0379*** (0.00129)
Undiff	0.00141*** (0.000133)	0.000155 (0.000137)	-0.0398*** (0.00335)	-0.0114*** (0.00267)	-0.00179* (0.00105)	0.00604*** (0.000788)
Undiff* Young	0.000490*** (0.000177)	-0.0000524 (0.000176)	0.00396 (0.00412)	0.00622* (0.00318)	-0.00221 (0.00178)	0.00460*** (0.00138)

Undiff*Falling	0.000141 (0.000180)	-0.00000507 (0.000191)	0.00731 (0.00469)	-0.00220 (0.00378)	-0.00354** (0.00142)	-0.0000748 (0.00106)
Undiff*Falling* Young	0.0000899 (0.000268)	0.000533* (0.000273)	-0.0137** (0.00639)	-0.00208 (0.00506)	-0.000348 (0.00266)	0.000568 (0.00207)
N	2,469,204	2,469,204	94,091	94,091	240,366	240,366
R ²	0.007	0.005	0.028	0.013	0.020	0.010

Notes: The sample consists of males aged 25-55. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. All specifications also included a constant, marital status, education, occupation and industry, and state and month fixed effects except specification 5 and 6, which exclude occupation and industry.

*p< 0.1,**p< 0.05,***p< 0.01

Table 10. Estimated Transitions across Labor Force Status: Matched CPS Data, 2008-2012

Regressor	Transition					
	Employed to Unemployed	Employed to Not in Labor Force	Unemployed to Employed	Unemployed to Not in Labor Force	Not in Labor Force to Employed	Not in Labor Force to Unemployed
Panel A. Linear Regressions Assuming Symmetric Responses Over the Business Cycle Transition						
Young	0.00230*** (0.000477)	0.0000968 (0.000430)	0.0370*** (0.00728)	-0.00301 (0.00592)	0.0526*** (0.00368)	0.0389*** (0.00330)
Undiff	0.000880*** (0.000114)	0.000182* (0.000100)	-0.0178*** (0.00156)	-0.00592*** (0.00127)	-0.000474 (0.000672)	0.00572*** (0.000646)
Undiff* Young	0.000140 (0.000144)	0.000161 (0.000121)	-0.00131 (0.00167)	0.000760 (0.00137)	-0.00157* (0.000953)	0.00293*** (0.000950)
N	945,695	945,695	71,595	71,595	115,747	115,747
R ²	0.011	0.004	0.026	0.011	0.017	0.013
Panel B. Linear Regressions Testing Symmetric Response Over the Business Cycle						
Young	0.00226*** (0.000477)	0.0000940 (0.000430)	0.0376*** (0.00729)	-0.00328 (0.00593)	0.0525*** (0.00368)	0.0387*** (0.00331)
Undiff	0.000749*** (0.000120)	0.000167 (0.000105)	-0.0184*** (0.00158)	-0.00511*** (0.00131)	-0.000424 (0.000697)	0.00556*** (0.000674)
Undiff* Young	0.0000180 (0.000156)	0.000154 (0.000132)	-0.000291 (0.00174)	0.000246 (0.00145)	-0.00167 (0.00101)	0.00216** (0.00101)
Undiff*Rising	0.000511*** (0.000124)	0.0000594 (0.000104)	0.00220* (0.00118)	-0.00315*** (0.000996)	-0.000158 (0.000566)	0.000741 (0.000605)
Undiff*Rising* Young	0.000372* (0.000191)	0.0000225 (0.000154)	-0.00328** (0.00162)	0.00169 (0.00138)	0.000290 (0.00104)	0.00245** (0.00114)
N	945,695	945,695	71,595	71,595	115,747	115,747
R ²	0.012	0.004	0.026	0.011	0.017	0.014
Panel C. Linear Regressions Testing Symmetric Response Over the Business Cycle						
Young	0.00229*** (0.000477)	0.0000971 (0.000430)	0.0370*** (0.00728)	-0.00297 (0.00592)	0.0526*** (0.00368)	0.0389*** (0.00331)
Undiff	0.00108*** (0.000122)	0.000200* (0.000107)	-0.0179*** (0.00161)	-0.00642*** (0.00131)	-0.000646 (0.000695)	0.00590*** (0.000677)
Undiff* Young	0.000219 (0.000160)	0.000145 (0.000133)	-0.00101 (0.00176)	0.00103 (0.00144)	-0.00119 (0.00102)	0.00374*** (0.00104)

Undiff*Falling	-0.000558*** (0.000125)	-0.0000508 (0.000105)	0.000256 (0.00118)	0.00147 (0.00102)	0.000480 (0.000590)	-0.000587 (0.000627)
Undiff*Falling* Young	-0.000216 (0.000187)	0.0000454 (0.000154)	-0.000865 (0.00160)	-0.000791 (0.00139)	-0.00107 (0.00102)	-0.00220** (0.00110)
N	945,695	945,695	71,595	71,595	115,747	115,747
R ²	0.012	0.004	0.026	0.011	0.017	0.014

Notes: The sample consists of males aged 25-55. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. All specifications also included a constant, marital status, education, occupation and industry, and state and month fixed effects except specification 5 and 6, which exclude occupation and industry.

*p< 0.1,**p< 0.05;***p< 0.01

Table 9 provides a set of estimates comparable to those found in Table 8; however, the sample period includes only the years before the Great Recession from 1996 to 2007. Looking first at the estimated parameters associated with being young on the six labor market transitions, the young are more likely to leave employment, more likely to come from being not in the labor force into either employment or unemployment, and less likely to leave unemployment than older workers. For all workers, young and old, the transitions are significantly related to the business cycle measure (*Undiff*) in the expected way. All workers are more likely to become unemployed when demand in the economy is weak. Workers are also less likely to either leave unemployment or move into the labor force when demand is weak. Generally, interactions of the dummy variable for being a younger worker with the business cycle variable are insignificant prior to the Great Recession with the exception of the transition from the young appearing more likely to enter the labor force than older workers when demand is weak.

Panels B and C of Table 9 examine whether the patterns of transitions vary during periods of rising or falling unemployment. For the estimated parameters on the interaction between rising or falling unemployment and the business cycle variable (*Undiff*) only three are statistically significant. Additionally, only two of the estimated parameters associated with the extra interaction with the variable for the younger workers are statistically significant. Thus, the patterns of transitions appear similar across periods of rising and falling unemployment.

Table 10 provides analogous estimates focusing on the sample period after the start of the Great Recession, from 2008 to 2012. Based on the estimated parameters in Columns (1) and (2), the younger workers appear to be more likely to leave employment than older workers on average although there is no statistically significant difference for their exits from the labor force. Examining

the transitions from unemployment in Columns (3) and (4), younger workers appear more likely to leave being unemployed and transitioning to employment on average than older workers, but there does not appear to be a significant difference in the base probability of moving to nonparticipation from being unemployed. The estimated probabilities of younger workers transiting from being out of the labor force to either being employed or unemployed are statistically significant and positive as would be expected.

Across the columns of Table 10 in Panel A, the transition probabilities of the combined group of younger and older workers are significantly associated with the measure of demand in the economy (*Undiff*) in most models. For example, movements from being employed to either unemployment or out of the labor force are positively associated with weak economic demand. Exiting unemployment is negatively associated with weak demand. Moving from out of the labor force to being unemployed is positively related to weak demand, and this association is shown to be stronger for younger workers (interaction of *Undiff* and *Young*).

Panels B and C of Table 10 examine whether the relationship between the labor market transitions is influenced by whether unemployment is rising or falling. Of the 12 parameter estimates associated with the interaction between the dummy for the period of rising or falling unemployment and the business cycle variable, only three are statistically significant. Similarly, only three of the additional interactions that provide an examination of whether the rising or falling patterns are different for younger workers are statistically significant. Overall, the results in Panels B and C indicate that patterns are fairly symmetric during periods of rising or falling demand.

7. Test of Structural Change before and after the Great Recession

Tables 11 and 12 present the results of a set of tests for structural change of the estimation parameters across the two sample periods from the two-way transition model and the three-way transition model, respectively. The reported estimates in Table 11 and 12, except for the two dummies—“Pre-recession” and “Post-recession”, are the interacted terms involved with the recession dummy. Thus, they show the magnitude of change in parameters from before the Great Recession to afterwards. The “Pre-recession” variable is a dummy variable taking the value 1 for the period from January 1996 to December 2007 and 0 for January 2008 through December 2012. “Post-recession” is a dummy taking the value 1 for the months after January 2008 and 0 for the sample period before December 2007.

Panel A of Table 11 reports the change in the estimation parameters that affect the unemployment entry rate from before to after the Great Recession. The Pre-recession and the Post-recession dummies represent the constant terms for the pre- and post-Great Recession periods, respectively. The mean level of the unemployment entry rate from 1996 to 2007 is around 0.034 and from 2008 to 2012 is around 0.065. This represents an upward shift in the cyclical pattern from before to after the Great Recession that would affect all men in the sample.

Compared to the months before the Great Recession, there is an increase in the base probability of moving from employment to unemployment for the younger members in the second period. This finding is consistent with the pattern shown in Figure 2 as the gap of unemployment entry transitions widened since 2008. The interaction term with the recession dummy and the business cycle control variable is negative and close to zero in all specifications. This indicates that the fluctuation in the unemployment entry rate caused by the business cycle control variable is slightly reduced in the post-Great Recession period. There is also a slight decrease in the parameter associated with the

interactions among the recession dummy, business cycle control variable, and the young dummy. This indicates that though the young were still first to be laid off when there is an increase in the local unemployment rate but the rate of lay-off was mild in the post-Great Recession months when compared to previous months. In summary, the baseline probability of increased unemployment shifted upwards for all workers and this change was exaggerated for younger workers. At the same time, cyclical volatility of the transition from employment to unemployment declined for the young.

Panel B of Table 11 reports the estimated parameters associated with unemployment exits from before to after the Great Recession. The estimates for the Pre-Recession dummy are all sizeable and statistically significant whereas those for the Post-Recession dummy are not (except in one column). The interaction term associated with the recession dummy and the business cycle control variable is sizeable, positive and significant in all specifications. By comparing these estimates of the business cycle control variable to those found in Panel B of Table 4 and 5, it can be seen that the corresponding estimation parameters are negative in both periods. Thus, a positive change from the pre-Great Recession period to post-Great Recession period means that the influence of fluctuations in local demand of labor on the unemployment exit rate became smaller in the later period. This test result confirms the pattern shown in Figure 3, where the trends of unemployment exit rate are countercyclical while the fluctuations are smaller in the later period for both the young and old. In summary, the odds of moving out of unemployment weakened in the Great Recession.

Table 12 considers potential changes in the structure of the transitions when three labor force states are considered. For the greatest part, these estimates confirm patterns found in Table 1. For example, from the pre-recession to the post-recession period, the likelihood of moving from employment to unemployment appears to increase markedly for all workers. This effect is larger for

younger workers. Similar to the two state estimates in Table 11, the cyclical effect declines both for all workers and younger workers.

Also, the likelihood of moving from unemployment to employment is precisely estimated in the pre-recession period and is sizeable (.215) but is not accurately captured in the post-recession period. The odds of making this transition also decline among younger workers. Thus, the chances of finding employment appear to weaken in the Post-Recession period.

Table 11. Test for Changes in Estimation Parameters from before to after the Great Recession

	Specification			
	(1)	(2)	(3)	(4)
Panel A. Linear Regressions for Probability of Employment-to-Unemployment Transition				
Pre-recession	0.0339*** (0.00116)	0.0338*** (0.00116)	0.0127*** (0.000604)	0.0339*** (0.00116)
Post-recession	0.0648*** (0.0227)	0.0650*** (0.0227)	0.0139*** (0.000658)	0.0651*** (0.0227)
Young	0.00185*** (0.000370)	0.00123** (0.000515)	0.000786 (0.000512)	0.00119** (0.000515)
Undiff	-0.000506*** (0.000113)	-0.000293** (0.000142)	-0.000252* (0.000142)	- (0.000160)
Undiff*Young		-0.000398* (0.000209)	-0.000470** (0.000210)	-0.000604** (0.000236)
Undiff*Rising				0.000376* (0.000221)
Undiff*Rising*Young				0.000635* (0.000338)
Sample size	3,377,350	3,377,350	3,377,350	3,377,350
Panel B. Linear Regressions for Probability of Unemployment-to-Employment Transition				
Pre-recession	0.271** (0.0221)	0.271** (0.0221)	0.283*** (0.0118)	0.272*** (0.0221)
Post-recession	0.232 (0.231)	0.230 (0.231)	0.259*** (0.0128)	0.230 (0.232)
Young	-0.0188*** (0.00590)	-0.0138 (0.00930)	-0.0166* (0.00935)	-0.0138 (0.00930)
Undiff	0.0233*** (0.00225)	0.0241*** (0.00319)	0.0252*** (0.00323)	0.0268*** (0.00382)
Undiff*Young		-0.00158 (0.00424)	-0.00129 (0.00429)	-0.00781 (0.00509)
Undiff*Falling				-0.00685 (0.00542)
Undiff*Falling*Young				0.0162** (0.00742)
Sample size	142,564	142,564	142,564	142,564

Notes: The sample period covers 1996-2012. The reported coefficients are the changes in relative parameters from the sample period 1996-2007 to 2008-2012, except for the two dummies, Pre-recession and Post-recession, which characterize the constant term of the regression. The sample consists of males aged 25-55. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. All specifications also included marital status, education, occupation and industry, and state and month fixed effects except Specification 3, which exclude marital status, education, occupation and industry.

*p< 0.1; **p< 0.05; ***p< 0.01

Table 12. Test for Changes in Estimated Transitions from before to after the Great Recession

	Transition					
	Employed to Unemployed	Employed to Not in Labor Force	Unemployed to Employed	Unemployed to Not in Labor Force	Not in Labor Force to Employed	Not in Labor Force to Unemployed
Panel A. Linear Regressions Assuming Symmetric Responses Over the Business Cycle Transition						
Pre-recession	0.0329*** (0.00114)	0.0263*** (0.000974)	0.215*** (0.0192)	0.189*** (0.0145)	0.0209*** (0.00420)	0.0381*** (0.00359)
Post-recession	0.0597*** (0.0204)	0.0240 (0.0270)	0.132 (0.212)	0.301* (0.182)	0.00862 (0.00564)	0.0333*** (0.00478)
Young	0.00122* (0.000509)	0.000659 (0.000462)	-0.0154* (0.00813)	0.00777 (0.00655)	-0.0109*** (0.00401)	0.00106 (0.00353)
Undiff	-0.000292** (0.000140)	-0.0000144 (0.000134)	0.0186*** (0.00279)	0.00384* (0.00222)	0.00197** (0.000946)	-0.000732 (0.000807)
Undiff*Young	-0.000395* (0.000207)	0.00000449 (0.000189)	0.000485 (0.00372)	-0.00476* (0.00288)	0.000727 (0.00174)	-0.00187 (0.00148)
Sample size	3,414,899	3,414,899	165,686	165,686	356,113	356,113
Panel B. Linear Regressions Testing Symmetric Response Over the Business Cycle						
Pre-recession	0.0330*** (0.00114)	0.0264*** (0.000974)	0.215*** (0.0192)	0.188*** (0.0145)	0.0210*** (0.00420)	0.0385*** (0.00359)
Post-recession	0.0598*** (0.0204)	0.0240 (0.0270)	0.132 (0.212)	0.299 (0.183)	0.00865 (0.00565)	0.0336*** (0.00478)
Young	0.00118* (0.000509)	0.000670 (0.000462)	-0.0150* (0.00814)	0.00741 (0.00655)	-0.0109*** (0.00401)	0.000790 (0.00353)
Undiff	-0.000420*** (0.000158)	0.0000651 (0.000152)	0.0151*** (0.00323)	0.00621** (0.00259)	0.00282*** (0.00107)	-0.000652 (0.000901)
Undiff*Young	-0.000594** (0.000233)	-0.000209 (0.000217)	0.00549 (0.00432)	-0.00422 (0.00338)	0.0000612 (0.00198)	-0.00232 (0.00166)
Undiff*Rising	0.000371* (0.000219)	-0.000251 (0.000216)	0.0112** (0.00496)	-0.00748* (0.00411)	-0.00270* (0.00153)	-0.000299 (0.00124)
Undiff*Rising*Young	0.000616* (0.000334)	0.000669** (0.000316)	-0.0158** (0.00680)	-0.00178 (0.00542)	0.00212 (0.00296)	0.00142 (0.00247)
Sample size	3,414,899	3,414,899	165,686	165,686	356,113	356,113
Panel C. Linear Regressions Testing Symmetric Response Over the Business Cycle						
Pre-recession	0.0329*** (0.00114)	0.0263*** (0.000974)	0.215*** (0.0192)	0.189*** (0.0145)	0.0212*** (0.00420)	0.0380*** (0.00359)
Post-recession	0.0597*** (0.0204)	0.0240 (0.0270)	0.132 (0.212)	0.301* (0.182)	0.00890 (0.00564)	0.0332*** (0.00478)
Young	0.00121* (0.000509)	0.000663 (0.000462)	-0.0155* (0.00813)	0.00780 (0.00655)	-0.0109*** (0.00401)	0.00107 (0.00353)

Undiff	-0.0000935 (0.000159)	-0.0000240 (0.000154)	0.0212*** (0.00334)	0.00268 (0.00269)	0.000447 (0.00108)	-0.000623 (0.000911)
Undiff*Young	-0.000282 (0.000238)	0.000188 (0.000220)	-0.00438 (0.00448)	-0.00530 (0.00349)	0.000950 (0.00204)	-0.000857 (0.00173)
Undiff*Falling	-0.000554** (0.000217)	0.0000232 (0.000216)	-0.00657 (0.00482)	0.00321 (0.00390)	0.00412*** (0.00152)	-0.000325 (0.00122)
Undiff*Falling*Young	-0.000306 (0.000327)	-0.000489 (0.000313)	0.0126* (0.00659)	0.00129 (0.00524)	-0.000664 (0.00285)	-0.00276 (0.00234)
Sample size	3,414,899	3,414,899	165,686	165,686	356,113	356,113

Notes: The sample period covers 1996-2012. The reported coefficients are the changes in relative parameters from the sample period 1996-2007 to 2008-2012, except for the two dummies, Pre-recession and Post-recession, which characterize the constant term of the regression. The sample consists of males aged 25-55. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. All specifications also included marital status, education, occupation and industry, and state and month fixed effects except specification 5 and 6, which exclude occupation and industry.

*p< 0.1,**p< 0.05,***p< 0.01

8. Conclusion

Using CPS data from January of 1996 to December of 2012 matched across adjacent months, this paper compares differences in monthly transitions in labor force status in response to business cycle conditions for the young (ages 25 to 40) and old (ages 41 to 55). The paper also disaggregates the sample into a period prior to the Great Recession (1996-2007) and after its start (2008-2012) in order to examine whether patterns of labor market dynamics changed.

Over the complete sample period, younger workers had a greater chance of being observed unemployed, primarily due to their higher chance of entering unemployment. The unemployment rates for the young and old were 7.4 and 6.19 percent respectively in the period of the Great Recession, almost double those before it (3.67 percent for the young and 2.92 for the old). While changes in transition rates out of and into unemployment contributed to a higher unemployment rate in the Post-Great Recession period, the smaller chance of becoming reemployed contributed somewhat more to the difference.

To examine the response of these transitions to business cycle conditions while controlling for other factors, a Linear Probability Model (LPM) was used. Over the whole sample period, the young are more likely to be fired in periods of slack demand. However, in the sample period initiated by the Great Recession, the relationship of job loss to the measure of the business cycle became insignificant for the young workers and all members of the sample experienced an upwards shift in their baseline probability of losing a job.

In considering movements from unemployment to employment, over the entire sample period, young workers have a larger probability of making that transition than older workers; however, the younger workers have the odds of making this transition reduced more than older workers when business cycle conditions worsen. In the two sub-periods of the sample, young workers have a higher chance of moving from unemployment to employment but appear no more responsive than older workers to changing business cycle conditions.

The analysis was expanded to include transitions into and out of the labor force. Those more disaggregated analysis suggest that when all transitions out of employment are considered (to

unemployment or out of the labor force), young workers appear to be the first to lose their jobs; i.e., they are first-fired. Similarly, when business cycle conditions are improving, they appear to have a less rapidly increasing chance of becoming re-employed. Thus, they appear to be the last hired.

Lastly, the paper provided a set of tests for structural change across the two sub-periods from before the Great Recession to afterwards. After the start of the Great Recession, in this sample, the baseline probability of increased unemployment shifted upwards for all workers and this change was exaggerated for younger workers. At the same time, cyclical volatility of the transition from employment to unemployment declined for the young.

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Chapter Three

First Fired, First Hired? Business Cycles and Immigrant Labor Market Transitions¹⁶

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Abstract

Using individual-level CPS data matched across adjacent months from 1996 to 2013, this paper examines immigrant-native differential in labor market transitions to changes in the business cycle. The paper captures economic fluctuations by measuring deviations in local demand from national economic circumstances and examines monthly transitions among employment, unemployment, and nonparticipation. Immigrants are found to be first fired and first hired as business cycle worsens, and the aggregate unemployment gap is caused by immigrants' higher rates in the unemployment entry flow. Though to some extent the gap can be explained by variation in the immigrant-native's exposure to cycles across industry-occupation, the first fired and first hired pattern remains unchanged. Tests for heterogeneity show that low skilled immigrants are more vulnerable to the business cycle. Tests of the structural change from the 2007 Great Recession show that since its start there was a secular shift in the transition probabilities that would affect all workers negatively, but the cyclical volatility was mitigated for immigrants in the post-Great Recession period.

JEL classification: J15, J21, J61, J63, J64

Keywords: Unemployment, Business Cycle, Immigration, Labor Force, Labor Dynamics, Transition

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1. INTRODUCTION

The share of foreign-born workers in the U.S. labor force has grown since 1996. Over the 1996 to 2012 period, more than half of the increase in the total labor force was among the foreign born. In 2012, there were 25 million foreign-born persons age 16 years and older in the U.S. labor force, representing 16.1 percent of the total.¹⁸ The economic adjustment of immigrant labor is important for understanding the economic well-being of immigrants and the host population, the income distribution, and their impact on native workers. Previous studies on the economic assimilation of immigrants mainly focused on immigrants' adjustment on earnings but little is known about immigrants' labor market performance in terms of their employment and unemployment dynamics through changing macro-economic conditions.

Among studies of wage assimilation, immigrants have been found to be more responsive to changes in local labor market conditions than natives. Does a similar pattern of immigrants being more sensitive to cyclical changes also hold in terms of their employment and unemployment dynamics? What is the driving force to the overall immigrant-native unemployment gap over cycles? In examining the sensitivity of the immigrant labor market to the fluctuations in the business cycle, most research takes business cycle conditions at the time of arrival in the receiving country as a source of economic fluctuations, and has found that arriving over different phases of the business cycle has very weak impact on immigrant cohorts' subsequent employment and unemployment experiences. While focusing on the contemporary macroeconomic condition as a measure of the business cycle, how would it affect the sensitivities of immigrant labor market dynamics? What type of immigrant workers would be more affected by the cyclical demand?

¹⁸ Statistics from United States Department of Labor, the Bureau of Labor Statistics <http://www.bls.gov/spotlight/2013/foreign-born/home.htm>.

Using individual-level CPS data matched across adjacent months from 1996 to 2013, this paper provides insight into these unanswered questions in the U.S. immigration literature by analyzing the difference in immigrant-native cyclical sensitivity in labor market transitions between employment, unemployment and nonparticipation. Specifically, the paper uses a locally exogenous measure of the business cycle to gauge the sensitivity of labor market transitions to aggregate demand, and studies how this contemporary cyclical fluctuation would cause a discrepancy in the unemployment rate of immigrants versus natives in the U.S. labor market.

In considering economic outcomes such as grouped average employment rates, there has been evidence showing that immigrants are more strongly tied to the business cycle than natives. However, there is certain shortcoming with this type of approach, which focuses on the movement of labor force aggregates to cyclical changes in demand. This approach limits the analysis to a static description of movements in labor force stocks without being able to reveal the dynamic source of underlying fluctuations, which is caused by transition flows into and out of the labor force status over time. In considering the pattern of unemployment, a decrease in the stock level of aggregate unemployment rate could be due to either a fall in the flow of people entering unemployment or an increase in the flow of people leaving unemployment, and vice versa. Thus, descriptions of the stock level of labor force aggregates over the business cycle cannot provide understandings to what is the driving force of cyclical variations and the overall immigrant-native gap.

Emphasizing the importance of labor market transitions, this paper studies the dynamic immigrant-native differential in cyclical hiring and firing behaviors by examining disaggregated monthly worker flows. This dynamic approach of relating differences in transition rates to movements of steady-state stocks of labor force aggregates over time was first developed by Badgett (1994), Blanchard and Diamond (1990), and Abraham and Shimer (2001). Employing the dynamic approach, Couch and Fairlie (2010) were the first to provide a detailed examination of the black-white unemployment gap over the business cycle in 1989 to 2004, and they found a

first-fired first-hired¹⁹ pattern for blacks in their labor market transitions. When comparing the immigrant-native differential responsiveness to the business cycle, this paper contributes to the immigration literature by adopting this dynamic approach to relate the aggregate unemployment variation to underlying unemployment entry and exit flows from one month to another.

This paper starts from a baseline two-way transition model (transitions between employment and unemployment) to investigate how immigrants respond differently to the business cycle relative to natives, and then expands the analysis to a three-way transition model (transitions among employment, unemployment, and nonparticipation) to provide a more comprehensive explanation on how transition flows would drive the cyclicity of the immigrant-native unemployment gap. Following the baseline transition model, the paper tests for heterogeneity by decomposing the sample to different demographic groups by age, country of origin, education, inhabit region, industry, and occupation. Further, the paper specifically tests the cyclical influence of being involved with certain skill and employment types on the underlying transition patterns.

Being recorded as the longest contraction period since the Great Depression by the National Bureau of Economic Research (NBER), the 2007 to 2009 Great Recession was associated with the deepest downturn in the labor market in the postwar era.²⁰ To investigate the impact of the Great Recession on immigrant cyclical sensitivities, a test for structural changes across the pre- and post-Great Recession period is also performed in the paper.

The main findings conclude that immigrants are first fired and first hired over the business cycle, and this pattern remains unchanged even after controlling for the cyclical

¹⁹ The “last in, first out” pattern was first proposed by Freeman (1973) to describe the black employment pattern over the business cycle. He found the employment of blacks is strongly cyclical, rising relative to other groups in expansions and falling in recessions, and is of greater sensitivity, compared to whites, to short-run changes in GNP.

²⁰ The National Bureau of Economic Research (NBER) dates the last recession as running from December 2007 to June 2009. At 18 months, it was the longest contraction period since the Great Depression. During this period the labor market also experienced its deepest downturn in the postwar era. The national unemployment rate rose 5 percentage points in only a year and a half, reaching a peak of 10 percent in October 2009.

influence of education, industry, and occupation. Potential discrimination and lack of U.S.-specific human capital likely underlie the remaining gaps in transitions into unemployment, and the gaps in transitions into employment may be attributable to lack of additional source of income and unfavorable policies towards immigrants. The first-fired pattern is driven mainly by immigrants below age 50, with no more than a high school degree, and working in construction, trade, and transportation industries, who appear to have a higher chance of being fired as the business cycle worsens. The first-hired pattern is driven mainly by immigrants characterized as 31 to 40 years old, with educational levels of masters and above, residing in the West, and working in the private sector related to the agricultural and financial industries, since they have a greater probability of being hired as local demand weakens. Although immigrants have a different responsiveness to business cycle conditions in both transitions into and out of unemployment, the immigrant-native gap in aggregate unemployment rate is mainly driven by immigrants' higher chance of losing a job. When local demand is more slack, immigrants are less likely to leave the labor force, and at the same time put more effort into moving from nonparticipation to actively searching for work. This may be explained by the fact that immigrants are ineligible for or are reluctant to apply for most public support programs intended to help families during recessions. The Great Recession brought along an upwards shift in the baseline probability of losing a job and a downward shift in the odds of finding a job that would affect all members in the sample. However, immigrants' cyclical volatility in transitioning into unemployment dampened in the post-Great Recession period.

The paper proceeds as follows. Section 2 starts with a review of the prior literature. Section 3 introduces the data, the construction of transition probabilities, and the business cycle measurement. Section 4 presents descriptive statistics, and the underlying monthly transition rates and trends, respectively. Section 5 provides a discussion of the methodological framework. Empirical results are offered in Section 6, with analyses of transitions between employment and unemployment then extended to include transitions among all the labor force states. Section 7

contains tests for heterogeneity, tests for changes brought by the Great Recession, and robustness checks. Section 8 concludes the paper.

2. LITERATURE REVIEW

Current studies on the labor market performance of immigrants have examined immigrants' adjustment on earnings (Borjas, 1985, 1995; Bratsberg, Barth, & Raaum, 2006; Chiswick, 1978; LaLonde & Topel, 1992; Schoeni, 1977), and the labor market impact of immigration on natives in the hosting country (Altonji & Card, 1991; Borjas, 2003; Card, 2001; Peri & Sparber, 2010, 2011). Immigrants have been documented as being more affected by changes in local labor market conditions than natives in the studies of wage assimilation, but there has not been much attention given to their employment and unemployment dynamics associated with economic fluctuations. To date, most research has focused on using the macroeconomic conditions at the time of arrival as a measure of the business cycle, and analyzed its impact on immigrant cohorts' subsequent employment and unemployment experiences, as in the work of Aydemir (2003), Chiswick, Cohen, and Zach (1997), and Chiswick and Hurst (2000), where the authors hoped to discover to what extent macro-economic conditions at the time of arrival would lead to a long-term gap between immigrants and natives. These studies primarily find little evidence to show that the employment status of immigrant workers is more sensitive to the measure of changing demand than it is for the native-born.

The literature of immigrant assimilation has raised the importance of a detailed examination on immigrants' labor market transitions in response to contemporary short-term economic fluctuations. For example, Bratsberg, Barth, and Raaum (2006) found that the immigrant-native wage gap widens during economic downturns and contracts when the labor market strengthens. Also, in the analysis of the employment and unemployment experiences of

immigrants in comparison with natives, Chiswick and Hurst (2000) concluded that the unemployment problems associated with foreign-born men appear to be short-term and merely transitional adjustments.

Building on the previous work, this paper contributes to the literature by examining the immigrant-native employment and unemployment dynamics in response to monthly changes in contemporary cyclical demand. Using variations generated by the monthly state-level unemployment rate for a 214-month time span, this paper investigates how immigrants differ from natives in their labor market transitions to contemporary fluctuations in local demand, and how these transitional differences would lead to immigrant-native gaps in the aggregate level of unemployment.

In considering economic outcomes in terms of earnings and grouped average employment rates, immigrants have been documented as being more sensitive to the business cycle than natives. For example, Orrenius and Zavodny (2009) found that the 2007 recession had hit the immigrants hard due to the fact that they are more likely to work in cyclical sectors and belong to minority racial or ethnic groups with less education. Hoynes (1999) found a similar pattern that across different demographic groups those with lower education levels and nonwhites are more impacted by cycles over a sample period of 1975 to 1997. In the study of the Great Recession by Hoynes, Miller, and Schaller (2012), the authors showed again that the impacts of the recession had been felt most by the group of young, nonwhite, and low education workers.

However, the limitation of the above studies is that the approach used only measures aggregate stock variables, such as grouped average rates, without explaining the underlying reasons for the fluctuations. This paper adopts a dynamic approach to investigate the immigrant-native gap in labor market transitions between employment, unemployment, and nonparticipation. This dynamic approach was first developed in the work of Badgett (1994), and Blanchard and Diamond (1990). Badgett (1994) estimated workers' net flows into and out of unemployment, tracking the different experiences of blacks and whites, and compared the effects of the changing

flows on the stock of unemployed workers across months. In studying the rates of job creation and destruction, Blanchard and Diamond (1990) explored disaggregated worker flows between different labor market statuses by various age-sex groups, and interpreted their findings by a model of two types of workers, primary and secondary workers, who differ in their attachments to the labor market. Using a labor market transition model, Couch and Fairlie (2010) provided an empirical examination of Black-White unemployment differential in response to changes in cyclical demand from 1989 to 2004, and the work was extended to study Hispanic workers and the influence of the Great Recession in Couch, Fairlie, and Xu (2016), where they found that minority workers are first fired and first hired over the business cycle.

The above works provide a theoretical framework for the empirical analysis in this paper so as to dynamically examine the hiring and firing patterns for immigrant-native differentials over the business cycle. By applying the individual-level data for a 214-month period from 1996 to 2013, this paper further extends the U.S. immigration literature to examine monthly labor market transition probabilities, and to answer the question as to whether immigrant workers would be more sensitive to business cycle variations in terms of labor market transitions as compared to their native counterparts.

3. DATA

3.1 Sample

This paper uses individual-level Current Population Survey (CPS) data. The observations are matched across adjacent months from 1996 to 2013 that encompass a 214-month time span.²¹ The matching algorithm for the data is based on the work of Madrian and Lefgren (2000), as

²¹ Data are available from 1996 to 2013 except for December 2012 and December 2013. The sample period covers 214 months in total.

implemented by Couch and Fairlie (2010). Instead of surveying a completely new set of housing units each month, the CPS re-samples households on a rotation basis. The sample is divided into eight representative subsamples called rotation groups, and each month a new rotation group is added to the overall sample.²² Housing units in each rotation group are interviewed for four consecutive months, followed by an eight-month break, then interviewed again for four more months before exiting the survey. This rotation pattern of the CPS survey makes it possible to match information on individuals across adjacent months by linking surveys. And individuals present in the sample in adjacent months have their data matched so that their labor market transitions can be directly observed. As the CPS data are the basis for calculating the official U.S. unemployment rates, this matching procedure allows the labor market transitions of survey respondents to be related to aggregate unemployment at a monthly frequency.

3.2 Indicator for Labor Market Transition

To examine underlying transition probabilities, this paper first employs a two-way transition model then expands the analysis to a three-way transition model. The two-way transition model focuses transitions between employment and unemployment by restricting the analytical sample to individuals who are in the labor force for any two consecutive months and excluding those who are not in the labor force. To better relate the underlying transitions to the aggregate stock level of unemployment, the sample is further expanded to include transitions into and out of the labor force in the three-way transition model.

The linking of data across months makes it possible to create indicators for labor market transitions from one month to the next. The transition rate takes a 0, 1 value and represents the probability that a person, i , being in a labor force state in current month, t , will be in another labor force state the following month, $t+1$.

²² See Appendix Table A1 for an illustration of rotation groups.

- *Transition from employment to employment:*

$$\text{Prob}(\text{Employed}_{i, t+1} | \text{Employed}_{i, t})$$
- *Transition from employment to unemployment:*

$$\text{Prob}(\text{Unemployed}_{i, t+1} | \text{Employed}_{i, t})$$
- *Transition from employment to NILF²³:*

$$\text{Prob}(\text{Nonparticipation}_{i, t+1} | \text{Employed}_{i, t})$$
- *Transition from unemployment to employment:*

$$\text{Prob}(\text{Employed}_{i, t+1} | \text{Unemployed}_{i, t})$$
- *Transition from unemployment to unemployment:*

$$\text{Prob}(\text{Unemployed}_{i, t+1} | \text{Unemployed}_{i, t})$$
- *Transition from unemployment to NILF:*

$$\text{Prob}(\text{Nonparticipation}_{i, t+1} | \text{Unemployed}_{i, t})$$
- *Transition from NILF to employment:*

$$\text{Prob}(\text{Employed}_{i, t+1} | \text{Nonparticipation}_{i, t})$$
- *Transition from NILF to unemployment:*

$$\text{Prob}(\text{Unemployed}_{i, t+1} | \text{Nonparticipation}_{i, t})$$
- *Transition from NILF to NILF:*

$$\text{Prob}(\text{Nonparticipation}_{i, t+1} | \text{Nonparticipation}_{i, t})$$

3.3 Business Cycle Measure

To measure local business cycle conditions that deviate from the national economy, a monthly state-level variable is constructed to capture local demand in the labor market. The state-level

²³ NILF = Not in the Labor Force.

business cycle control variable measures the deviation of the aggregate state-level unemployment rate from the national natural rate of unemployment (NRU). It captures state demand relative to a national measure of full employment. Thus, this variable empirically allows us to relate the deviations in local economic conditions relative to full employment to changes in labor market transitions. To the extent these local deviations from national economic circumstances are exogenous, the study may be seen as capturing causal relationships between changing aggregate demand and labor force transitions. Data for the monthly state unemployment rate is retrieved from the Bureau of Labor Statistics (BLS). The NRU applied in this paper is the same estimation as employed by Couch and Fairlie's (2010) analysis, 5.28 percent.²⁴

4. DESCRIPTIVE STATISTICS AND TRANSITION TRENDS

4.1 Descriptive Statistics

The demographic composition of immigrant versus native workers is provided in Table 1. By age, the proportion of the immigrant workers make up of 20- to 40-year-olds is higher (53 percent) than for the native workers (45.4 percent). There is no significant difference in the composition by gender between the two groups, but more immigrants are married, represented by 68.1 percent of the total, compared with 59.9 percent for the natives. In the sample, nearly 90 (86.3) percent of the native workers are white, and almost 10 (9.9) percent are black, while the two largest ethnic groups for immigrants are white (65.1 percent) and Asian (24.4 percent). Among the immigrant labor force, a larger proportion concentrates along the east and west coast (60.6 percent) as compared to the natives (43.4 percent). The immigrant workers are more likely than the native born to have a degree below college – 54.1 percent versus 40.3 percent. They are also more likely

²⁴ The NRU of 5.28 is taken from the prior research of Couch and Fairlie (2010). More detail on its estimation can be found there (p. 232).

than the native born to have a master's degree or higher, at 10.5 percent and 9.2 percent, respectively. When comparing the two groups, immigrants have a higher share working in agriculture, construction, manufacturing, leisure and hospitality, and other service fields. They are also more concentrated in the for-profit private sector. The question of whether immigrants with characteristics such as holding a lower-level degree or being in a more cyclically affected industry would have a differential sensitivity to the business cycle is addressed in Section 7.

[Insert Table 1 Here]

4.2 Transition Trends

Table 2 shows the unemployment rates and the transition probabilities between employment and unemployment by immigrant status for the entire sample period.²⁵ Panel A summarizes the statistics for the entire sample years from 1996 to 2013. Generally, immigrants have a higher unemployment rate (5.03 percent) than natives (4.47 percent) over the years, represented by a difference of 0.56 percentage points. Immigrants are also 0.43 percentage points more likely to enter unemployment in the following month, and 4.36 percentage points more likely to transfer from unemployment to employment.

The sample period is then divided into two parts, the pre-Great Recession period from 1996 to 2007 shown by Panel B, and the post-Great Recession period of 2008 to 2013 in Panel C. Comparing patterns before and after the Great Recession, the unemployment rates were much higher in the second period, 6.72 percent for immigrants and 6.39 percent for natives, nearly double those in the first period (3.96 percent and 3.50 percent). However, the unemployment gap between immigrants and natives narrowed to 0.33 percentage points after the Great Recession.

²⁵ Only people in the labor force are considered here.

Immigrants continued to have a higher probability in both unemployment entry and exit rates in the two sub-periods. There appears to be noticeable within-group changes in the period after the Great Recession relative to its start. For example, the rate of losing jobs increased about 50 percent for immigrants, from 1.49 percent to 1.92 percent. And the rate of finding jobs dropped markedly for immigrants and natives, from 39.43 percent to 27.46 percent, and from 35.11 percent to 22.13 percent, respectively.

[Insert Table 2 Here]

In the hope of assessing whether the entry or the exit rate contributes more to a higher unemployment of immigrants, the steady-state stock level of unemployment is decomposed into portions due to differences in unemployment entry rate and unemployment exit rate using the formula $stock = (entry / [entry + exit])$ ²⁶ (Abraham & Shimer, 2001). Applying the observed transition rates in Panel A of Table 2, the calculated steady-state level of unemployment rate is 4.73 percent for immigrants and 4.05 percent for natives. If immigrants entered unemployment at the same rate as natives, their predicted unemployment rate in the steady-state level would fall to 3.54 percent. If immigrants were assigned the same rate of leaving unemployment as natives, their predicted unemployment rate would be raised to 5.4 percent. By contrasting the predicted and observed rates for immigrants, it seems that the relatively high unemployment is primarily due to their greater chance of leaving unemployment. In order to evaluate whether the unemployment entry or exit flow drives a higher unemployment rate of immigrants, the paper will empirically examine the transitions in detail using a linear probability model.

Figures 1 through 3 visually provide the movement of the seasonally adjusted rates

²⁶ In Abraham and Shimer's (2001) three-state model, $u = \lambda_{eu} \times e + \lambda_{uu} \times u + \lambda_{nu} \times n$, where e denotes the fraction of the population that is employed, u the fraction that is unemployed, and n the fraction that is not in the labor force. λ_{eu} , λ_{uu} , and λ_{nu} are the transition rates of employment to unemployment, unemployment to unemployment, and not in the labor force to unemployment, respectively.

through the sample period. Figure 1 shows the unemployment rates for immigrants and natives over the years 1996 to 2013. While the unemployment rate for immigrants was consistently higher than that of the natives for most of the sample years, the gap between the two series was not large. It seemed to be disappearing before the Great Recession took place and became wider again in the following years. At the end of the sample period, the two groups seemed to approach a similar level of unemployment.

It is also found in the unreported regressions²⁷ that immigrant monthly unemployment status is not significantly different from natives in response to changes in the business cycle. This could be a result of three different cyclical patterns between immigrants and natives. First, immigrants do not differ from natives in either unemployment entry or exit flow over the business cycle. Second, immigrants have higher rates of flow in both transitions over the business cycle—they are more likely to be fired and more likely to be hired as compared with the native workers. Third, immigrants have lower transition rates in both flows over the business cycle—they are less likely to be fired and hired. To see which pattern underlies the immigrant cyclical sensitivity, the paper will empirically study the effect of the business cycle on the immigrant-native labor force dynamics in Section 6.

Figure 2 shows the seasonally adjusted movements of employment-to-unemployment transitions from 1996 to 2013. The gap between the two series narrowed before the two economic peaks, March 2001 and December 2007,²⁸ and was most pronounced starting from the Great Recession. For the monthly unemployment exit rates shown by Figure 3, the two series overlapped in the 1990s, then immigrants started to display a visibly higher rate of moving into employment in the rest of the sample period. A close look of the structural change from before and after the Great Recession will be discussed in Section 7.

²⁷ Immigrants appear to be less likely unemployed over the business cycle without personal and job controls, but do not differ from natives in response to business cycle conditions when controlling for personal and job characteristics. See Appendix Table A2 for regression results.

²⁸ Two peaks in the sample period are March 2001 and December 2007. Business cycle expansions as reported by the National Bureau of Economics (NBER) <http://www.nber.org/cycles.html>.

[Insert Figure 1 Here]

[Insert Figure 2 Here]

[Insert Figure 3 Here]

5. METHODOLOGY

To examine the differences in immigrant-native cyclical sensitivities with respect to business cycle conditions, a linear probability model (LPM) that controls for personal and job characteristics is used. The empirical analysis will be evaluated first through a two-way transition model, where only transitions between employment and unemployment are considered. The unemployment entry rate represents the probability that a worker employed in one month will become unemployed the following month. The unemployment exit rate represents the probability that a worker unemployed in one month will become employed the following month. The study would then be extended to a three-way transition model. In addition to the unemployment entry and exit rate, transitions into and out of the labor force are also considered here. The three-way transition model includes transitions across all the labor force states: *Employed to Unemployed*, *Employed to Not in the Labor Force (NILF)*, *Unemployed to Employed*, *Unemployed to NILF*, *NILF to Employed*, and *NILF to Unemployed*.

The corresponding results are reported from ordinary least square (OLS) estimates of linear probability models. The regression framework in the empirical model starts from a base specification then adds interactions as follows to see how immigrants would respond differently to the business cycle.

Specification 1:

$$T_{pqist} = \beta_0 + \beta_1 Imm_{ist} + \beta_2 Undiff_{st} + \chi_{ist} \delta + \alpha_s + \gamma_t + \epsilon_{ist}$$

Specification 2:

$$T_{pqist} = \beta_0 + \beta_1 Imm_{ist} + \beta_2 Undiff_{st} + \beta_3 Undiff_{st} \times Imm_{ist} + \chi_{ist} \delta + \alpha_s + \gamma_t + \epsilon_{ist}$$

Specification 3:

$$\begin{aligned} T_{pqist} = & \beta_0 + \beta_1 Imm_{ist} + \beta_2 Undiff_{st} + \beta_3 Undiff_{st} \times Imm_{ist} + \beta_4 Undiff_{st} \\ & \times Rising(Falling)_t + \beta_5 Undiff_{st} \times Rising(Falling)_t \times Imm_{ist} + \chi_{ist} \delta \\ & + \alpha_s + \gamma_t + \epsilon_{ist} \end{aligned}$$

where i references the individual, s their state, and t the month. The dependent variable T (transition probability) is a binary variable representing the probability that a person in state p (U, E, or NILF) in one month will be in state q (U, E, or NILF) in the following month, where U is unemployment, E is employment, and $NILF$ is not in the labor force. The transition is a stochastic process following a discrete-time Markov chain.

Imm is a dummy variable indicating whether an individual is an immigrant (1 for immigrants and 0 for natives). $Undiff$ is the business cycle control variable measuring the deviation of the state demand relative to a national measure of full employment, which is equal to the state-level aggregate unemployment rate minus the national natural rate of unemployment. $Rising$ ($Falling$) is a dummy variable for whether it is a period of rising (falling) aggregate unemployment.²⁹ X is a set of control variables including age, age-squared, gender, marital status, race, education, occupation and industry.³⁰ α and γ represent state and month fixed effects, respectively. ϵ is the error term. All estimates are calculated using sample weights provided by the CPS. Standard errors are clustered to adjust for multiple observations per individual.

The key parameters in the equation are β_1 , β_2 , and β_3 . β_1 measures whether the

²⁹ $Rising$ ($falling$) takes the value 1 for a month when the state-level unemployment rate in the following month is higher (lower) than the unemployment rate in the current month; 0 otherwise.

³⁰ Gender is a dummy variable, female = 1; male = 0. Marital status is a dummy variable, married = 1; 0 otherwise. Race, education, occupation, and industry are categorical variables.

immigrant workers have an increased probability of making a transition. The estimate of β_2 indicates the extent to which the transition is influenced by the business cycle. The estimate of β_3 indicates whether the influence of the business cycle is greater for immigrants relative to native workers.

Further, the empirical analysis will be conducted on sub-samples (g represents an individual i belonging to a group g) by age, educational level, inhabit region, industry and occupation to test for heterogeneity,

$$T_{pqist}^g = \beta_0 + \beta_1 Imm_{ist}^g + \beta_2 Undiff_{st} + \beta_3 Undiff_{st} \times Imm_{ist}^g + \chi_{ist}^g \delta + \alpha_s + \gamma_t + \epsilon_{ist}^g$$

Two additional tests would be performed to study the change in the magnitude of parameters of interest. To test the structural change brought by the Great Recession, a dummy variable *Recession* (1 for the months after the Great Recession) will be constructed and interacted with the other regressors from the linear probability model. The interacted terms show changes in the corresponding estimation parameters from before the Great Recession to afterwards,

$$\begin{aligned} T_{pqist} = & Pre - recession + Post - recession + \beta_1 Recession_t \times Imm_{ist} \\ & + \beta_2 Recession_t \times Undiff_{st} + \beta_3 Recession_t \times Undiff_{st} \times Imm_{ist} \\ & + \beta_4 Recession_t \times Undiff_{st} \times Rising(Falling)_t + \beta_5 Recession_t \times Undiff_{st} \\ & \times Rising(Falling)_t \times Imm_{ist} + \chi_{ist} \delta + \alpha_s + \gamma_t + \epsilon_{ist} \end{aligned}$$

To test the influence of different education, occupation, and industry characteristics over the business cycle on the immigrant-native cyclical sensitivities, the model will be evaluated as follows. This approach is to see to what extent the magnitude of β_3 would fall or rise as the new interactions are added,

$$T_{pqist} = \beta_0 + \beta_1 Imm_{ist} + \beta_2 Undiff_{st} + \beta_3 Undiff_{st} \times Imm_{ist} + \beta_4 Undiff_{st} \times Edu_{ist} \\ + \beta_5 Undiff_{st} \times Ind_{ist} + \beta_6 Undiff_{st} \times Occ_{ist} + \chi_{is\Box} \delta + \alpha_s + \gamma_t + \epsilon_{ist}$$

6. EMPIRICAL RESULTS

6.1 Transitions between Employment and Unemployment

Table 3 reports the two-way transition linear regression results for the sample period of 1996 to 2013.³¹ Only people who are in the labor force for two consecutive months are included in this model. Panel A shows the estimates for employment to unemployment transitions. Specification 1 starts from a base model where a dummy variable for the immigrant and a business cycle control variable are included. The model also controls for age and its square, gender, race, marital status, education, occupation, industry, and includes a state and month fixed effect. Standard errors are adjusted for clustering multiple observations per individual. The dummy variable shows that on average, employed immigrants have a 0.29 percentage point higher probability to enter unemployment than employed natives the following month. All people are significantly affected by business cycle conditions in the way that the monthly unemployment entry rate would rise by 0.11 percentage points when there is a one-percent increase in the state-level unemployment.

Specification 2 adds an interaction term between the immigrant dummy and the business cycle control to the first model. Immigrants continue to have a higher base probability to move from employment to unemployment the following month, and all workers are more likely to enter unemployment when there is an increase in the local unemployment rate. The interaction term

³¹ A two-way transition model was also performed for two sub-periods in the sample, a pre-Great Recession period of 1996-2007 and a post-Great Recession period of 2008-2013. Immigrants are found to be more sensitive to business cycle conditions in making the unemployment entry transitions while showing no significant results in the unemployment exit transitions. See Appendix Table A3 and Table A4.

shows that immigrants have a stronger cyclical response to business cycle conditions in the way that they are 0.05 percentage points more likely to enter unemployment than their native counterparts for each percentage-point increase in the state-level unemployment.

Specification 3 follows the same model as in Specification 2 but without controlling for personal and job characteristics. Excluding the controls gives us a similar pattern in the immigrant and native cyclical sensitivities. A detailed examination of influence of education, occupation, and industry on labor market transitions is studied in Section 7.

In Specification 4, interaction terms between the immigrant dummy, the business cycle control, and a dummy variable indicating whether it is a period of rising unemployment are added. In periods of rising unemployment, the probability of losing jobs increases by 0.03 percentage points more for all workers, and immigrants respond even stronger to weakening demand with a 0.04 percentage point higher probability of moving into unemployment.

[Insert Table 3 Here]

Panel B reports the set of estimates from the linear probability model for unemployment-to-employment transitions from 1996 to 2013. Specification 1 only includes the dummy for immigrants and the business cycle measure, together with the other controlling regressors. This base model shows that immigrants have a higher monthly probability of being re-employed when local demand is poor. Out of all the unemployed workers, immigrants are 6.55 percentage points more likely than the natives to become rehired the following month. All people are 3.24 percentage points less likely to enter employment when business cycle conditions worsen.

Adding the interaction term associated with the immigrant dummy and the business cycle control variable in Specifications 2 and 3 does not alter the basic pattern as provided by Specification 1. Immigrants show a greater responsiveness to changes in business cycle conditions, as shown by the *Undiff*Immigrant* coefficients. When there is a one-percent increase

in the state-level unemployment, immigrants are around 0.26 percentage points more likely than natives to move into employment the following month. For both groups, there is no finding that suggests a different degree of responsiveness to periods of falling unemployment.

Combining the evidence from the two-way transition model, immigrants have a greater probability of making both transitions. In response to weakening local demand, they appear to have a greater chance of losing jobs as well as becoming rehired the following month. It could be concluded that there is a first-fired, first-hired cyclical pattern in the immigrant employment and unemployment dynamics.

6.2 Transitions Across All Labor Force Statuses

To provide a comprehensive understanding of labor market dynamics, Table 4 examines transitions across all the three labor force states for the sample period of 1996 to 2013. All specifications follow the baseline model (Specification 2, Table 3), which includes the immigrant dummy, the business cycle control variable, and their interactions, controlling for personal and job characteristics.

[Insert Table 4 Here]

Based on the estimates for the interaction between immigrant status and the business cycle, Columns 1 and 3 indicate that employed immigrants are more likely to be fired and unemployed immigrants are more likely to be re-employed the following month when the labor market is weakening. Columns 2 and 4 consider the movements into nonparticipation, either from employment or unemployment. For both transitions, the interactions (*Undiff*Immigrant*) are negative and statistically significant, indicating that immigrants are less likely to move into

nonparticipation when business cycle conditions are worsening. Combining the evidence from Column 6, which indicates immigrants being more likely to move out of nonparticipation to being unemployed, it could be found that immigrants are driven by some factors that discourage them from continuing their nonparticipation status when the economy turns bad. The ineligibility for social support programs may be one contributor. The 1996 federal welfare and immigration laws excluded most immigrants from eligibility for federal programs such as Medicare, non-emergency Medicaid, food stamps, Supplemental Security Income (SSI), the Children's Health Insurance Program (CHIP), and Temporary Assistance for Needy Families (TANF) (Broder & Blazer, 2011). The ineligibility for many public benefits caused hardship for some low-income immigrant families who lacked the support available to other low-income families. Without other sources of income support, this group of immigrants would be of high probability to take any job that is offered or to keep searching for work instead of remaining unemployed or leaving the labor force.

In summary, findings in this section with the inclusion of transitions across all the labor force states confirms the first-fired, first-hired pattern from the two-way transition model.

7. ADDITIONAL TESTS AND ROBUSTNESS CHECKS

7.1 Tests for Heterogeneity

The paper has examined the overall difference in cyclical sensitivities to the business cycle between immigrants and natives. Since the immigrant population is vastly diverse, the paper then turns its focus on a narrower scope of classification to explore what types of immigrants would be affected most in economic downturns when compared to their native counterparts. The analytical sample is again restricted to those in the labor force for any two consecutive months. Test results

from a two-way transition model are presented in Table 5 and Table 6, where a specification is estimated including the immigrant dummies, the business cycle measure, their interactions, and all the controls, comparable to the baseline model in Table 3 Specification 2.

[Insert Table 5 Here]

Table 5 reports estimates of the interaction terms associated with immigrant dummies and the business cycle measure by countries of origin. Immigrants from Mexico and other American countries are more likely to be laid off whereas European and Asian immigrants are less likely to be laid off when business cycle conditions are poor. Also, Mexican and Asian immigrants are the only two groups who are more likely to be re-employed when business cycle conditions are poor.

[Insert Table 6 Here]

The reported estimation parameter in Table 6 is *Undiff*Immigrant*, which shows differential influence of the business cycle to immigrant rates of entering or leaving unemployment. The coefficients for the age groups below fifty are positive and statistically significant, indicating that relatively young immigrants are more sensitive to business cycles in terms of the employment-to-unemployment transition. In moving from unemployment to employment, the immigrant group of ages 31 to 40 has an advantage in finding a job when demand is weakening, while none of the other groups respond differently from the natives to increasing local unemployment.

The reported coefficients for immigrants with a high school degree or lower are positive and statistically significant in both transitions.³² Workers with less education are apparently the

³² Bratsberg, Raaum, and Roed's (2016) recent study about Norway show a similar finding that the most negative employment effects of job loss are among immigrants from developing countries without a high

first to be fired when the labor market is worsening. However, they might also have a higher chance of getting a job in bad economic times because they tend to hold fewer restrictions on a potential job offer. Another immigrant group with a higher chance of finding jobs than the natives are those who hold master's degrees or higher. This is one example where a higher degree pays off for immigrants in the labor market. Even though college-level immigrants do not have a different response to cyclical changes compared to natives, a degree of master's and above lets immigrants stand out in a slack labor market.

Except for the Midwest region, immigrants from all other parts of the U.S. have a higher probability of entering unemployment than the natives when there is a rise in the local unemployment rate. This could be due to immigrants being more concentrated in the east and west coast rather than in the Midwest region, as summarized by Table 1, so the heterogeneity would be less obvious in the Midwest region. West regional immigrants are the only group who are more likely to become re-employed than the natives when demand is more slack.

Out of thirteen types of industries, immigrants who have a higher risk of losing jobs than natives in a weakening labor market are those who work in more cyclically affected industries such as construction, wholesale and retail trade, and transportation and utility industries. Immigrants who work in the agricultural and financial industries are more likely to leave unemployment when local demand is relatively poor. For most types of workers, including those working in the government sector, the private sector, and the self-employed, the probability of losing jobs is higher for immigrants than for natives, while private sector workers are the only category where immigrants have a greater chance of being rehired than natives when business cycle conditions are poor.

In summary, immigrants below age 50, with no more than a high school degree, and working in the construction, trade, and transportation industries appear to have a higher chance of being fired as the business cycle worsens, thus, lead to a first-fired pattern in the immigrant

school degree.

group. Immigrants aged 31 to 40, with less than a college degree or with a master's degree or above, residing in the West, and working in the private sector related to agricultural and financial industries appear to have a greater probability of being hired as local demand weakens, thus, lead to a first-hired pattern in the immigrant group.

7.2 Tests for Changes Brought by the Great Recession

In order to examine the changes brought by the Great Recession, a set of tests are performed to compare the immigrant-native differences from two sub-sample periods. Table 7 presents the results of tests for structural change of the estimation parameters from before to after the Great Recession using the baseline two-way transition model. The reported estimates in Table 7—except for the two dummies, “*Pre-recession*” and “*Post-recession*”—are the interacted terms involved with a recession dummy. Thus, they show the magnitude of change in relative parameters from before the Great Recession to afterwards. The “*Pre-recession*” variable is a dummy taking the value 1 for the period from January 1996 to December 2007 and 0 for January 2008 through December 2013. “*Post-recession*” is a dummy taking the value 1 for the months after January 2008 and 0 for the sample period before December 2007. All specifications include personal and job characteristics, and standard errors are adjusted for clustering multiple observations per individual.

[Insert Table 7 Here]

Estimation parameters in Panel A show the changes in unemployment entry transitions from before the Great Recession to afterwards. There is an increase in the base probability of the unemployment entry rate from around 0.057 in the pre-recession period to around 0.073 in the post-recession period. This increase in the base probability of moving into unemployment affects

all workers in the sample. The cyclical effect of a one-percentage increase in the state-level unemployment rate on the employment-to-unemployment transition drops by 0.04-0.05 percentage points (shown by *Recession*Undiff*) after the initiation of the Great Recession. The coefficient associated with the interactions among the recession dummy, the immigrant dummy, and the business cycle variable is negative, small, and statistically significant, indicating that the cyclical effect on the immigrant-native unemployment entry gap is reduced in the post-Great Recession period. There is no significant change for immigrant-native differential in their rates of being fired in periods of rising unemployment. Thus, after the start of the Great Recession, the monthly probability of being laid off structurally shifted up for all members, and the cyclical volatility reduced for immigrants.

Panel B shows the test results of changes in unemployment exit rates between immigrants and natives from the two sub-periods. Before the recession, the base probability of unemployment exit rate for all members in the sample is around 0.58, and this level decreases to around 0.46 after the recession, meaning that all workers would be negatively affected by this downward shift brought by the Great Recession in terms of their rates of being rehired. For both periods, a weakening demand would lead to a decrease in the chance of re-employment but the magnitude is moderated for the months after the start of the Great Recession, shown by the positive significant coefficients on the recession and the business measure interactions, *Recession*Undiff*. From before the Great Recession to afterwards, immigrants do not change significantly in their sensitivities to the tightness of the labor market though, as compared with natives. Neither do they demonstrate a different cyclical responsiveness to periods of falling unemployment.

7.3 Robustness Checks

There have been arguments about immigrants being in more cyclically affected industries and occupations or holding different educational levels that would make them more vulnerable to

business cycle conditions. This section contains a discussion of the estimates associated with the interactions among the business cycle measure, and the education, industry, and occupation controls, to investigate their influence on the cyclical behavior between immigrants and natives. The models estimated in Table 8 follow the same structure as the baseline two-way transition model (Specification 2, Table 3). Column 1 reports the same set of estimates as provided by Specification 2 of Table 3. Columns 2 through 5 compare whether the inclusion of the new interactions would affect the magnitude of the immigrant-native gap in their business cycle responsiveness. In the employment-to-unemployment transitions shown in Panel A, the inclusion of the education, industry, and occupation interaction reduces the corresponding coefficient (*Undiff*Immigrant*) from 0.0005 to 0.0004, 0.00035, and 0.00044, respectively. The coefficient falls to 0.00031 when all three interactions are included together. Thus, education, industry, and occupation contribute to a stronger cyclical responsiveness for immigrants as economic conditions worsen. The remaining immigrant-native gap in transition rates into unemployment would possibly be attributed to the potential impact of discrimination. Unobserved unfamiliarity with the labor market that makes them less productive may also contribute to immigrants still being first-fired when the influence of education, industry, and occupation are controlled. This may result from immigrants having different family backgrounds and educational quality, or their lack of U.S.-specific human capital,³³ including their proficiency in the English language, knowledge of social norms, communication and cognitive skills, etc.

In the unemployment-to-employment transitions in Panel B, the coefficient estimate on *Undiff*Immigrant* falls from 0.0026 to 0.0021 and 0.0024 when controlling for the cyclical influence of education and industry, respectively. This indicates that a relatively higher unemployment exit rate for immigrants is partially due to their being concentrated in certain types of education and industry, which offers them a higher chance of becoming re-employed.

³³ For the studies of immigrant-native earning gaps, Chiswick (1978) found that being less productive leads to the earning gap in earlier years, by using a basic human capital earnings function in a multiple regression analysis.

Controlling for the influence of occupation during the business cycle slightly increases the coefficient estimate by 0.00006, meaning that without the cyclical influence of being in certain types of occupations immigrants would have had higher rates of leaving unemployment as economic conditions worsen. Adding all the three types of control factors reduces the coefficient to 0.0018. Policy discrepancy, such as immigrants being ineligible for many federal benefit programs, may help explain the remaining gap showing that immigrants are still more likely to be rehired the following month. Overall, the inclusion of the three new interactions contributes somewhat to the widening and narrowing of the immigrant-native transition gaps but does not alter the pattern of immigrants being first-fired and first-hired over the business cycle.

[Insert Table 8 Here]

8. CONCLUSION

Using the monthly matched individual-level observations from CPS, this paper compares the cyclical sensitivities of immigrants versus natives from 1996 to 2013. The paper initially investigates labor market transitions by a two-way transition model and then expands the analysis to a three-way transition model. To capture the fluctuations in local labor demand, the paper uses variations generated by the monthly state-level unemployment relative to a national measure of full employment.

The underlying transition pattern between employment and unemployment implies that immigrants are more likely to be fired than natives as business cycle conditions worsen. They also have a higher probability of being re-employed in the following month when the local demand weakens. When adding the transitions across labor force in the three-way transition

model, empirical findings confirm the above pattern from the two-way transition model that immigrants are first fired and first hired over the business cycle. Thus, the immigrant-native gap in aggregate unemployment rate over the sample period is mainly caused by immigrants being associated with a higher probability in the unemployment entry flow. Further, evidence from the three-way transition model reveals that immigrants are less likely to leave the labor force and are more likely to move from nonparticipation to searching for work than natives when demand conditions are relatively weak. This pattern may be driven by the fact that immigrants are ineligible for or are reluctant to apply for most public support programs intended to help families during recessions.

In order to find what types of immigrant groups would be affected most by cyclical changes, the paper decomposes the sample to different demographic groups by country of origin, age, education, residential region, industry, and occupation. Considerable evidence suggests that immigrants who are more likely to enter unemployment are those aged below 50, with no more than a high school degree, working in the construction, trade, or transportation fields. And these are the immigrant groups who drive the first-fired pattern. Immigrants who are more likely to exit unemployment are characterized by those from Mexico and Asia, aged 31 to 40 years old, with less than a high school or higher than a master's degree, residing in the West, being involved with the agricultural and financial industries, and working in the private sector. Compared with native workers, the first-hired pattern among immigrants appears to be driven by these groups with a greater chance of leaving unemployment.

In the test of changes brought by the Great Recession, the most noticeable change is an upward shift in the baseline probability of losing a job and a downward shift in the odds of finding a job for all workers in the post-Great Recession period. Obviously, as the Great Recession hit the economy, both immigrant and native workers were negatively affected. However, the cyclical volatility of transitioning into unemployment declined for immigrants after the start of the Great Recession.

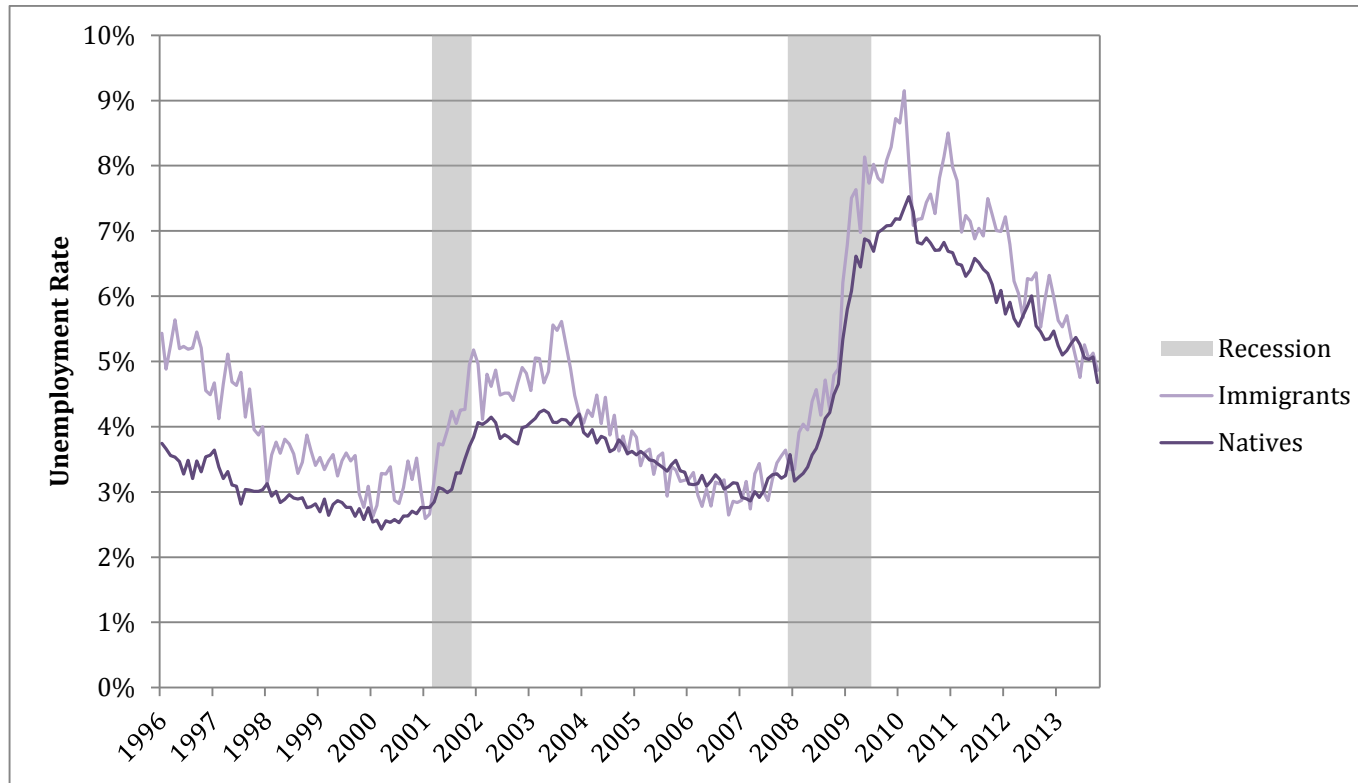
To provide a comprehensive explanation to the underlying transitions, the paper also tests the influence of skill and employment characteristics on the immigrant-native differential patterns in labor market transitions. After controlling for the cyclical influence of education, industry, and occupation, immigrants are still found to be first-fired and first-hired over the business cycle as compared with the native-born. Potential discrimination and lack of U.S.-specific human capital may help explain the remaining gap in transitions into unemployment, and the gap in transitions into employment may be attributable to unfavorable public policies towards immigrants.

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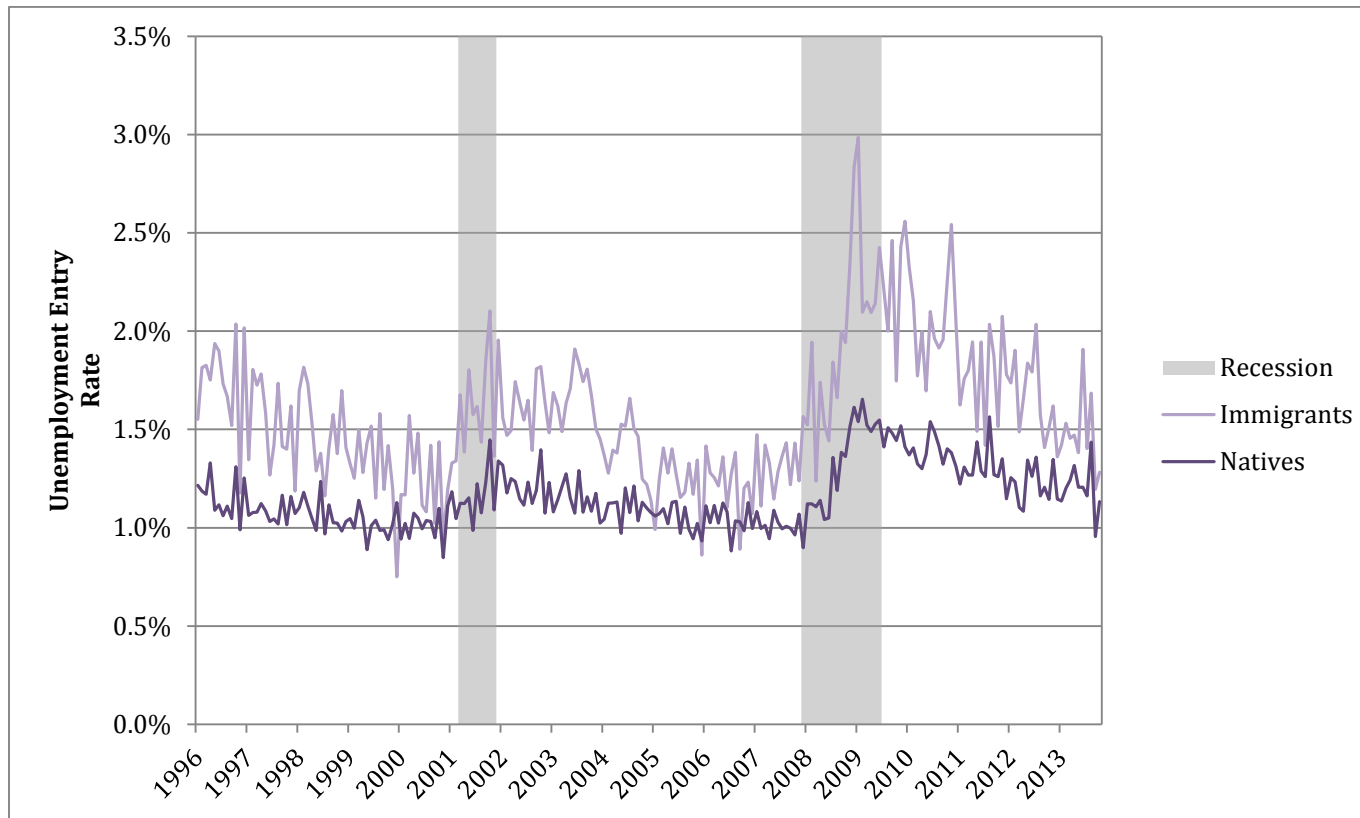
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Figure 1. Seasonally Adjusted Monthly Unemployment Rates: Current Population Surveys, 1996-2013.



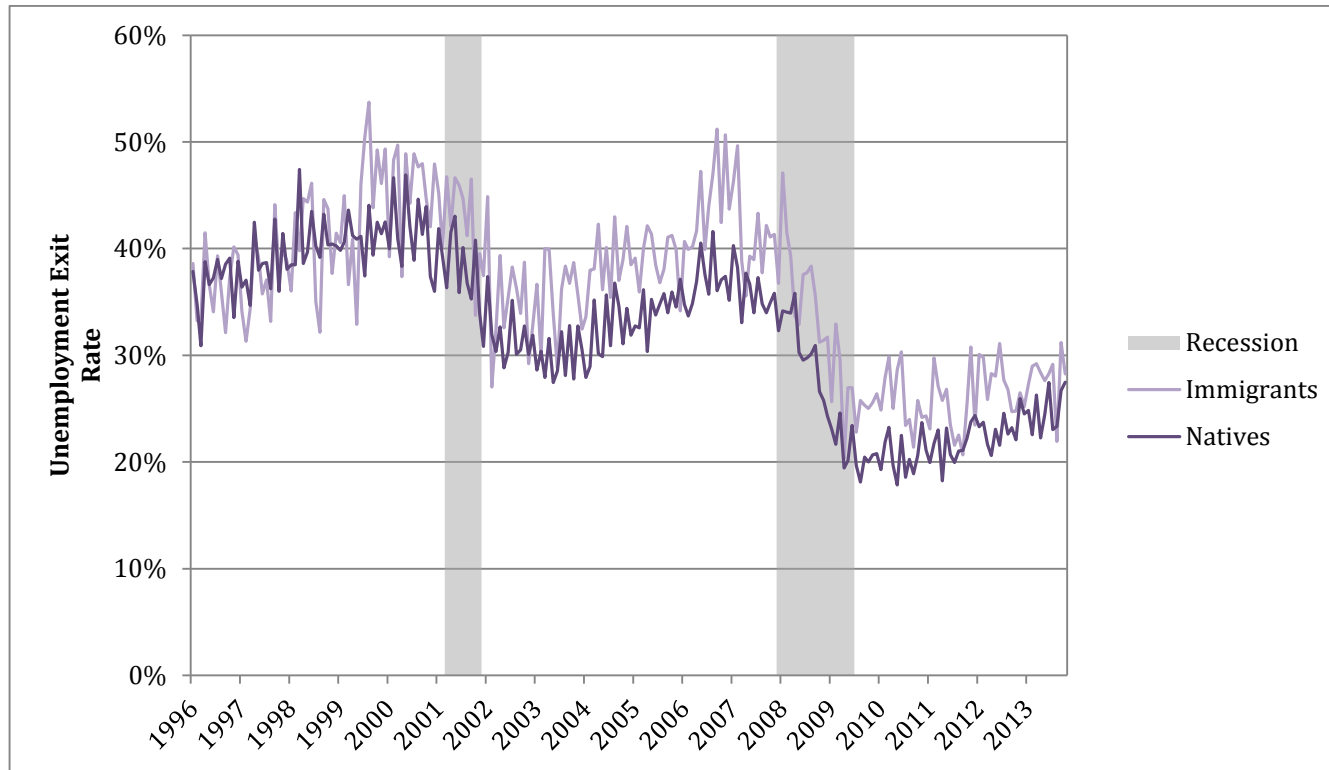
Notes: Monthly unemployment rates are calculated by author using the CPS data. All data are seasonally adjusted. The sample consists of people aged 20-64 who are in the labor force for any two consecutive months. Shaded area represents recessions as reported by the National Bureau of Economic Research (NBER).

Figure 2. Seasonally Adjusted Monthly Unemployment Entry Rates: Current Population Surveys, 1996-2013.



Notes: Monthly unemployment entry rates are calculated by author using the CPS data. All data are seasonally adjusted. The sample consists of people aged 20-64 who are in the labor force for any two consecutive months. Shaded area represents recessions as reported by the National Bureau of Economic Research (NBER).

Figure 3. Seasonally Adjusted Monthly Unemployment Exit Rates: Current Population Surveys, 1996-2013.



Notes: Monthly unemployment exit rates are calculated by author using the CPS data. All data are seasonally adjusted. The sample consists of people aged 20-64 who are in the labor force for any two consecutive months. Shaded area represents recessions as reported by the National Bureau of Economic Research (NBER).

Table 1. Sample Composition by Immigrant Status, CPS, 1996-2013.

		Native (%)	Immigrant (%)	Total (%)
Age	20-30	22.4	24.0	22.6
	31-40	23.0	29.0	23.7
	41-50	25.8	25.1	25.7
	51-60	22.1	17.0	21.4
	>61	6.8	4.9	6.5
	Total	100	100	100
Gender	Male	48.0	48.6	48.1
	Female	52.0	51.4	51.9
	Total	100	100	100
Marital Status	Single	40.1	31.9	39.1
	Married	59.9	68.1	60.9
	Total	100	100	100
Race	White only	86.3	65.1	83.6
	Black Only	9.9	8.5	9.7
	Alaskan Native	1.2	0.8	1.2
	Asian	1.3	24.4	4.3
	Hawaiian/Pacific Islander	0.2	0.6	0.2
	2 race combinations	1.0	0.6	1.0
	More than 2 races	0.1	0.0	0.1
	Total	100	100	100
Country of Birth	United States and its territories	99.0	0.0	86.4
	Mexico	0.1	28.2	3.7
	Canada	0.1	2.3	0.4
	Other Americas	0.1	22.9	3.0
	Europe	0.4	12.9	2.0
	Asia	0.3	27.7	3.8
	Pacific region	0.0	2.5	0.3
	Africa	0.0	3.6	0.5
	Total	100	100	100
Region	Northeast	20.5	23.2	20.9
	Midwest	25.6	12.6	24.0
	South	31.0	26.8	30.5
	West	22.9	37.4	24.7
	Total	100	100	100

Table 1 Continued.

		Native (%)	Immigrant (%)	Total (%)
Education	No more high school	40.3	54.1	42.1
	Some college but no degree	30.9	18.0	29.3
	Bachelor's degree	19.5	17.4	19.3
	Master's degree	6.7	6.9	6.7
	Professional school degree	1.4	1.6	1.4
	Doctorate degree	1.1	2.0	1.2
	Total	100	100	100
Industry	Agriculture	1.8	2.1	1.9
	Mining	0.7	0.3	0.7
	Construction	7.2	9.1	7.4
	Manufacturing	12.1	15.3	12.5
	Wholesale and retail trade	14.1	12.6	13.9
	Transportation and utilities	5.4	4.6	5.3
	Information	2.5	1.6	2.4
	Financial activities	7.1	5.4	6.9
	Professional and business services	10.1	11.6	10.3
	Educational and health services	22.3	16.9	21.7
	Leisure and hospitality	6.7	12.0	7.3
	Other services	4.4	6.3	4.6
	Public administration	5.4	2.2	5.0
	Armed Forces	0.0	0.0	0.0
	Total	100	100	100
Occupation	Government-federal	3.0	1.7	2.8
	Government-state	5.0	2.7	4.7
	Government-local	8.4	3.7	7.9
	Private, for profit	65.8	77.3	67.2
	Private, nonprofit	6.6	4.0	6.3
	Self-employed, incorporated	3.6	3.5	3.6
	Self-employed, not incorporated	7.5	7.0	7.4
	Without pay	0.1	0.1	0.1
	Total	100	100	100
Observations		10,217,419	1,486,801	11,704,220

Notes: The sample consists of people aged 20-64. All estimates are calculated using sample weights provided by the CPS.

Table 2. Unemployment and Transition Rates, Matched Current Population Surveys.

Panel A. 1996-2013

	Immigrants (%)	N	Natives (%)	N	Immigrant-Native Difference (%)
Unemployment Rate	5.03	1,094,181	4.47	7,916,965	0.56
Unemployment Entry Rate	1.65	1,041,193	1.22	7,590,294	0.43
Unemployment Exit Rate	33.24	52,988	28.88	326,671	4.36

Panel B. 1996-2007

	Immigrants (%)	N	Natives (%)	N	Immigrant-Native Difference (%)
Unemployment Rate	3.96	687,546	3.50	5,352,555	0.46
Unemployment Entry Rate	1.49	661,004	1.13	5,174,972	0.36
Unemployment Exit Rate	39.43	26,542	35.11	177,583	4.32

Panel C. 2008-2013

	Immigrants (%)	N	Natives (%)	N	Immigrant-Native Difference (%)
Unemployment Rate	6.72	406,635	6.39	2,564,410	0.33
Unemployment Entry Rate	1.92	380,189	1.39	2,415,322	0.53
Unemployment Exit Rate	27.46	26,446	22.13	149,088	5.33

Notes: The sample consists of people aged 20-64 who are in the labor force for any two consecutive months. All estimates are calculated using sample weights provided by the CPS.

Table 3. Two-way Transitions between Employment and Unemployment: Matched CPS Data, 1996-2013.

Regressor	Specification			
	(1)	(2)	(3)	(4)
Panel A. Linear Regressions for Probability of Employment-to-Unemployment Transition				
Immigrant	0.00291*** (0.000179)	0.00236*** (0.000180)	0.00342*** (0.000161)	0.00236*** (0.000180)
Undiff	0.00107*** (0.0000267)	0.000985*** (0.0000280)	0.000891*** (0.0000279)	0.000891*** (0.0000327)
Undiff*Immigrant		0.000503*** (0.0000740)	0.000464*** (0.0000746)	0.000381*** (0.0000859)
Undiff*Rising				0.000283*** (0.0000519)
Undiff*Rising*Immigrant				0.000400*** (0.000147)
Constant	0.0549*** (0.000934)	0.0551*** (0.000934)	0.0121*** (0.000161)	0.0552*** (0.000934)
Observations	8,622,334	8,622,334	8,622,334	8,622,334
Mean of dependent variable	0.0128	0.0128	0.0128	0.0128
Panel B. Linear Regressions for Probability of Unemployment-to-Employment Transition				
Immigrant	0.0655*** (0.00297)	0.0602*** (0.00370)	0.0542*** (0.00361)	0.0602*** (0.00370)
Undiff	-0.0324*** (0.000412)	-0.0329*** (0.000438)	-0.0334*** (0.000440)	-0.0328*** (0.000493)
Undiff* Immigrant		0.00262** (0.00102)	0.00266** (0.00104)	0.00213* (0.00117)
Undiff*Falling				-0.000350 (0.000629)
Undiff*Falling* Immigrant				0.00130 (0.00146)
Constant	0.592*** (0.0147)	0.594*** (0.0147)	0.334*** (0.00286)	0.594*** (0.0147)
Observations	370,144	370,144	370,144	370,144
Mean of dependent variable	0.2976	0.2976	0.2976	0.2976

Notes: The sample consists of people aged 20-64 who are in the labor force for any two consecutive months. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. All specifications also included a constant, age, age squared, gender, marital status, race, education, occupation and industry, and state and month fixed effects except Specification 3, which excludes personal and job controls.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

†Undiff = the state-level unemployment rate – the national natural rate of unemployment.

Table 4. Three-way Transitions across All Labor Force States: Matched CPS Data, 1996-2013.

Regressor	Transition					
	Employed to Unemployed	Employed to Not in Labor Force	Unemployed to Employed	Unemployed to Not in Labor Force	Not in Labor Force to Employed	Not in Labor Force to Unemployed
Immigrant	0.00222*** (0.000175)	0.00659*** (0.000239)	0.0412*** (0.00303)	0.0188*** (0.00265)	0.0144*** (0.000753)	0.00168*** (0.000509)
Undiff	0.000965*** (0.0000274)	-0.000103*** (0.0000334)	-0.0254*** (0.000366)	-0.00543*** (0.000347)	-0.00296*** (0.000103)	0.00347*** (0.0000908)
Undiff* Immigrant	0.000494*** (0.0000721)	-0.000480*** (0.0000845)	0.00350*** (0.000846)	-0.00223*** (0.000774)	0.0000601 (0.000251)	0.00104*** (0.000211)
Constant	0.0515*** (0.000899)	0.139*** (0.00122)	0.414*** (0.0120)	0.414*** (0.0113)	0.155*** (0.00244)	0.100*** (0.00201)
Observations	8,805,216	8,805,216	457,460	457,460	2,416,885	2,416,885
Mean of dependent variable	0.0125	0.0215	0.2403	0.1927	0.0651	0.0379

Notes: The sample consists of people aged 20-64. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. All specifications also included a constant, age, age squared, gender, marital status, race, education, occupation and industry, and state and month fixed effects except Specification 5 and 6, which exclude occupation and industry.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

†Undiff = the state-level unemployment rate – the national natural rate of unemployment.

Table 5. Two-way Transitions by Country of Origin: Matched CPS Data, 1996-2013.

	Employment to Unemployment	Unemployment to Employment
Undiff*Mexico	0.00153*** (0.000158)	0.00311* (0.00166)
Undiff*Canada	-0.000482 (0.000340)	-0.000439 (0.00679)
Undiff*Other Americas	0.000739*** (0.000154)	-0.000913 (0.00191)
Undiff*Europe	-0.000454*** (0.000138)	0.00165 (0.00265)
Undiff*Asia	-0.000427*** (9.01e-05)	0.00312* (0.00177)
Undiff*Pacific	0.000242 (0.000511)	-0.000780 (0.00713)
Undiff*Africa	0.000346 (0.000368)	0.00154 (0.00467)

Notes: The sample consists of people aged 20-64 who are in the labor force for any two consecutive months. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. All specifications also included a constant, the immigrant dummy by country of origin, the business cycle control variable, relative personal and job controls, and state and month fixed effects, comparable to the baseline model in Table 3 Specification 2.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

†Undiff = the state-level unemployment rate – the national natural rate of unemployment.

Table 6. Test for Heterogeneity Based on Two-way Transitions: Matched CPS Data, 1996-2013.

	Employment to Unemployment	Unemployment to Employment
	Reported Coefficient: <i>Undiff*Immigrant</i>	
Age		
20-30	0.000795*** (0.000191)	0.00104 (0.00218)
31-40	0.000532*** (0.000140)	0.00694*** (0.00201)
41-50	0.000293** (0.000127)	0.00203 (0.00194)
51-60	0.000213 (0.000153)	0.00152 (0.00228)
>61	-0.000179 (0.000321)	0.00368 (0.00478)
Education		
No more high school	0.000804*** (0.000128)	0.00312** (0.00135)
Some college but no degree	0.000187 (0.000151)	0.00275 (0.00225)
Bachelor's degree	-0.000073 (0.000123)	-0.00236 (0.00252)
Master's degree and above	-0.000178 (0.000119)	0.0110*** (0.00395)
Region		
Northeast	0.000290* (0.000176)	0.00455 (0.00307)
Midwest	0.0000285 (0.000184)	-0.000134 (0.00279)
South	0.000626*** (0.000146)	0.00122 (0.00222)
West	0.000549*** (0.000120)	0.00256* (0.00153)

Table 6 Continued.

Industry	Employment to Unemployment	Unemployment to Employment
	Reported Coefficient: <i>Undiff*Immigrant</i>	
Agriculture	0.00139 (0.000911)	0.0230*** (0.00578)
Mining	0.000408 (0.00151)	-0.0116 (0.0292)
Construction	0.00200*** (0.000404)	-0.00343 (0.00273)
Manufacturing	-0.0000379 (0.000180)	0.00167 (0.00233)
Wholesale and retail trade	0.000565*** (0.000185)	0.0026 (0.00277)
Transportation and utilities	0.000586** (0.000297)	0.00124 (0.00514)
Information	0.000683 (0.000526)	0.000421 (0.00635)
Financial activities	0.0000336 (0.000212)	0.0126*** (0.00421)
Professional and business services	0.000165 (0.000222)	-0.000308 (0.00281)
Educational and health services	-0.00000648 (0.000123)	0.000738 (0.00308)
Leisure and hospitality	0.00000727 (0.000210)	0.00332 (0.00328)
Other services	0.000171 (0.000306)	0.00581 (0.00476)
Public administration	0.000392 (0.000283)	0.00333 (0.00782)
Occupation		
Government	0.000322* (0.000170)	0.00663 (0.00440)
Private	0.000441*** (0.0000842)	0.00239** (0.00107)
Self-employed	0.000761*** (0.000237)	0.00630 (0.00454)
Without pay	0.00186 (0.00315)	-0.0738 (0.170)

Notes: The sample consists of people aged 20-64 who are in the labor force for any two consecutive months. The reported estimate is *Undiff*Immigrant*. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. All specifications also included a constant, the immigrant dummy by country of origin, the business cycle control variable, relative personal and job controls, and state and month fixed effects, comparable to the baseline model in Table 3 Specification 2.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

†Undiff = the state-level unemployment rate – the national natural rate of unemployment.

Table 7. Tests for Changes in Estimated Transitions from before to after the Great Recession: Matched CPS Data, 1996-2013.

Regressor	Specification		
	(1)	(2)	(3)
Panel A. Linear Regressions for Probability of Employment-to-Unemployment Transition			
Pre-recession	0.0575*** (0.00114)	0.0574*** (0.00114)	0.0575*** (0.00114)
Post-recession	0.0731*** (0.00621)	0.0733*** (0.00621)	0.0785*** (0.00771)
Recession* Immigrant	0.00117*** (0.000331)	-0.000424 (0.000487)	0.0000748 (0.000514)
Recession*Undiff	-0.000457*** (0.0000692)	-0.000414*** (0.0000720)	-0.000523*** (0.0000809)
Recession*Undiff* Immigrant		-0.000502** (0.000212)	-0.000622** (0.000245)
Recession*Undiff*Rising			0.000333*** (0.000113)
Recession*Undiff*Rising* Immigrant			0.000486 (0.000370)
Observations	8,622,334	8,622,334	8,622,334
Panel B. Linear Regressions for Probability of Unemployment-to-Employment Transition			
Pre-recession	0.583*** (0.0219)	0.583*** (0.0219)	0.585*** (0.0219)
Post-recession	0.457*** (0.105)	0.455*** (0.105)	0.563*** (0.118)
Recession* Immigrant	0.00768 (0.00541)	0.0162* (0.00849)	0.0155* (0.00868)
Recession*Undiff	0.0226*** (0.00141)	0.0232*** (0.00149)	0.0210*** (0.00178)
Recession*Undiff* Immigrant		-0.00384 (0.00403)	-0.00214 (0.00485)
Recession*Undiff*Falling			0.00576** (0.00255)
Recession*Undiff*Falling* Immigrant			-0.00301 (0.00706)
Observations	370,144	370,144	370,144

Notes: The sample period covers 1996-2013. The reported coefficients are the changes in relative parameters from the sample period 1996-2007 to 2008-2013. The sample consists of people aged 20-64 who are in the labor force for any two consecutive months. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. A non-constant regression method is used here. All specifications also included, age, age squared, gender, marital status, race, education, occupation and industry, and state and month fixed effects.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

†Undiff = the state-level unemployment rate – the national natural rate of unemployment.

Table 8. Tests for the Influence of Education, Occupation, and Industry Based on Two-way Transitions: Matched CPS Data, 1996-2013.

	Specification				
Regressor	(1)	(2)	(3)	(4)	(5)
Panel A. Transitions from Employment to Unemployment					
Immigrant	0.00236*** (-0.00018)	0.00232*** (-0.00018)	0.00237*** (-0.00018)	0.00237*** (-0.00018)	0.00232*** (-0.00018)
Undiff	0.000985*** (-0.000028)	0.000249** (-0.000105)	0.000356*** (-0.0000635)	0.00407*** (-0.00122)	0.00250** (-0.00122)
Undiff*Immigrant	0.000503*** (-0.000074)	0.000397*** (-0.000074)	0.000352*** (-0.0000739)	0.000436*** (-0.0000742)	0.000308*** (-0.0000744)
Undiff*Education indicators	No	Yes	No	No	Yes
Undiff*Industry indicators	No	No	Yes	No	Yes
Undiff*Occupation indicators	No	No	No	Yes	Yes
Observations	8,622,334	8,622,334	8,622,334	8,622,334	8,622,334
Mean of dependent variable	0.0128	0.0128	0.0128	0.0128	0.0128
Panel B. Transitions from Unemployment to Employment					
Immigrant	0.0602*** (-0.0037)	0.0613*** (-0.0037)	0.0607*** (-0.0037)	0.0601*** (-0.0037)	0.0616*** (-0.00371)
Undiff	-0.0329*** (-0.000438)	-0.0192*** (-0.00528)	-0.0323*** (-0.00588)	-0.0525*** (-0.0188)	-0.0391* (-0.0206)
Undiff*Immigrant	0.00262** (-0.00102)	0.00208** (-0.00103)	0.00240** (-0.00102)	0.00268*** (-0.00102)	0.00184* (-0.00103)
Undiff*Education indicators	No	Yes	No	No	Yes
Undiff*Industry indicators	No	No	Yes	No	Yes
Undiff*Occupation indicators	No	No	No	Yes	Yes
Observations	370,144	370,144	370,144	370,144	370,144
Mean of dependent variable	0.2976	0.2976	0.2976	0.2976	0.2976

Notes: The sample consists of people aged 20-64 who are in the labor force for any two consecutive months. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. All specifications also included a constant, age, age squared, gender, marital status, race, education, occupation and industry, and state and month fixed effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. †Undiff = the state-level unemployment rate – the national natural rate of unemployment.

APPENDIX

Table A1. Rotation Groups in the Current Population Survey.

Rotation groups in the current population survey								
	Month in sample (MIS)							
	1	2	3	4	5	6	7	8
Year t								
January	A	z	y	x	o	n	m	l
February	B	A	z	y	p	o	n	m
March	C	B	A	z	q	p	o	n
April	D	C	B	A	r	q	p	o
May	E	D	C	B	s	r	q	p
June	F	E	D	C	t	s	r	q
July	G	F	E	D	u	t	s	r
August	H	G	F	E	v	u	t	s
September	I	H	G	F	w	v	u	t
October	J	I	H	G	x	w	v	u
November	K	J	I	H	y	x	w	v
December	L	K	J	I	z	y	x	w
Year $t+1$								
January	M	L	K	J	A	z	y	x
February	N	M	L	K	B	A	z	y
March	O	N	M	L	C	B	A	z
April	P	O	N	M	D	C	B	A
May	Q	P	O	N	E	D	C	B
June	R	Q	P	O	F	E	D	C
July	S	R	Q	P	G	F	E	D
August	T	S	R	Q	H	G	F	E
September	U	T	S	R	I	H	G	F
October	V	U	T	S	J	I	H	G
November	W	V	U	T	K	J	I	H
December	X	W	V	U	L	K	J	I
Year $t+2$								
January	Y	X	W	V	M	L	K	J
February	Z	Y	X	W	N	M	L	K
March	a	Z	Y	X	O	N	M	L
April	b	a	Z	Y	P	O	N	M
May	c	b	a	Z	Q	P	O	N
June	d	c	b	a	R	Q	P	O
July	e	d	c	b	S	R	Q	P
August	f	e	d	c	T	S	R	Q
September	g	f	e	d	U	T	S	R
October	h	g	f	e	V	U	T	S
November	i	h	g	f	W	V	U	T
December	j	i	h	g	X	W	V	U

Source: B. C. Madrian and L. J. Lefgren, 2000, *An approach to longitudinally matching Current Population Survey (CPS) respondents*.

Table A2. Monthly Unemployment Status: Matched CPS Data, 1996-2013.

	Unemployed	
Immigrant	-0.00370*** (0.000429)	0.00176*** (0.000299)
Undiff	0.00960*** (0.0000870)	0.00761*** (0.0000699)
Undiff*Immigrant	-0.000146 (0.000208)	-0.000284* (0.000165)
Constant	0.168*** (0.00225)	0.0416*** (0.000266)
Observations	9262676	11704220
Personal and Job Controls	Yes	No

Notes: The sample consists of people aged 20-64 in the labor force. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. The dependent variable *Unemployed* is a dummy, 1 for a worker being unemployed in a month, 0 otherwise. All specifications also included a constant, age, age squared, gender, marital status, race, education, occupation and industry, and state and month fixed effects.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[†]Undiff = the state-level unemployment rate – the national natural rate of unemployment.

Table A3. Estimated Transitions between Employment and Unemployment: Matched CPS Data, 1996-2007.

Regressor	Specification			
	(1)	(2)	(3)	(4)
Panel A. Linear Regressions for Probability of Employment-to-Unemployment Transition				
Immigrant	0.00211*** (0.000211)	0.00227*** (0.000218)	0.00345*** (0.000194)	0.00227*** (0.000218)
Undiff	0.00144*** (0.0000658)	0.00132*** (0.0000673)	0.00124*** (0.0000676)	0.00132*** (0.0000741)
Undiff*Immigrant		0.000974*** (0.000172)	0.00105*** (0.000173)	0.000999*** (0.000206)
Undiff*Rising				0.000000346 (0.0000968)
Undiff*Rising*Immigrant				-0.0000761 (0.000333)
Constant	0.0556*** (0.00111)	0.0555*** (0.00111)	0.0124*** (0.000192)	0.0555*** (0.00111)
Observations	5826823	5826823	5826823	5826823
Panel B. Linear Regressions for Probability of Unemployment-to-Employment Transition				
Immigrant	0.0603*** (0.00440)	0.0600*** (0.00441)	0.0539*** (0.00418)	0.0600*** (0.00441)
Undiff	-0.0466*** (0.00158)	-0.0470*** (0.00165)	-0.0490*** (0.00168)	-0.0451*** (0.00190)
Undiff* Immigrant		0.00357 (0.00372)	0.00329 (0.00383)	0.00234 (0.00457)
Undiff*Falling				-0.00531** (0.00248)
Undiff*Falling* Immigrant				0.00332 (0.00690)
Constant	0.601*** (0.0210)	0.601*** (0.0210)	0.340*** (0.00395)	0.601*** (0.0210)
Observations	199530	199530	199530	199530

Notes: The sample consists of people aged 20-64 who are in the labor force for any two consecutive months. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. All specifications also included a constant, age, age squared, gender, marital status, race, education, occupation and industry, and state and month fixed effects except Specification 3, which excludes personal and job controls.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

†Undiff = the state-level unemployment rate – the national natural rate of unemployment.

Table A4. Estimated Transitions between Employment and Unemployment: Matched CPS Data, 2008-2013.

Regressor	Specification			
	(1)	(2)	(3)	(4)
Panel A. Linear Regressions for Probability of Employment-to-Unemployment Transition				
Immigrant	0.00391*** (0.000320)	0.00247*** (0.000473)	0.00406*** (0.000454)	0.00240*** (0.000473)
Undiff	0.000875*** (0.0000584)	0.000796*** (0.0000602)	0.000749*** (0.0000604)	0.000676*** (0.0000636)
Undiff*Immigrant		0.000449*** (0.000128)	0.000291** (0.000129)	0.000340** (0.000136)
Undiff*Rising				0.000375*** (0.0000604)
Undiff*Rising*Immigrant				0.000419*** (0.000160)
Constant	0.0558*** (0.00172)	0.0560*** (0.00172)	0.0121*** (0.000328)	0.0562*** (0.00172)
Observations	2795511	2795511	2795511	2795511
Panel B. Linear Regressions for Probability of Unemployment-to-Employment Transition				
Immigrant	0.0719*** (0.00400)	0.0798*** (0.00765)	0.0737*** (0.00767)	0.0798*** (0.00765)
Undiff	-0.0211*** (0.000887)	-0.0207*** (0.000920)	-0.0211*** (0.000929)	-0.0207*** (0.000941)
Undiff* Immigrant		-0.00209 (0.00168)	-0.00215 (0.00170)	-0.00225 (0.00177)
Undiff*Falling				0.0000950 (0.000671)
Undiff*Falling* Immigrant				0.000420 (0.00149)
Constant	0.537*** (0.0205)	0.536*** (0.0205)	0.286*** (0.00499)	0.536*** (0.0205)
Observations	170614	170614	170614	170614

Notes: The sample consists of people aged 20-64 who are in the labor force for any two consecutive months. All estimates are calculated using sample weights provided by the CPS. Standard errors are adjusted for multiple observations per individual. All specifications also included a constant, age, age squared, gender, marital status, race, education, occupation and industry, and state and month fixed effects except Specification 3, which excludes personal and job controls.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

†Undiff = the state-level unemployment rate – the national natural rate of unemployment.