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Job mobility among young college graduates

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To Sharon Raszap Skorbiansky, Amy Camp, and Joe Camp.

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PREFACE

"World domination is such an ugly phrase. I prefer to call it world optimisation."

Eliezer Yudkowsky, Harry Potter and the Methods of Rationality

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ABSTRACT

Camp, Kevin M. MS, Purdue University, May 2015. Job Mobility Among Young College Graduates. Major Professor: Brigitte Waldorf.

This study focuses on the question of whether job mobility relates to improved labor market outcomes among young college-educated individuals in the United States. I analyze unemployment duration, overeducation, and wage earnings among college graduates. The analysis centers around three specific questions: (1) Are there differences in labor market outcomes for those who migrate (movers) and those who stay (stayers)? (2) Did the recent economic crisis exacerbate the mover-stayer differences? (3) Do mover-stayer differences vary for individuals based on their demographic characteristics or where they live? I examine data on migrant status, location before and after a move, reasons for moving, wages, overeducation (by occupation), unemployment duration, and other related socioeconomic characteristics of college graduates aged 22 to 30 years. I use yearly data from the March Supplements of the Current Population Survey (CPS). The data are consistent over time, allowing for comparisons between the time periods before and after the 2008 economic crisis.

The results for the relationship between job mobility and labor market outcomes are mixed. Moving for job reasons correlates with shorter unemployment durations before and (seemingly more strongly) after the recession. For certain individuals, job mobility relates to lower overeducation propensities, but by and large overeducation and job migration do not seem to move together. Regarding wages, once again an overall correlation between moving and earnings is not found. Certain specific demographic groups experience positive ("boomerang" movers before the recession and immigrants after the recession) and negative (women before the recession) correlations between the two variables. Among groups of individuals for whom moving for

job reasons counterintuitively correlates with worsened labor market performance, it is likely that some unmeasured confounding effect (perhaps amenity preference) is present. The research is of some interest to policy makers hoping to attract young highly educated individuals, but due to uncertainty regarding causality its applicability is limited.

CHAPTER 1. AN INTRODUCTION TO EDUCATION, EMPLOYMENT, AND MIGRATION

1.1 Problem Statement

Educational attainment plays a crucial role in the labor market and, by extension, the economy as a whole. At the most fundamental level, added levels of education within a population beget increased job attainment and higher wages in the same population (Borjas, 2009). Ceteris paribus, firms employing these more highly skilled workers experience productivity increases. This results in an increase in the level of goods and services produced by an economy. A number of other indirect, yet important, indicators such as technological adoption and social outcomes also are impacted by educational attainment (Barro and Lee, 2001). Hence, the study of educational attainment and its related factors is an inherently interesting and rewarding endeavor. In this thesis I narrow the focus down to one particular domain related to educational attainment. Specifically, I look at how young, highly educated people in the United States perform in the labor market. I frame this analysis in the context of labor migration and the great recession of 2008.

To set the tone for the analysis that follows, first I briefly describe some of the historical and recent trends in United States educational attainment. Figure 1.1 charts educational attainment levels as percentages of the U.S. population aged 25 and older from 1964 to 2012. In this time period, adults in the United States transitioned from being largely undereducated (more than 50 percent having less than a high school diploma in 1964) to being relatively highly educated (less than 13 percent lacking a diploma in 2012).

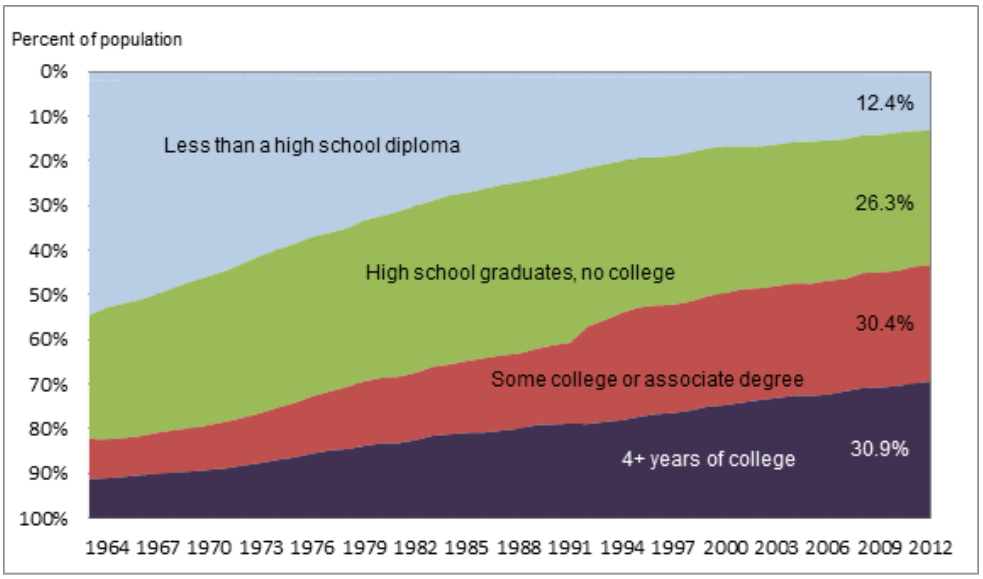

Figure 1.1. Educational Attainment Levels as Percentages of the U.S. Population Aged 25 and Over.

Source: 1964 to 2002 March Current Population Survey and the 2003 to 2012 Annual Social and Economic Supplement to the Current Population Survey (noninstitutionalized population, excluding members of the Armed Forces living in barracks).

As the population transitions to being more educated over time, it becomes increasingly important to understand what happens to individuals at high levels of attainment. In this thesis, I focus on individuals who have attained bachelor's degrees. This subset of the population has grown consistently for decades. From Figure 1.1, less than 10 percent of the 25 and older U.S. population had a bachelor's degree in 1964. This figure climbed to nearly 31 percent in 2012. This increase represents important context for the study of the labor market performance of young highly-educated individuals.

1.2 Significance

As previously mentioned, rather than examining all individuals with bachelor's degrees, I focus instead on only those young people who have recently finished college.

Young bachelor's degree holders are in the throes of early participation in the job market. For a variety of reasons, initial and early-career labor market experiences are crucially important for individuals. For one, college debts are climbing. Two-thirds of U.S. public and private four-year graduates emerge from college with outstanding debt, averaging nearly 27 thousand dollars (Reed and Cochrane, 2012). These college debt burdens mean graduates are likely to put increasing importance on finding secure and high-paying jobs immediately following school.

Another factor adding import to early labor market performance is the rising cost of living, and in particular housing, in the United States. National housing prices (as measured by the S&P /Case−Shiller Home Price Indices) trended downward after the recession and hit a low point during 2012, but have since rebounded and retaken approximately 2004 values. [1] Data indicate that, overall, housing prices are near all-time highs, and growing. Thus college graduates, who often finish school with substantial debt, are likely to face added constraints on their housing choices.

Third parties put additional emphasis on job placement for recent graduates. With a focus on improving outcomes for graduates, Gallup, Purdue University, and the Lumina Foundation have produced the Gallup-Purdue Index. The index claims a rigorous, data-based approach to addressing whether graduates are successful in work and other dimensions.[2] This endeavor is merely one example of a growing societal push to address the costs and benefits of college. By pushing graduate employment closer to the forefront of the national conscience, the Gallup-Purdue Index and other such efforts also are likely to increase their perceived importance to graduates themselves.

An additional important aspect of early career experience is the tradeoff between starting salary and wage growth. This tradeoff has been theorized, but also shown empirically by Simon and Warner (1992). In the context of job networks, the au-

[1] See https://www.spice-indices.com/idpfiles/spice-assets/resources/public/documents/103542_cshomeprice-release-0729.pdf?force_download=true.

[2] More information is available at http://online.wsj.com/news/articles/SB10001424052702304403804579261893126434068.

thors find evidence that workers who get a good initial job match (high salary) go on to experience lower wage growth. For recent college graduates impacted by the previously mentioned factors influencing early labor market performance, this is especially problematic. If high debts, housing costs, and third party pressure increase the reservation wages of new labor market participants, these workers could suffer lower-than-expected wage growth in the years thereafter. Other life course events, in particular marriage and child bearing, are relevant to the discussion of wage growth and labor market earnings over the life course. Hirschl et al. (2003) look at the effects of marriage and children, and find that couples looking to maximize their life course earnings do best when they are married and have no children. Hence, the career earning potential of young college graduates could be impacted by their marital and child bearing status as they enter the labor market.

Just as early-career wage preferences may have long-term impacts, individuals experiencing substantial bouts of unemployment coming out of college may suffer future career setbacks. This "scarring effect", or persistence of early unemployment, appears to be a contentious topic in the literature. Heckman and Borjas (1980) find that early career unemployment does not influence future joblessness among high school graduates. One study even finds that for degree holders, there is a positive effect for early unemployment on future employment, meaning early career unemployment actually translates to increased employment chances in the later career (Burgess et al., 2003). However, Schmillen and Umkehrer (2013) use an instrumental variables approach and find not only that the scarring effect exists, but also that it is underestimated by alternative approaches used in previous studies. Another study (Mroz and Savage, 2006) finds that unemployment persistence exists, and also that early career unemployment results in substantial negative earnings effects for individuals. If it is true that early unemployment has adverse effects in the long term for United States college graduates' careers, then these individuals will feel added pressure to secure employment upon graduation.

All of the factors discussed mean the early job market experience for college graduates is becoming increasingly important for both short and long term personal finances. This added importance, coupled with widespread labor market changes brought about by the recent recession, amount to a very interesting climate in which to study young college graduates' employment outcomes. This setting in part motivates the choice of topics for this thesis.

1.3 Links among Migration, Labor Market Outcomes, and Economic Cycles

Given that U.S. college graduates are subjected to pressure on their early job success, they may take exceptional measures to ensure adequate occupational attainment when leaving school. One option at their disposal is to conduct job searches at the national (or international), as opposed to local, level. In order to pursue jobs in outside regions, these graduates must be willing to migrate to distant labor markets. With the possibility of college graduates increasingly turning to migration to improve their early labor market experiences, the effects of relocation begin to warrant special attention. For this reason, I aim to investigate whether migration is correlated with the early career employment outcomes of bachelor's degree holders in the United States.

Migration represents a major life-course decision for individuals. For this reason, it is instructive to briefly review migration in the United States before conducting an analysis of migrants.

In a widely recognized study, Sjaastad (1962) pioneers the concept of regional migration (i.e. migration from one labor market to another) as an investment for individuals. Bowles (1970) follows up to show that economic incentives can beget relocation at the individual level. Indeed, a review of internal migration literature as a whole (Cushing and Poot, 2003) identifies unanimity in the idea that the migration decision is a means of maximizing well-being based on a calculation of (discounted) future benefits relative to costs.

In terms of internal migration, U.S. residents are relatively mobile. From 1995 to 2000, estimates indicate more than 43 million natives moved to a different state or a different county within their own state, representing 18.7 percent of the U.S.-born population (Perry et al., 2003). In a broad study of United States migration trends, Molloy et al. (2011) estimate that 5 to 6 percent of individuals in the United States move across county boundaries annually. The authors also note that, while economic recessions are generally associated with decreased mobility, the financial crisis of 2008 does not appear to be impacting migration above and beyond existing long term trends.

There is evidence that differences in migration propensities exist when comparing college educated individuals to the rest of the population. In particular, college graduates appear more likely to migrate compared to less-educated individuals. Beyond this, they are more willing to relocate based on improved labor market conditions in outside states (Wozniak, 2010). Other demographic variables also seem to have an effect on migration propensities. For one, women may be more likely to migrate than men (Faggian et al., 2007; Borjas et al., 1992). Estimates suggest people are less likely to migrate as they age, if they are black or Hispanic, if they immigrated to the United States, and if they have children (Molloy et al., 2011).

1.4 Specific Research Questions and Hypotheses

Entrance into the labor market and early career job matching pose interesting challenges to college graduates in the United States. Research suggests that educational attainment levels are increasing in the U.S. population (Figure 1.1), meaning more increasing numbers of educated people enter the job market with each graduating cohort. At the same time, growing student loan debts, cost of living increases, third party pressure, and the importance of early labor market outcomes translate into increased job competition among graduates. As the economy perhaps struggles to accommodate the addition of highly-skilled workers, degree holders are likely to

look for any way to get a leg up. Specifically, this research focuses on migration and asks the question whether migration for job reasons correlates positively with the labor market outcomes of young college graduates in the United States.

Research Question 1: Is job-related migration correlated with labor market outcomes among young college graduates in the United States?
Hypothesis 1: Job-related migration is correlated with outcomes. In particular, job migration will be associated with improved outcomes in the labor market.

A parallel issue is that the job outcomes of recent college graduates are likely to be impacted by business cycle booms and busts. Indeed, recessionary job losses are most commonly observed among young individuals (Bell and Blanchflower, 2011), while people graduating college in the midst of recessions are found to experience lower occupational attainment and wages (Kahn, 2010). The 2008 financial collapse represents a very substantial shock to the domestic and global labor market. The fact that concerns about college graduate labor market performance are mounting in the wake of the 2008 recession gives rise to the second research question, which asks whether the recession itself had any impact on the association between job-related migration and labor market outcomes.

Research Question 2: Is the correlation, or lack thereof, between job migration and labor market outcomes for young college graduates changed in any way by the labor impacts of the recent global recession?
Hypothesis 2: The recession will impact the correlation, leading to a stronger association between job-related migration and improved labor market performance.

Finally, the literature on labor market indicators is firmly grounded in the practice of controlling for confounders arising in demographic and other characteristics of workers. The practice of including controls for these variables is important because

evidence indicates they play important roles. For individuals, labor market outcomes are often observed to vary based on race, ethnicity, age, place of residence, and a myriad of additional characteristics. This phenomenon brings about the third and final research question, which asks whether young college graduates experience different levels of correlation for job migration on the basis of their individual demographic characteristics.

Research Question 3: Do demographic characteristics influence the correlation between job-related migration and individuals' labor market outcomes?
Hypothesis 3: A number of individual-level demographic variables will influence this correlation.

1.5 Research Design

Among the numerous labor market outcomes by which to measure job migration's effect, I select three. First, I investigate the fundamental concern of whether young college graduates are finding jobs by measuring unemployment durations. Then, for those who do find jobs, I analyze whether they are adequately matched, along two dimensions: overeducation and wage earnings. Individuals who are overeducated (in this case, employed in jobs requiring less than a bachelor's degree) are by definition underperforming in the labor market. Lastly, individuals with depressed wages are inherently less successful in the labor market than higher earners.

The research questions at the heart of this study are best addressed using microdata. I use Current Population Survey (CPS) data, which I access via the Integrated Public Use Microdata Series (IPUMS). CPS data are the product of monthly surveys of United States households. The survey is administered by the U.S. Bureau of Census under direction of the Bureau of Labor Statistics. The data include broad, individual-level information on labor force participation, employment/unemployment, typical hours worked, wage and salary earnings, and other labor characteristics, as

well as a host of demographic and personal variables. Although the CPS observations are based upon only a sample of U.S. residents, probability weighting techniques allow for the data to be representative of the entire population. I use these data to analyze job migration's correlation with unemployment duration, overeducation, and wages.

In assessing unemployment, I use event history analysis techniques to analyze the lengths of time young college graduates spend without jobs. I investigate how unemployment durations are associated with two specific factors, namely job-related migration and the labor market changes associated with the great recession of 2008. I isolate these effects using Kaplan-Meier estimation. Then, I use the Cox Proportional Hazards method to estimate the same association while controlling for the effects of additional demographic and locational covariates at the individual level.

I also empirically study the propensity for overeducation among young college graduates. Conditional on the fact that individuals in the sample possess bachelor's degrees, I consider workers employed in jobs requiring lower levels of education to be overeducated. Using logit analysis, I model propensities for overeducation (the binary dependent variable) for individuals who are movers versus those who are not, both before and after the recession. My model specification allows estimates to vary based on individuals' additional demographic and locational characteristics.

Finally I analyze wage earnings among individuals in the sample in the context of the recession and migration. I use OLS regressions to model the wages of young "mover" college graduates, which I compare to analogous estimates of "stayer" graduates' wages. I conduct this analysis for individuals both before and after the labor market impacts of the great recession occur. Additionally, the OLS technique allows for a nuanced analysis accounting for demographic and locational differences among the populations studied.

1.6 Structure of the Thesis

This thesis is structured as three separate research papers, preceded by this introductory chapter and followed by a concluding chapter. Chapter 2 is comprised of the first paper, which focuses on measuring and characterizing the unemployment durations of young college graduate movers, compared to stayers. The second paper, presented as Chapter 3, aims to quantify differences in overeducation propensities for young college graduates who move and those who do not. The final paper, contained in Chapter 4, investigates migration's association with the wage earnings of young college graduates. In Chapter 5, I conclude the thesis with a synthesis of pertinent results. Specifically, I discuss the empirical findings in the context of whether job-related migration is associated with changes to labor market outcomes, and if so, whether the correlations are positive or negative. Finally, I make mentions of relevant information for policymakers, as well as future research directions.

CHAPTER 2. THE ASSOCIATION BETWEEN JOB MOBILITY AND UNEMPLOYMENT DURATION IN YOUNG COLLEGE-EDUCATED WORKERS

2.1 Introduction

A growing number of young people are seeking post-secondary education, with U.S. undergraduate college enrollment increasing from 10.5 million students in 1980 to 17.6 million in 2009 (Avery and Turner, 2012). As college enrollment spikes, the cost of attending college is also observed to be climbing. Estimates suggest two-thirds of individuals graduating from public and private four-year colleges in the U.S. in 2011 had outstanding student loans, with debt among those individuals averaging nearly 27 thousand dollars (Reed and Cochrane, 2012). Furthermore, the aggregate level of student loan debt is growing, with the current level projected at more than 1 trillion dollars.[1]

Hence, many young college graduates are experiencing the financial burden of substantial debt accumulation. At the same time, the labor market is presenting additional challenges to their financial solvency. Analysis reveals the recent economic crisis has worsened labor market outcomes in the United States. Specifically, Rothstein (2011) reports that non-farm payroll employment decreased by roughly 6.8 million from the midpoint of 2008 to that of 2009. These factors are likely to increase the importance that college-educated job market entrants place on their initial employment. Individuals with outstanding debt in a struggling economy may take unique steps to improve their labor market outcomes. One possible means of generating this type of job market opportunity is job mobility. Here and throughout this

[1] http://www.finaid.org/loans/studentloandebtclock.phtml

thesis, job mobility refers to the migration of a given individual to a new labor market for primarily a job-related reason.[2] Conceptually, job mobility is similar to the migration component of a related phenomenon called "spatial flexibility" (Van Ham and Hooimeijer, 2009). Regarding migration in particular, there is a precedent in economic theory for treating relocation from one spatially separate labor market to another as an investment (Sjaastad, 1962). In the presence of economic incentives, individuals can be induced into relocation (Bowles, 1970). Wozniak (2010) shows that college graduates are not only more likely to migrate than high school graduates, but also are more likely to respond to better labor market conditions at the state level. The economic crisis has affected state labor markets, with some states faring worse than others. This has likely impacted individuals' migration decisions, providing especially interesting context in which to study job mobility.

The goal of this chapter is to measure the link between job mobility and unemployment duration for young college graduates in the United States. In particular, I address a number of research questions. First, is job mobility correlated with unemployment durations? Second, is this association changed in any way by the recent global financial crisis? Finally, do any personal characteristics (socioeconomic, locational, etc.) change the correlation between job mobility and unemployment duration at the individual level? I hypothesize that job migration will be negatively correlated with unemployment durations. In other words, I expect job migrants to experience shorter unemployment durations (improved labor market performance). I presume this correlation will become stronger after the onset of the financial crisis. Finally, I think a number of personal characteristics including race, gender, and marital status will affect unemployment durations in the presence of job migration.

I hope to contribute to the literature on labor migration with this research. In the context of the recession, research studies explain patterns of unemployment rates (Schaal, 2012) and the share of unemployment that is long-term (Rothstein, 2011). Additionally, the propensity for and determinants of job mobility during business

[2]In this research, individuals exhibiting job mobility are "movers" defined in section 2.4.1

cycle booms and busts before and during the recession has been addressed (Roosaar et al., 2014). My research is related, but sets itself apart by connecting unemployment to job migration, looking in particular at college graduates in the United States. This is a topic which has yet to be directly addressed in the literature.

The rest of this chapter is organized as follows. First, I undertake a review of literature relevant to unemployment, and migration. Second, I introduce the methods I employ to analyze the correlation between job mobility and unemployment duration. Third, I describe the data to be used in this analysis, including a discussion of the advantages and disadvantages of available datasets. Fourth, I report the results of the analysis. Finally, I make concluding remarks and attempt to shed light on possible policy implications of the results.

2.2 Literature Review

2.2.1 Background and Current State of Youth Unemployment

A considerable body of economics literature addresses the topic of youth unemployment and its determinants. At the outset of a survey of this literature, it is worth noting there is debate as to the definition of youth among the relevant studies. An International Labor Organization (2010a) report on youth unemployment indicates two sources of this debate, namely differing definitions for statistical agencies across nations, as well as the tendency for young people to delay their job market entry in recent years. Further attention is given to the issue of defining cutoffs for youth age groups in section 4 of this chapter.

There is strong evidence justifying the importance of studying youth unemployment. Problems with youth unemployment at the individual level include potentially lifelong labor market inhibition and social exclusion. In the context of the economy at-large, young people lose out on income, which can have negative effects on savings and aggregate demand. Furthermore, institutional and governmental investments in

education are squandered. Taken together, the economic detriments of youth unemployment constitute serious problems for societies International Labor Organization (2010a).

International Labor Organization data reveal unemployment rates for young people to be "perpetually higher" than those for adults, due to both supply and demand side labor market factors (International Labor Organization, 2010b).[3] The report estimates the 2009 global youth unemployment rate to be 13.0 percent, compared to 4.9 percent for adults. It additionally documents larger increases in the youth unemployment rate relative to adult rate associated with the early stages of the recent global recession. Between 2007 and 2009, the youth rate climbed 1.1 percentage points, compared to 0.7 percentage points for adults. Furthermore, in 2008 the global youth share of unemployment was 40.2 percent, despite the fact that youths comprised less than 25 percent of the world's total working-age population. As a final note, phenomena of disproportionate youth unemployment affect developed and developing nations alike. For developed economies in 2009, the ratio of youth-to-adult unemployment rates was 2.5, meaning in these regions youths were around two-and-a-half times as likely to be unemployed as adults. Globally, the rate in 2009 was only slightly higher, at 2.7. These numbers suggest youth unemployment is a prevalent and growing problem in the modern economies worldwide.

2.2.2 Determinants of Youth Unemployment

A substantial amount of literature on youth unemployment aims to identify the various factors that determine whether young people are unemployed. Scarpetta et al. (2010) point to disadvantages for young individuals without higher education qualifications. In an all-encompassing assessment of youth unemployment, Freeman and Wise (1982) find a number of key determinants including overall labor market booms and busts, the youth proportion of the total population, and the minimum

[3]For its definition of "youth", the report considers individuals aged 15 to 24.

wage. The authors also find young people coming from poor families are less likely to be employed than those from wealthy upbringings, and that race is a determinant of youth unemployment to the extent that black youths are more frequently unemployed than whites. Finally, Freeman and Wise cite the relationship between youth unemployment and the behavior of individuals during high school, in particular regarding academic performance and employment history.

Of the determinants they catalog, Freeman and Wise find the most important is the overall economy, and in particular whether it is in a recession or an expansion. Additional studies make conclusions in support of this finding. Bell and Blanchflower (2011) report that recessionary job losses are most likely to occur in the young age cohorts of 15 to 24 and 25 to 34. Verick (2009) studies the recent economic crisis in particular and finds it has made young people more vulnerable to unemployment, with magnitudes varying by country. For a panel of more than 70 countries around the world, Choudhry et al. (2012) uncover evidence that financial crises have positive and significant effects on youth unemployment rates. The authors go on to compare the effects for young people and those for the overall population, observing that adverse recessionary employment effects are larger among youths relative to adults. Looking specifically at students who graduate college in the midst of recessions, Kahn (2010) finds they experience decreased job acquisition and depressed wages. These phenomena occur despite slightly higher educational attainment among recession-era graduating cohorts. On a related note, Clark (2011) investigates whether recessions result in increased enrollment in post-secondary schooling by weakening youth labor markets. Among young people in England, the study finds strong positive effects for youth unemployment on enrollment for both males and females.

2.2.3 Measures of Unemployment

Labor economics literature studying unemployment generally focuses on two particular measures: the unemployment rate and unemployment duration. A number of

publications (Chiswick et al., 1996; Blanchard and Katz, 1996; Bianchi and Zoega, 1998) base their analysis on only the rates of unemployment. However, as Gradín et al. (2012) indicate, it is not sufficient to simply gauge the incidence of unemployment via unemployment rates. Rather, the authors argue research must also address the length of spells for individuals experiencing unemployment. They contend long term unemployment is more detrimental to individual well-being, in addition to being more damaging for long term employment prospects. These arguments are further supported by analysis from Layard et al. (2005), indicating in many countries, variation in unemployment is driven by variation of average unemployment spell length. Studies report a number of key determinants for this individual-level unemployment duration. Unemployment insurance benefits and the share of young workers in the labor force are two such determinants (Valletta and Kuang, 2012). Arulampalam and Stewart (1995) examine unemployment duration in Britain between 1978 and 1987, and find significant effects for income and local unemployment rates. Evidence for the impact of unemployment benefits on spell length has also been found (Caliendo et al., 2013). Finally, Gradín et al. (2012) explore the link between the recent global recession and unemployment spell lengths in certain EU countries. As anticipated, they find that the economic slowdown increased durations in Spain, Portugal, Greece, the UK, France, Italy, and Poland.

2.2.4 Job Mobility and Recessions

Studying Dutch university graduates, Venhorst et al. (2011) find that their job migration behavior is disproportionately influenced by regional and national business cycle changes. They show that a higher regional GDP growth rate decreases the likelihood of a given university graduate to exercise job mobility. In other words, job mobility is less common for graduates during boom periods. The authors find an opposite result for recessionary periods. Specifically, higher regional unemployment rates beget interregional migration among the Dutch university graduates analyzed.

Roosaar et al. (2014) investigate job mobility and its determinants among Estonian workers during the great recession. They find that demographic characteristics influence job migration from 2001 to 2003, a period of recovery from a recession. However, they do not find significance for the same personal attributes during the economic boom period starting in 2004, nor during the onset of the great recession itself that followed in 2008. Their study also addresses differences in job migration among public versus private sector employees. The results suggest only minor differences.

2.3 Model and Methods of Analysis

2.3.1 Introduction to Event History Analysis

Event history analysis originated from the field of biostatistics. For this reason, the analyses have historically made use of the terms "survival" and "failure". This remains true in social science applications (Box-Steffensmeier and Jones, 2004). To the extent that events and the timing of their occurrence are relevant to social scientists, event history analysis is a useful tool for researchers in the discipline. The analysis is conducted on observations with associated longitudinal data. There are a variety of event history models, and certain aspects of event history analysis are consistent across them. For one, the analyses can be boiled down to the transition between one state and another. Consequently, dependent variables in event history analysis measure how long an observation spends in an initial state before an "event" occurs, moving the observation to a different state. Duration is expressed as a continuous, positive random variable T, and states can be denoted in a variety of ways (e.g. s_1, s_2). Another important aspect of event history models is that they allow for analysis in the presence of observations that are censored. Censoring occurs when a particular observation cannot be observed to experience an event. This does not mean the observation does not experience the event, but rather in the time frame of the study, the

transition between states is not observed. To summarize, in event history analysis, a subject "survives" in an initial state and is subject to "risk of failure" until the failure (event) occurs, or until the observation is censored. Generally, event history analysis is concerned with modeling hazard rates, which represent the risk of a failure occurring at a specific time given that the subject has not experienced a failure prior to that time. Specifics on the calculation of hazard rates are explored in the sections that follow.

There are a host of examples in the literature of longitudinal analysis applied to unemployment duration. Meyer (1990) and Moffitt (1985) both use non-parametric hazard modeling techniques to explore the effect of unemployment insurance on unemployment spell lengths. This method is also applied in a study of the determinants of unemployment in Russia (Foley, 1997). Additionally, Chuang (1999) studies unemployment duration among Taiwanese university graduates using a parametric approach (namely the Weibull distribution).

2.3.2 Kaplan-Meier Estimation

In the analysis that follows, the distribution of unemployment duration periods is obtained via Kaplan-Meier estimators (Kaplan and Meier, 1958). The Kaplan-Meier estimator is a nonparametric maximum likelihood estimator which involves calculating a hazard rate in each time period for the population at risk of experiencing an event. Within the context of this analysis, the at risk population is comprised of individuals who are at risk of becoming employed.[4] A more detailed description of the factors affecting risk is provided in section 2.3.2. In Kaplan-Meier estimation the hazard is calculated separately at each point, meaning the result is a discrete distribution (Moffitt 1985).

For a population of size n, one can observe k distinct event times $t_1 < t_2 < \cdots < t_k$. Each event t_i is related to an n_i, the number of individuals that are at risk at said

[4]It is worth noting that employment is one of a number of possible exit events. Others could be dropping out of the labor force, going back to school full time, or dying.

time, and d_i, the number of deaths at t_i. Individuals that are marked at risk at time t_i have either not yet experienced the event or have failed specifically at time t_i.

The probability that an individual will have a lifetime that exceeds time t, $S(t)$, is calculated by multiplying a sequence of conditional survival probability estimators from those at risk and actual deaths:

$$\hat{S}(t) = \Pi_{t_i \leq t} \frac{n_i - d_i}{n_i}. \tag{2.1}$$

Thus, the Kaplan-Meier curves present a preliminary univariate analysis to better understand when different groups of individuals survive or fail in the system. In case of this study, it allows for observation of the proportion of young, educated individuals who survive (in this context continue to be unemployed) or fail (become employed).

2.3.3 Cox Proportional Hazards Regression

A more nuanced analysis of unemployment spells arises from modeling the hazard rate in terms of additional variables. The goal is to determine if these covariates have an impact on unemployment duration. To avoid erroneous model specification, and for ease of interpretation of results, this study takes a nonparametric approach to this branch of the analysis. In particular, I adopt the most common nonparametric specification, namely the Cox proportional hazards model ("Cox model" hereafter). The Cox model is a seminal statistical framework that was introduced by Sir David Cox in 1972, and has been used widely since its inception (Box-Steffensmeier and Jones, 2004).

The Cox model is an estimator that is applicable to data with information for individuals not only on failure times but also, crucially, additional relevant covariates. The model allows for analyzing if, and how, these additional covariates impact the distribution of failures over time (Cox, 1992). The Cox model is a proportional hazards model whereby the effect of a covariate amounts to a multiplication of the

baseline hazard. In accordance with Cox's model, for the ith individual the hazard rate can be written as

$$h_i(t) = h_0(t)exp(\boldsymbol{\beta}'\boldsymbol{z_i}), \tag{2.2}$$

where $\boldsymbol{\beta}$ is the $(p \times 1)$ vector of regression parameters, $\boldsymbol{z_i}$ is the $(1 \times p)$ vector of covariates for individual i, and $h_0(t)$ is the (unknown) function for the baseline hazard. Cox estimates are generated via a partial likelihood estimation process. Based on equation 2.2, the partial likelihood function can be written as

$$\mathcal{L}(\beta) = \Pi_{j:C_j=1}\left[\frac{exp(\boldsymbol{\beta}'\boldsymbol{z_i})}{\Sigma_{i\in Y(t_i)}exp(\boldsymbol{\beta}'\boldsymbol{z_i})}\right]^{\delta_j}, \tag{2.3}$$

where $Y(t_i)$ is the "risk set" – the number of individuals at risk of failure at time t_i – and the definition of δ_j is 0 in the case of a censored observation and 1 with an uncensored observation Box-Steffensmeier and Jones (2004). Finally, via log-transformation of 2.3, one can obtain a log-likelihood function. Then, estimates of the β terms can be generated by maximizing this log-likelihood.

If parameter estimates are exponentiated, they are interpreted as hazard ratios. In this case, hazard ratios less than one correspond to a negative correlation between the hazard and the covariate. In the application at hand, a negative hazard ratio means the covariate has a downward (shortening) effect on unemployment duration.

With failure-time data enumerated by a discrete time variable, it is possible for events to occur at the same time, or "tie". In fitting a Cox model, adjustments must be made in light of this possibility. The partial likelihood function cannot account for ties inherently. As a result, the partial likelihood must be approximated. A number of methods exist to perform this approximation, and I opt for the Breslow approach due to its straightforward nature.[5]

The goal of this study's application of the Cox model is to assess not only the effects of given covariates on unemployment duration, but also whether the anticipated

[5]For additional details on the Breslow method of handling ties, see Breslow (1974) and Box-Steffensmeier and Jones (2004).

unemployment-migration correlation is associated with differences in these effects for movers versus stayers (before and after the recession). To do so, I include job migration and timing relative to the recession as dummy variables and allow for interaction effects.[6] This allows for the parsing of an added level of detail that is critical in this analysis. For example, if marital status is one of the chosen covariates, one could answer the query, "what is the effect of marital status on unemployment duration for movers before the recession?"

2.4 Data

2.4.1 Dataset

I use data from the annual March supplement of the Current Population Survey (CPS) to examine individuals' labor market outcomes. The CPS is a household survey administered jointly by the U.S. Census Bureau and the Bureau of Labor Statistics. It incorporates two dimensions: a monthly survey that asks basic labor force and demographic questions, and the March Annual Demographic File and Income Supplement (March CPS) which is generated using a more detailed questionnaire. The data is accessed from IPUMS CPS, which integrates years of March CPS data into an overall dataset.

Table 2.1.
Sample Selection Criteria

Variable	Criterion
time period	survey years 2003, 2004, 2005, 2006, 2007, 2008, 2010, 2011, 2012, 2013
education	bachelor's degree
age	22 to 30 years old
labor force status	in the labor force and currently employed
armed forces status	not an active member of the armed forces

[6]For more on the variables used and their definitions, see Table 2.2 (Section 2.4.1).

Table 2.1 presents the selection criteria for the sample of individual-level observations from IPUMS CPS. Foremost, the analysis is based on individuals whose highest educational attainment is a bachelor's degree. In the interest of better addressing the early labor market experiences of college graduates, advanced (master's, Ph.D., and professional) degree holders are excluded from the analysis. By assumption, students with advanced degrees enter the job market in vastly different circumstances than the majority of undergraduate degree holders. Their distinct debt obligations and employment/earning prospects mean they warrant dedicated studies of their own. Toward the same end of capturing early labor market experiences, the sample is limited to individuals aged 22 to 30. Using the most recent data, and to relate the analysis to the recent global recession, I examine observations from the years 2003 to 2008 and 2010 to 2013. Only individuals reporting themselves to be "in the labor force" at the time of the survey are considered. With the goal of analyzing individuals' diverse experiences regarding unemployment spell length, only those individuals who report at least one week of unemployment in the past year are examined. Finally, this study adheres to the custom of excluding active members of the armed forces when dealing with labor market issues. The data consist of unemployment duration characteristics and relevant socioeconomic covariates as reported by individuals in each year's March CPS. This means the dataset is built from yearly cross sections of individuals that are randomly sampled from the overall U.S. population. In other words, it is a pooled cross-sectional dataset.

Table 2.4.1 is a comprehensive list of the variables of choice and their definitions. The variable of interest is "unempdur", which appears first in the table. This variable is a measure of the lengths of unemployment spells for individual survey respondents. It is constructed using two variables from IPUMS CPS, namely "WKSUNEM1" which measures the number of weeks an individual spent unemployed in the past year and "DURUNEMP" which measures the number of consecutive weeks of unemployment for individuals unemployed at the time of the survey. More specifically, observations representing individuals who are currently employed are coded into "unempdur" as

Table 2.2.
Variables and their Definitions

Variable	Definition
dependent variable	
overeducated	= 1 if respondent reports an occupation needing less than a bachelor's degree level of education for entry
key independent variable	
mover	= 1 if respondent migrated for job-related reasons across county boundary
personal characteristics	
age	= age of respondent [yrs]
female	= 1 if respondent is female
married	= 1 if respondent is married
children	= 1 if respondent lives with his/her own children
white	= 1 if respondent is white
immigrant	= 1 if respondent was born outside the United States
hispanic	= 1 if respondent reported Hispanic origin
boomerang	= 1 if respondent reports being the child of the household head
locational characteristics	
metro	= 1 if respondent lives in a metropolitan area
coastal	= 1 if respondents current state of residence is CA, CT, DC, FL, IL, MD, MA, NJ, NY, NC, OR, PA, RI, TX, VA, WA

the number of weeks the individual was unemployed in the past year. On the other hand, observations reporting currently unemployed individuals are coded into the variable as the number of weeks they have been unemployed consecutively.[7] In explicit terms, this variable gives a measure (in weeks) of the duration of individuals' unemployment spells over the course of the past year.

The distinction between movers and stayers is paramount in this analysis. Hence, it requires explicit coding at the individual level. Toward that end I designate the key independent variable of analysis – "mover" – described in Table 2.4.1. This variable identifies whether an individual engages in job-related migration. Migration literature customarily designates individuals who migrate as "movers" and those who do not migrate as "stayers". For the purposes of this analysis, I consider one to be

[7]These observations are eventually censored in the analysis, by way of a process described below.

a mover if the individual's job migration has taken him/her across county lines in the past year. In designating so called job-related reasons, I make use of the IPUMS CPS variable "WHYMOVE", which identifies a respondent's single main reason for moving. Specifically, I limit job-related reasons to the following survey responses: "New job or job transfer"; and "To look for work or lost job".

Aside from the key independent variable, the model makes use of a number of personal and locational characteristics available for individuals recorded in the survey. Personal covariates include respondents' ages, as well as marital status, gender, whether respondents live with their own children, race, immigrant status, Hispanic origin, and whether the respondent is the child of the head of their household. Regarding individuals locational characteristics, I include covariates measuring residence in metro areas and in U.S. regions. Metro status is determined based on U.S. Census Bureau definitions of metropolitan areas. Finally, I have a variable that identifies individuals based on their region of residence. The variable "coastal" is used to denote individuals who live in areas of relatively high economic activity. For the United States, economic activity is concentrated in the east and west coasts, as well as a select few interior areas. At the state level, I designate California, Connecticut, Washington D.C., Florida, Illinois, Maryland, Massachusetts, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Texas, Virginia, and Washington as regions of relatively high economic activity. Hence, "coastal" identifies individuals who live in one of these states.

Relevant literature provides a basis for the inclusion of a number of the selected covariates. In studying unemployment duration in Turkey, Tansel and Taşçi (2004) find women to have substantially longer spell durations than men. They also report marital status to have significant effects on unemployment duration for both men and women, although the effect of being married is negative for women and positive for men. The authors' evidence for the effect of age suggests older individuals have relatively lower hazard rates for exiting unemployment. Interestingly, the study also reveals discrepancies in exit rates for both men and women under different definitions

of unemployment. Unemployment studies have previously argued an individual's relationship to the household head can significantly impact labor market outcomes. Namely, non-household heads face a more constrained market and greater unemployment (Green and Hendershott, 2001). Nickell (1979) reports, among married men in particular, a positive correlation between the expected length of unemployment spells and the number of children. Examination of rural-urban differences in unemployment duration points to increased durations in urban areas (Tansel and Taşçi, 2004). Finally, in a seminal study of unemployment duration, Katz and Meyer (1990) recognize the impact of geographic characteristics and control for them (in their case using state fixed effects).

Additionally, in order to make comparisons relative to the recent recession, it is necessary to group observations according to their timing relative to the economic bust period. I use 2009 as the reference year. The justification for this revolves around the timing of recessionary increases in both the unemployment rate and the long-term (27+ weeks) unemployment share. From Rothstein (2011) Figure 1, the large part of these increases took place in 2009. Thus, for the analysis that follows, observations from 2003 to 2008 are considered pre-recession, and observations from 2010 to 2013 are considered post-recession. Data from the year 2009 are not used, due to their volatile nature.

Table 2.4.1 gives summary statistics for the variables appearing in the analysis grouped by both job-migrant status and timing relative to the recession. The figures presented are based on the CPS sample used throughout the analysis. Probability weights are employed to make the statistics representative of the overall U.S. population. Hence, the mean and standard deviation figures are estimates, calculated using statistical software (Stata12). The calculations are based on actual observations from a CPS sample, which are subjected to probability weighting in order to be made representative of the United States population at large. This means the calculations are performed on an estimated 0.34 million movers before the recession, 3.68 million

Table 2.3.
Summary Statistics

	CPS 2003-2008			CPS 2010-2013		
	Mover	Stayer	Difference	Mover	Stayer	Difference
dependent variable						
overeducated	0.545	0.600	-0.054***	0.517	0.611	-0.094***
	(0.498)	-0.490	(0.019)	(0.500)	(0.488)	(0.023)
personal characteristics						
age	25.399	26.299	-0.900***	25.452	26.276	-0.824***
	(2.465)	-2.422	(0.091)	(2.373)	(2.396)	(0.111)
female	0.518	0.559	-0.041**	0.538	0.546	-0.007
	(0.500)	-0.496	(0.019)	(0.499)	(0.498)	(0.023)
married	0.321	0.368	-0.047***	0.307	0.313	-0.006
	(0.467)	-0.482	(0.017)	(0.462)	(0.464)	(0.021)
children	0.130	0.199	-0.069***	0.155	0.175	-0.020
	(0.336)	-0.399	(0.011)	(0.362)	(0.380)	(0.016)
white	0.855	0.805	0.050***	0.877	0.800	0.077***
	(0.352)	-0.396	(0.013)	(0.329)	(0.400)	(0.015)
immigrant	0.097	0.145	-0.048***	0.087	0.121	-0.033***
	(0.296)	-0.352	(0.010)	(0.282)	(0.326)	(0.013)
hispanic	0.058	0.077	-0.018**	0.070	0.092	-0.021*
	(0.234)	-0.266	(0.008)	(0.256)	(0.289)	(0.011)
boomerang	0.040	0.189	-0.148***	0.033	0.219	-0.186***
	(0.197)	-0.391	(0.008)	(0.178)	(0.413)	(0.009)
locational characteristics						
metro	0.898	0.910	-0.011	0.918	0.925	-0.006
	(0.302)	-0.287	(0.010)	(0.274)	(0.263)	(0.011)
coastal	0.591	0.612	-0.022	0.583	0.635	-0.052**
	(0.492)	-0.487	(0.018)	(0.493)	(0.481)	(0.022)
observations	1,109	24,673		695	18,679	
estimated weighted observations	1,998,429	42,503,207		1,331,052	33,859,253	

Means and standard deviations (in parentheses) are based on probability weights "WTSUPP". Significance indicators ***, ** and * mean that the difference of means is significantly different from zero at the 1%, 5% and 10% levels, respectively.

stayers before the recession, 0.30 million movers after the recession, and 4.12 million stayers after the recession.

Comparing results across the four groupings, mean values for "unempdur" range from roughly 13 weeks to more than 19 weeks. On average, unemployment spells last longer for stayers. This difference is not significant before the recession, but after the recession it is. This is preliminary evidence that the financial crisis resulted in a stronger correlation between moving and unemployment duration among college graduates. Standard deviation estimators increase after the financial crisis, and are also larger for stayers. This measure indicates unemployment spell lengths are

more volatile among people who do not move for job reasons, suggesting by contrast increased labor market stability among movers.

Mean ages of individuals range from 25 to 26 years old across all four groupings. Stayers are significantly older than movers before, but not after, the recession. After the recession, movers are significantly more likely to be married relative to stayers. Prior to the recession, those who do not make job-related moves are more likely to have children than those who do. An implication is that people with children are more likely to be "settled in" to a geographic location for social and/or familial reasons, and therefore have limited ability to relocate for work. However, this result does not carry over to the post-recession period. Significantly larger proportions of white individuals migrate, both before and after the financial crisis.

Stayers are significantly more likely to be immigrants on average in both the pre- and post-recession periods, while Hispanic proportions do not change measurably relative to migration. Non-migrants are substantially and significantly more likely to be the children of household heads, or "boomerang movers". This is true before the economic crisis, and also to a greater extent after the crisis. This suggests economic benefits of living in the household of one's parents exist, and have added influence in poorer economic times.

Finally, Table 2.4.1 reports estimates of the locational characteristics of the population. Of individuals exhibiting job migration before the economic crisis, nearly 88 percent live in metropolitan areas at the time of analysis. This compares to around 90 percent of stayers pre-crisis. In general, a slightly greater proportion of individuals live in metro areas after the crisis. This amounts to roughly 90 percent of movers and 92 percent of stayers. Differences in metropolitan area residencies are insignificant across the groupings. Before 2009, 66 percent of movers live in coastal areas, as do 62 percent of stayers. After the economic crisis, 52 percent of job migrants are found to be living in coastal regions. This is significantly lower than the proportion of non-migrants (64 percent) living in those regions. The implication is that after the

recession, many people who live in the most prosperous parts of the United States are staying put.

2.4.2 Issues with CPS Survey Data

Due to the less-than-perfect nature of the data, issues abound when using the Current Population Survey to measure unemployment duration. Sider (1985) expounds on the myriad of issues with CPS unemployment data. Many of the problems the author raises are related to survey and questionnaire design, meaning their relevance persists to this day. Response bias is one issue of particular importance. Sider's paper argues unemployment stints that are in progress tend to spike at round numbers. The data that are reported in the CPS refer to consecutive weeks since a currently employed individual became unemployed. However, the data cluster disproportionately at "round" durations such as monthly and quarterly. In other words, unemployment stints totaling 4 weeks (roughly one month) are more likely to occur in the dataset than unemployment stints totaling 3 or 5 weeks. But Sider goes on to explain these reporting errors appear to have a tendency to offset. This tendency helps to mitigate errors (Sider, 1985). Owing to the fact that the Current Population Survey is derived from person-to-person interviews, its data is subject to issues associated with self-reporting. Individuals are asked to report on their own employment status and the length of their own unemployment spell. However, the official definition of "unemployed" is something that may not be known to survey respondents. This is primarily due to the ambiguity between being unemployed (but in the labor force) and being a non-participant in the labor force. One argument is that individuals will ignore periods where they officially drop out of the labor force, as well as periods of intermittent employment, and instead report an unemployment duration dating back to their initial job loss (Rothstein, 2011).

Additionally, a number of more generalized issues are inherent in Current Population Survey data. Poterba and Summers (1984) describe problems with recording

and coding of survey responses, as well as with the logical consistency of what the respondents themselves report in CPS interviews. The authors conduct their analysis by comparing initial interview results with reconciled results from a follow-up interview administered to a subsample of CPS households. In their measurement of coding errors, the authors report more than ten percent of individuals who are determined to be genuinely unemployed are incorrectly classified as not in the labor force initially (Poterba and Summers, 1984).

On the topic of logical consistency, Poterba and Summers (1984) explore whether individuals who responded to successive CPS surveys gave answers that were in accordance logically from month-to-month. The study looks specifically at individuals who are unemployed in two consecutive months. By differencing the reported duration of unemployment from one month to the next, it finds that more than two-thirds of these individuals gave survey responses that were logically inconsistent. Evidence also suggests this inconsistency was more pronounced with people experiencing longer stints of unemployment. However, the authors conclude their study by indicating that, while these errors exist in the Current Population Survey, the interviewing and coding methods specific to the CPS are likely to ensure that they occur less frequently than in other datasets. The overarching takeaway from the paper is not that CPS data should no longer be used. Instead, the argument is the errors investigated may introduce bias in CPS data, and this potential bias should be addressed (Poterba and Summers, 1984).

The aforementioned Current Population Survey issues have prompted a number of unemployment duration studies to use other datasets. Moffitt (1985) and Meyer (1990) conduct analysis using Continuous Wage and Benefit History (CWBH) data. CWBH data are derived from the administrative records of the United States Unemployment Insurance program. The dataset has accurate information on the number of weeks individuals have collected benefits, and how many additional weeks of benefits individuals are able to collect, as well as the levels of benefits themselves. However, these data also are not without their limitations. For one, only males are observed.

But the truncation of CWBH data is arguably a more substantial caveat. The data do not extend beyond the point where Unemployment Insurance benefits are exhausted for a given individual (Moffitt, 1985).

Despite the issues inherent in the Current Population Survey, the dataset has particular aspects that make it ideal for the analysis that follows. Many of these positive elements are described in detail by Rothstein (2011). Foremost among these is the CPSs characteristically large sample sizes. In addition to size, the data also have the advantage of being current. Unlike the CWBH, the CPS allows for examination of individuals not receiving unemployment benefits during the period of time being studied. Finally, the CPS allows for a more detailed analysis of why unemployment stints end, in particular by distinguishing between individuals who exit the labor force and those who get jobs. Self-reporting issues remain a concern, although they may have been mitigated to some extent by a redesign of CPS procedures in 1994 (Rothstein, 2011).

2.4.3 Heteroskedasticity

Because I am using survey data it is appropriate to use probability weights to correct for nonrandom sampling. Not taking into account this type of survey problem will lead to errors in both the coefficients and standard errors. To derive estimates for this study I use the STATA statistical analysis package and include the option "pweights" to include weights into the analysis. Probability weights, or pweights, are the inverse of the probability of being included in the sample as given by the sampling design.

Aside from the problem of sample design, there is a question of whether heteroskedasticity – or a non-constant variance among the error terms in the survey – exists. Heteroskedasticity occurs when the variance of the error term differs across observations in the dataset. For example, it could be possible that a particular state has laws in place making it more likely for residents to stay unemployed. Hence, the

variance of the errors for the group of individuals from that state would be different than that for individuals in states without similar laws. In another example, it could be possible that as young college educated people age, they become less likely to stay unemployed. In this case, the variance of the error term would change depending on a person's age. Another reason that heteroskedasticity is generally of concern in survey data is that specific sub-samples of the population could be more prone to measurement error than others. In fact, previous studies (Solon et al. (2013), Pitt (2011), Wissoker (1999)) suggest the use of probability weights in and of itself introduces heteroskedasticity into data. Heteroskedasticity in data biases the standard errors. The bias could be either upward or downward but it is generally observed to be downward.

In the context of this research, there are several points that are worth discussing. First of all, the typical tests for heteroskedasticity, such as the Breusch-Pagan test and White test cannot be used with survey data. However, a common response to finding heteroskedasticity is to include robust or clustered standard errors. Estimators robust for heteroskedasticity use a different formula to calculate standard errors. For example, for the OLS,

$$V(\hat{\beta_{OLS}}) = (X'X)^{-1}X'\hat{\Omega}X(X'X)^{-1}, \tag{2.4}$$

where X is a nxk observations, where n is the number of observations and k is the number of independent variables for these observations, and,

$$\Omega = \begin{pmatrix} \hat{\epsilon_1^2} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \hat{\epsilon_2^2} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & . & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & . & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \hat{\epsilon_{n-1}^2} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \hat{\epsilon_n^2} \end{pmatrix},$$

where ϵ are the individual residuals. While the actual disturbances (ε) are not observed, White (1980) showed that the $X'ee''X$ is a consistent estimator of $X'E[\varepsilon\varepsilon']X$, where E[] is the expectation function.

When using the probability weight option, the standard errors are automatically estimated as robust standard errors (or Huber-White sandwich estimators). With the robust option, the point estimates of the coefficients are exactly the same as in ordinary OLS, but the standard errors are modified as described above.

The other type of response to heteroskedasticity is to use clustered standard errors. This approach is typically used if the error terms are correlated only within groups and the division of observations into a group is known. For a clustered robust standard error, Ω is the matrix,

$$\Omega = \begin{pmatrix} \sigma^2_{11,1} & \sigma^2 12,1 & \cdots & \sigma^2 1N_1,1 & \cdots & 0 & 0 & 0 & 0 \\ \sigma^2_{21,1} & \sigma^2_{22,1} & \cdots & \sigma^2 2N_1,1 & \cdots & 0 & 0 & 0 & 0 \\ \vdots & \vdots & \ddots & \vdots & \cdots & 0 & 0 & 0 & 0 \\ \sigma^2_{N_1 1,1} & \sigma^2_{N_1 2,1} & \cdots & \sigma^2_{N_1 N_1,1} \cdots & 0 & 0 & 0 & 0 & \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & 0 & 0 & 0 & \sigma^2_{11,G} & \sigma^2_{12,G} & \cdots & \sigma^2_{1N_G,G} \\ 0 & 0 & 0 & 0 & 0 & \sigma^2_{21,G} & \sigma^2_{22,G} & \cdots & \sigma^2_{2N_G,G} \\ 0 & 0 & 0 & 0 & 0 & \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 & 0 & \sigma^2_{N_G 1,G} & \sigma^2_{N_G 2,G} & \cdots & \sigma^2_{N_G N_G,G} \end{pmatrix},$$

where σ_i is the variance associated with the error ϵ_i, G is the cluster group, and N_i is the number of observations within the specific group. The clustered standard error is thus a very attractive option when the exact groups are known. This would be the case in the previously described example of a given state having a particular law impacting unemployment durations. In that case, unemployment would be correlated for individuals living in that locality.

For this study I use robust standard errors as opposed to clustered standard errors. Since I observe movement within states from county to county, county clusters could be appropriate. However, using county clusters is not an option because the minimum level of clustering available with the CPS data is the state in which the respondent is located. Also, there may be other channels through which heteroskedasticity could enter the model, i.e. different demographic characteristics across which error terms vary. As a result, I am unable to discern that the heteroskedasticity is stemming from any one particular variable. For those reasons, robust standard errors that deal more generally with the presence of heteroskedasticity seem the safer, more conservative option. As a test for how sensitive the results of this project are to the choice of standard error types, I also estimate the models in this chapter and throughout the thesis using standard errors clustered over the variable STATEFIP (an individual's current state of residence). The results of these estimations are largely the same as those obtained using my chosen robust standard errors, and therefore I do not report them.

2.5 Analysis and Results

2.5.1 Kaplan-Meier Estimation

As a first step in the analysis, I obtain Kaplan-Meier curves for specific groups of individuals within the sample. I then employ a "Cox" test[8] to assess differences in the Kaplan-Meier survival curves across the groups being studied. In practical terms, the Cox test amounts to fitting a Cox proportional hazards regression and performing a Wald test on the results (StataCorp, 2013).

Figure 2.1 takes the entire weighted sample in all years studied (roughly 8.43 million individuals) and plots the Kaplan-Meier survival functions for stayers versus movers. The blue (solid) line represents stayers, and the red (dashed) line movers.

[8]I use the term Cox test as defined in StataCorp (2013).

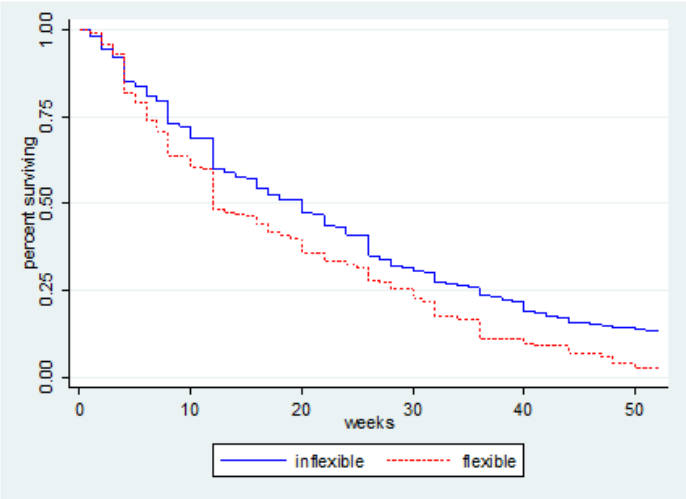

Figure 2.1. Kaplan-Meier survival curves - stayers vs movers, 2003-2008 & 2010-2013

Table 2.4.
Cox Test for Equality of Survival Curves - Stayers vs Movers, 2003-2008 & 2010-2013

migration	events observed	events expected	relative hazard
stayers	5027864.19	5142387.83	0.9806
movers	474001.53	359477.91	1.3234
total	5501865.72	5501865.72	1
Wald χ^2(1 d.f.)	16.90***		

***, **, and * refer to significance at the 0.01, 0.05, and 0.1 levels, respectively.

As the figure refers to those experiencing unemployment, survival refers to remaining unemployed, meaning the y-axis represents the percent of individuals still unemployed. The x-axis plots weeks, i.e. the duration of unemployment spells. Vertical and horizontal gaps between the curves plotted indicate differences among the groups

in question.[9] By revealing vertical and horizontal gaps between the curves, Figure 2.1 appears to indicate shorter unemployment durations among individuals who move for job reasons. To more explicitly describe this phenomenon, one can refer to median survival times, where $S(t)$=0.5. The median survival time (i.e. unemployment spell length) for stayers is 20 weeks. This is compared to 12 weeks for movers, a substantially lower figure. Additionally, I estimate average unemployment duration for the two groupings, taking into account weighting and censored observations. For stayers the average is 17.05, compared to 14.65 for movers. These statistics suggest job-migration is associated with an improved labor market outcome, i.e. a decrease in the duration of unemployment at the individual level. Table 2.4 reaffirms this association. It reports the result of a Cox test between stayers and movers, suggesting the survival function of unemployment duration for stayers is significantly different from the survival function of unemployment duration for movers.

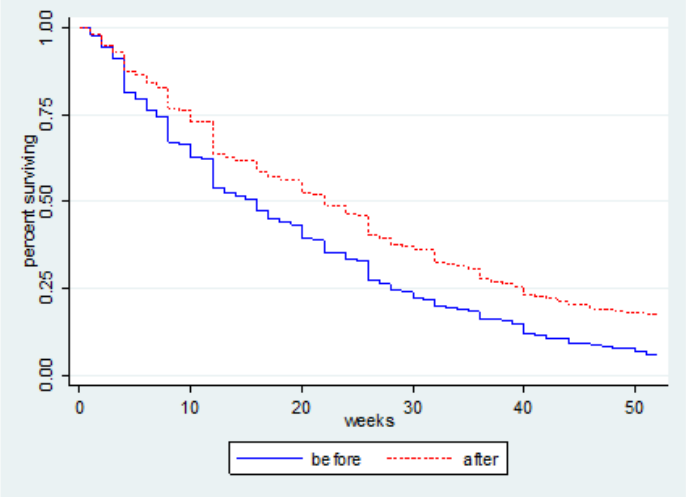

Figure 2.2. Kaplan-Meier survival curves - before vs after 2009

[9] An interpretation of vertical gaps is that at a given point in time, one group has a greater percentage still surviving. Horizontal gaps can be interpreted to mean that it takes one group more time to experience a given number of failures.

Table 2.5.
Cox Test for Equality of Survival Curves - Before vs After 2009

timing	events observed	events expected	relative hazard
before	2740875.46	2245056.54	1.245
after	2760990.26	3256809.2	0.8598
total	5501865.72	5501865.72	1
Wald χ^2(1 d.f.)	77.99***		

***, **, and * refer to significance at the 0.01, 0.05, and 0.1 levels, respectively.

I hypothesize that the recent recession impacted individuals' unemployment durations, regardless of job mobility. To better characterize this impact, I compare Kaplan-Meier survival curves for all individuals (both movers and stayers) before and after 2009. The results are reported in Figure 2.2. As in Figure 2.1, the y- and x-axes measure the percent of individuals surviving (staying unemployed) and the time elapsed in weeks. Observations from before 2009 are represented by the solid blue line, while those after 2009 are represented by the dashed red line. The gaps that exist between the curves suggest post-recession individuals experience longer unemployment durations than their pre-recession counterparts. Estimated statistics (accounting for censoring) on the survival times of both groupings provide further evidence of the group-wise differences. For one, median survival time before the recession is 16 weeks, while median survival time afterward is 22 weeks. A similar discrepancy exists between average survival times, with the pre-recession average estimated to be 14.49 weeks and the post-recession estimate at 19.04 weeks. As before, these averages account for probability weights and censoring. The Cox test results reported in Table 2.5 confirm that statistically significant differences exist between subjects before and after 2009.

Taking into account only subjects from before 2009, Figure 2.3 plots survival curves for stayers versus movers. On the other hand, Figure 2.4 plots stayers ver-

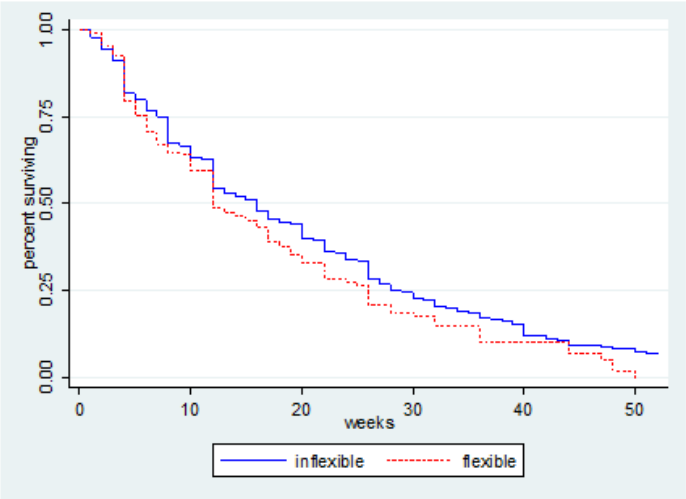

Figure 2.3. Kaplan-Meier survival curves before 2009 - stayers vs movers

Table 2.6.
Table 2.6 Cox Test for Equality of Survival Curves Before 2009 - Stayers vs Movers

migration (before)	events observed	events expected	relative hazard
stayers	2493563.8	2531785.98	0.9861
movers	247311.66	209089.48	1.1845
total	2740875.46	2740875.46	1
Wald χ^2(1 d.f.)	3.46*		

***, **, and * refer to significance at the 0.01, 0.05, and 0.1 levels, respectively.

sus movers after 2009. The graphs suggest more favorable unemployment durations among people who move for job reasons. This finding is further evidenced by estimates of median and mean duration values for each grouping (which I calculate using methods that account for censored observations). Before 2009, median survival time is 16 weeks people who don not move for job reasons and 12 weeks for people who do. After 2009, stayers survive 22 weeks at the median and movers survive 12 weeks at the median. In other words, a gap indicating shorter median unemployment dura-

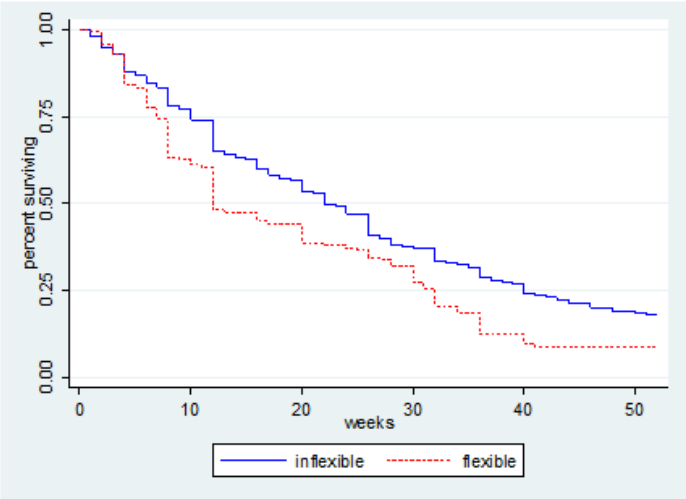

Figure 2.4. Kaplan-Meier survival curves after 2009 - stayers vs movers

Table 2.7.
Cox Test for Equality of Survival Curves After 2009 - Stayers vs Movers

migration (after)	events observed	events expected	relative hazard
stayers	2534300.39	2602335.38	0.9781
movers	226689.87	158654.9	1.4368
total	2760990.26	2760990.26	1
Wald χ^2(1 d.f.)	12.41***		

***, **, and * refer to significance at the 0.01, 0.05, and 0.1 levels, respectively.

tions among movers exists in both figures, but this gap is more pronounced in Figure 2.4 (post-2009). Additionally, a Cox test (Table 2.5.1) reports statistical significance at the 0.1 level for the pre-2009 comparison of movers versus stayers. But, a greater level of significance, 0.01, is reported for the post-2009 comparison (Table 2.7). This suggests the association linking job-related migration to shortened unemployment durations is more robust after the economic crisis.

Table 2.8.
Median and Average Survival Times

duration	movers before	stayers before	movers after	stayers after
median	12	16	12	22
average	13.197	14.606	16.302	19.237

2.5.2 Cox Model Estimation

In the next step of this analysis, I fit a Cox model with "unempdur" as the dependent variable, and a number of independent covariates that I assume will impact the duration of unemployment. The model takes the econometric form

$$\log\left(\frac{h_i\left(t\right)}{h_0\left(t\right)}\right) = \alpha mover_i + \boldsymbol{x_i}\boldsymbol{\beta} + \left(mover_i \times \boldsymbol{x_i}\right)\boldsymbol{\lambda}, \tag{2.5}$$

where α is the parameter estimate for the variable "mover" for the ith individual, $\boldsymbol{x_i}$ is the vector of the remaining independent variables (aside from "mover"), $\boldsymbol{\beta}$ is the vector of parameters associated with the remaining independent variables, and $\boldsymbol{\lambda}$ is a vector of parameters associated with the terms obtained by interacting "mover" with the remaining independent variables for the ith individual. With this regression framework, the partial effect of a given variable x^* is allowed to vary for movers compared to stayers. For movers, the partial effect of x^* is as follows:

$$\Delta\left[\widehat{\log\left(\frac{h\left(t\right)}{h_0\left(t\right)}\right)}\right] = (\hat{\beta_{x^*}} + \hat{\lambda_{x^*}})\Delta x^*. \tag{2.6}$$

For stayers, the partial effect of x^* is as follows:

$$\Delta\left[\widehat{\log\left(\frac{h\left(t\right)}{h_0\left(t\right)}\right)}\right] = \hat{\beta_{x^*}}\Delta x^*. \tag{2.7}$$

Finally, the model with interactions allows me to test the differences in estimates between movers and stayers. The partial effect for the difference between movers and stayers of x^* is as follows:

Table 2.9.
Cox Proportional Hazard Model Estimates, 2003-2008

	(1)	(2)	(3)
Variable	Mover = 1	Mover = 0	Difference = (1) - (2)
mover	-0.488		
	(1.293)		
age	-0.016	-0.055***	0.038
	(0.045)	(0.014)	(0.048)
female	-0.393**	0.246***	-0.639***
	(0.192)	(0.063)	(0.202)
married	-0.139	0.111	-0.25
	(0.288)	(0.089)	(0.302)
children	-0.184	-0.092	-0.092
	(0.336)	(0.100)	(0.351)
white	0.174	0.258***	-0.085
	(0.288)	(0.089)	(0.302)
immigrant	-0.126	-0.300***	0.174
	(0.365)	(0.108)	(0.381)
hispanic	-0.722*	0.099	-0.821*
	(0.437)	(0.101)	(0.449)
boomerang	-0.667**	-0.382***	-0.285
	(0.290)	(0.075)	(0.300)
metro	0.115	0.08	0.035
	(0.308)	(0.094)	(0.322)
coastal	-0.048	-0.135**	0.087
	(0.232)	(0.068)	(0.241)
observations	2,277		
no. of subjects	4,015,620		
% censored	31.70%		

Robust standard errors in parentheses. Values are based on probability weights "WTSUPP". Significance indicators ***, **, and * mean estimates are significantly different from zero at the 1%, 5%, and 10% levels, respectively.

$$\Delta\left[\log\left(\frac{\widehat{h\left(t\right)}}{h_0\left(t\right)}\right)\right] = \hat{\lambda_{x^*}}\Delta x^*. \tag{2.8}$$

The results tables that follow report the coefficients, rather than the hazard ratios, from the fitted Cox regression. They can be translated into hazards by exponentiation.

Table 2.9 presents estimation results from Cox model specifications comparing individuals from before the recession on the basis of job mobility. The values reported in column (1) are computed in the manner of Equation 2.6 for each $x^* \in \boldsymbol{x}$. Those reported in column (2) are computed in the manner of Equation 2.7, and those reported in column (3) are computed in the manner of Equation 2.8. Obtaining all of the estimates and their standard errors requires two regression models. Running the

model as outlined in Equation 2.5, specified for the movers, gives the stayer (column (2)) and difference (column (3)) partial effect estimates. Then, running an analogous model specified for the stayers,

$$\log\left(\frac{h_i\left(t\right)}{h_0\left(t\right)}\right) = \alpha stayer_i + \boldsymbol{x_i}\boldsymbol{\beta} + \left(stayer_i \times \boldsymbol{x_i}\right)\boldsymbol{\lambda}, \tag{2.9}$$

where "stayer" = 0 wherever "mover" = 1 and "stayer" = 1 wherever "mover" = 0, gives the mover (column (1)) partial effect estimates. The overall statistical significance of the model is high, as a Wald chi-square test returns significance at the 1 percent level. The number of observations before the economic crisis is 2,277, a number which is probability weighted to represent more than 4 million subjects for the analysis. The percentage of observations censored is 31.7.

In the previously discussed Kaplan-Meier survival curve analysis, I find general significance for not only the correlation between job mobility and unemployment duration, but also the impacts of of the great recession on duration. With the Cox model results in Table 2.9, I explore whether incorporating personal covariates into the modeling changes those preliminary findings. For movers (column (1)), the results suggest that, by and large, an individual's personal characteristics generally do not bring about any change in the correlation between job migration and unemployment duration. Many of the estimates for these individuals are not statistically significant. However, the results suggest female movers fare worse in the search for employment before the recession. The coefficient of the "female" variable is negative and statistically significant, meaning women who move face substantially lower exit rates of unemployment relative to men who move. Another variable with a negative coefficient and statistical significance among movers is "boomerang". Recall that people who have moved (for job reasons) in the past year and are currently living with their parents are boomerang movers. In other words, their job migration takes them back into the households of their parents. These boomerang movers have a negative and significant coefficient in the Cox model, indicating they struggle to find employment relative to movers who do not relocate to their parents' residences. With the "crutch"

of living cheaply (perhaps even rent-free) as the child of the household head, the decreased weight given to job security in individuals' employment calculus could mean these boomerang movers are finding jobs with high turnover rates. This would add to the overall duration of unemployment these individuals experience in a given calendar year.

Examining individuals who do not move for job reasons before the economic crisis, Table 2.9 reveals age, immigrant status, and being the child of the household head have significant negative impacts. In other words, stayers are less likely to exit unemployment as they get older, if they are immigrants, and/or if they live with their parents. On the other hand, stayers who are female and who report their race to be white alone are subject to higher rates of exiting unemployment relative to others who do not move before 2009. Looking at the difference terms in column (3) of Table 2.9 allows for parsing out the association between job mobility and unemployment durations for a given demographic group. The estimate for the difference in the female coefficients is significant and negative. On the one hand, unemployment durations are relatively shorter among women who do not move for job reasons. On the other hand, durations are longer among women who do move for job reasons. Both are evidence of a positive correlation between job mobility and unemployment duration. This suggests, paradoxically, that migration for job reasons is linked to longer stints of unemployment among women before 2009. The same can be said (albeit with less statistical significance) for individuals of Hispanic origin.

Table 2.10 presents additional Cox estimation results for a specification comparing those who move for job reasons and those who don't after the recession. The results reported come from an identical regression framework as that outlined in Equation 2.5 and Equation 2.9, only for observations from 2010 onward. As before, the estimates reported in column (1) are the "mover" partial effects described by Equation 2.6, the estimates reported in column (2) are the "stayer" partial effects described by Equation 2.7, and the estimates reported in column (3) are the difference partial effects described by Equation 2.8. A Wald chi-square test for overall model robustness

Table 2.10.
Cox Proportional Hazard Model Estimates, 2010-2013

	(1)	(2)	(3)
Variable	Mover = 1	Mover = 0	Difference = (1) - (2)
mover	-0.882		
	(1.615)		
age	-0.012	-0.075***	0.063
	(0.065)	(0.014)	(0.067)
female	-0.330	0.273***	-0.603**
	(0.248)	(0.065)	(0.257)
married	-0.171	0.016	-0.187
	(0.276)	(0.083)	(0.288)
children	-0.151	-0.281***	0.13
	(0.430)	(0.094)	(0.440)
white	0.205	0.387***	-0.183
	(0.262)	(0.076)	(0.273)
immigrant	-0.220	-0.06	-0.161
	(0.385)	(0.091)	(0.396)
hispanic	0.130	-0.222**	0.352
	(0.377)	(0.093)	(0.388)
boomerang	-0.747	-0.596***	-0.151
	(0.502)	(0.075)	(0.508)
metro	-0.119	-0.081	-0.039
	(0.308)	(0.116)	(0.329)
coastal	-0.100	0.033	-0.133
	(0.230)	(0.068)	(0.240)
observations	2,341		
no. of subjects	4,417,163		
% censored	37.50%		

Robust standard errors in parentheses. Values are based on probability weights "WTSUPP". Significance indicators ***, **, and * mean estimates are significantly different from zero at the 1%, 5%, and 10% levels, respectively.

is significant at the 1 percent level. A total of 2,341 individuals appear in our sample after the economic crisis, giving a probability weighted 4.4 million subjects for the analysis, with 37.5 percent censored.

Estimates reported in Table 2.10 give an indication of the impacts of personal characteristics on the correlation between job migration and unemployment after the recession. Coefficients in column (1) reveal that, among movers, demographic and locational attributes do not have measurable impacts on unemployment durations one way or another. Estimates in this column are uniformly lacking in statistical significance. This is not the case among stayers, however. Negative and significant estimates are reported for "age", "children", "hispanic", and "boomerang". These

indicate that after the recession, individuals who do not move for job reasons are less likely to exit unemployment as they age, if they have children, if they report Hispanic origins, and/or if they live with their parents. I look to the difference terms for evidence on the overall correlation between migration and unemployment durations for individuals with given characteristics. Similar to their counterparts before the recession, women after the recession appear to experience a positive correlation between job mobility and unemployment durations. They stay unemployed longer if they engage in job-based moves.

2.6 Conclusion

This chapter contributes to labor migration literature by giving new evidence for the correlation between job mobility and unemployment duration, taking into account the great recession and individuals' personal characteristics. I analyze the link between labor migration and the unemployment durations experienced by young college graduates. I use yearly micro-level CPS data from the United States, with observations from 2003 to 2008 representing the pre-recession group and those from 2010 to 2013 representing the post-recession group. I find differences before and after the recession, as well as for a number of demographic and locational covariates.

With regard to the unemployment duration, the evidence indicates benefits (shorter spell lengths) associated with job mobility. People who move for job reasons generally experience shorter periods of unemployment than those who do not. As anticipated, the financial crisis impacts unemployment durations, as the data reveal generally longer durations among the group of individuals sampled after 2008. But, importantly, the crisis begets a stronger correlation between job migration and unemployment stint length among the individuals studied. In particular, the correlation linking job-related moves to shorter unemployment durations among all individuals is both larger in magnitude and of greater statistical significance after 2009. While the link

between the two variables existed before the crisis, it became more pronounced as economic conditions worsened.

Additionally, I find that this correlation can vary based on the personal characteristics of individuals. Interestingly, women who move perform worse than men who move, and women who stay perform better than men who stay. This difference is significant both pre- and post-2009, evidencing the striking result that job mobility does not appear to be a benefit for women either before or after the recession. Looking at stayers, I find being white to be a benefit both before and after the recession. The opposite is true for being the child of the household head. People living with their parents before the crisis are less adept at exiting unemployment whether or not they exhibit job mobility. This result holds after the crisis as well. Hence, it appears living with one's parents is a serious detriment to one's employment prospects. Before and after 2009, stayers become less likely to find employment as they age. This cannot be said for movers, however. For all of the personal characteristics with substantial effects on unemployment durations, a number of other attributes were not consequential. No impacts were found for marital status, metropolitan area residence, or regional characteristics (i.e. whether an individual was moving into or out of an economically active area).

Future research endeavors would do well to pursue this issue with more specialized data. This study uses a sample that allows for direct study of the early labor market activity of individuals. However, it would be ideal to analyze individuals searching specifically for their first career-type employment. This type of analysis could have stronger implications, to the extent that an individual's first job after graduation is especially crucial to their life-course labor market performance. Additionally, this analysis is limited to individuals with unemployment durations of at most one year. The ability to study those with longer durations is a luxury that could be afforded by a more specialized dataset. Finally, as mentioned earlier, future research studies should address the issues of job mobility and unemployment among graduates with advanced degrees.

CHAPTER 3. 10,000 TAXI DRIVERS WITH A BACHELOR'S DEGREE: OVEREDUCATION AMONG YOUNG COLLEGE GRADUATES

3.1 Introduction

Educational attainment has long been considered an important factor for economic growth. For a given economy, high levels of education are associated with a more productive labor force, more skilled workers, and enhanced technology adoption (Barro and Lee, 2013). Important social outcomes ranging from child mortality and fertility (Barro and Lee, 2013) to employment and income (Ryan and Siebens, 2012) are also influenced by educational attainment levels within populations. Measured as average years of schooling, educational attainment levels have been steadily increasing worldwide, both in developing and advanced countries (Barro and Lee, 2013). This long term worldwide trend is exhibited by the United States. Since the U.S. Census Bureau first began collecting data on education in 1940, high school diploma and bachelor's degree attainment rates have increased steadily and substantially (three-fold and five-fold, respectively). 2009 U.S. data for adults aged 25 and over reveal high school diploma attainment rates to be around 85 percent, with bachelor's degree rates at around 28 percent (Ryan and Siebens, 2012).

The consistent increases in U.S. attainment rates have given rise to concerns regarding the labor market's ability to accommodate additional skilled workers. If workforce skills are increasing above and beyond job requirements, it follows that a sizable group of overeducated workers will develop (Duncan and Hoffman, 1981). Overeducation represents a considerable detriment to economic progress. At the individual level, job mismatch due to overeducation has negative impacts on job satisfaction and earnings (Battu et al., 1999). In aggregate terms, overeducation implies an inefficient

allocation of skills over jobs (Groot and Maassen Van Den Brink, 2000). In a study of multiple cohorts, Battu et al. (1999) find that overeducation has significant impacts for college graduates in particular.

A number of studies (Battu et al., 1999; Büchel and Van Ham, 2003; Hensen et al., 2009) have found evidence that job mobility is an important determinant of overeducation. The findings indicate the ability to migrate improves the job matching process, thereby reducing overeducation. This chapter explores the interaction of job migration and overeducation among young United States college graduates. The specific research questions addressed are as follows. First, to what extent are job mobility and overeducation correlated? Second, how has the link between the two phenomena changed in the context of the recent global financial crisis? Third, assuming a correlation exists, is it changed in any way based on the personal characteristics of individuals? The primary hypothesis is that mobility has a negative correlation with overeducation propensity. Job mobility's link to overeducation is hypothesized to become greater in magnitude and significance in the wake of the recession. Additionally, marital status, race, immigrant status, local labor market characteristics, and other personal and locational aspects of the individuals studied are assumed to impact overeducation's correlation with job migration.

This chapter represents an important contribution to the literature on job migration. While previous studies relate to this research, they have yet to directly address what I aim to study. Changes to job mobility resulting from the great recession are analyzed by Roosaar et al. (2014). Other researchers have investigated how overeducation relates to recessionary economic conditions (Verhaest and Van der Velden, 2013). But, uniquely, this research looks at the relationship between job mobility and overeducation in the context of the great recession. Additionally, the data affords the ability to analyze this relationship for young college graduates in the United States.

The chapter proceeds in the following manner. First, the relevant literature regarding overeducation, and especially its relationship to job migration and college graduate cohorts, is reviewed. Second, I discuss the methods of the analysis at hand.

Third, I provide details on the dataset that I use in the analysis. Fourth, I report and discuss the results. I conclude by exploring policy implications of the results, along with directions for future research.

3.2 Literature Review

3.2.1 Overeducation in the Labor Market

A primary goal of the literature addressing overeducation has been to quantify its prevalence. In a U.S. based study using data from the late 1970s, Sicherman (1991) applies a measure of mean education levels per occupation to a sample of males aged 18 to 60 and finds around 40 percent (self-reported) of them to be overeducated. Additionally, the author reports mean levels of overschooling to be between 4.15 and 4.73 years, depending on which measure is used. Using similar parameters, Duncan and Hoffman (1981) look at overeducation across race and gender, finding overeducation among roughly 42 percent of all individuals, and among more than 48 percent of black men. Battu et al. (1999) study panels of 1985 and 1990 graduates from the United Kingdom. They report roughly 40 percent of the individuals sampled are working in jobs that do not require degrees. A substantially lower overeducation incidence of 14 percent is reported by Rubb (2003), although this is perhaps due to the use of a particular measure of overeducation based on standard deviation from national mean education levels per occupation. Rubb does mention, however, that overeducation incidence is slightly greater in magnitude during recession years. Synthesizing results from multiple studies, Hartog (2000) finds U.S. overeducation propensities to be generally in the range of 27 to 42 percent, and generally lower propensities in European countries. Leuven and Oosterbeek (2011) condense results from multiple studies of overeducation. The authors document not only larger shares

of overeducated individuals in United States (and Canadian) based studies, but also dramatic increases in overeducation propensities from the 2000s onward.[1]

A large body of research addresses the specific determinants of overeducation. With regards to field of study, Battu et al. (1999) find that graduates in science and technology disciplines, as well as those in law and medicine, are less likely to be overeducated. Interestingly, the authors also note that overeducation incidence does not change with attainment of advanced degrees, nor is it affected by pre-university school choice. Chevalier (2003) finds an opposing result, namely that Ph.D. and (especially) vocational qualification attainment reduce overeducation propensity. In a broad assessment of overeducation determinants, Verhaest and Omey (2010) find student work experience to be insignificant, and academic achievement (e.g. graduating with distinction) to be significant. For the purposes of this study, I present additional discussion of overeducation determinants in Section 3.4.1 of this chapter.

3.2.2 Effects of Being Overeducated

At the individual level, overeducation can be detrimental in a number of ways. Battu et al. (1999) report lower job satisfaction among university graduates who find themselves in jobs not requiring degrees. The same study addresses earnings, and uncovers premiums between 8 and 20 percent for individuals who are properly "matched" in their jobs (i.e. those with adequate education). Duncan and Hoffman (1981) find that an added year of surplus education (increasing overeducation) affects earnings differently than an added year of deficit schooling (reducing undereducation). In particular, their results indicate earnings increases associated with higher surplus education are half as large as those for deficit education. Hartog (2000) makes the same argument of positive but relatively smaller returns to overeducation, also adding that this result is consistent regardless of the measure of overeducation used.

[1]However, the authors caution that the 2000s increases may be unduly influenced by one study in particular.

To the extent that overeducation is problematic for individuals, overeducation duration is also of concern to researchers. Data from Robst (1995) indicate nearly 70 percent of overeducated people in one year (1976) remain overeducated after nearly a decade (1985). Battu et al. (1999) provide evidence that individuals initially finding jobs for which they are properly educated can later end up in positions for which they are overeducated. Another study based in the United Kingdom (Dolton and Vignoles, 2000) suggests 38 percent of graduates are overeducated in their initial jobs, but this number drops slightly to 30 percent after individuals spend 6 years in the workforce. These studies raise concerns that overeducation may be a long term problem for certain individuals.

3.2.3 Migration/Job Search Dimensions of Overeducation

Prior research has uncovered evidence for the link between job migration and overeducation. In the United Kingdom, graduates with the ability to move regions (i.e. access a larger labor market) are better able to find adequate job matches (Battu et al., 1999). Büchel and Van Ham (2003) investigate "spatial flexibility," which they define as the ability to use a car to access additional labor markets. Under this definition, the authors find that spatial flexibility reduces the risk of a given individual being overeducated. While their spatial flexibility measure differs from my job mobility variable, their study still offers relevant insight into the relationship between individuals' locations (and in particular their ability to access work opportunities in distant locations) and their likelihood of being overeducated. The authors are careful to warn that this result only represents a correlation, however. Additionally, the study finds that access to competitive regional labor markets, rather than simply large regional labor markets, impacts overeducation propensities. Hensen et al. (2009) examine geographic mobility's impact on job matching in the Netherlands. They find that, in general, graduates who are able to migrate have better chances of acquiring jobs for which their level of education is needed. Additionally, they document better

performance of male movers relative to female movers in terms of finding jobs for which they are properly educated.

3.3 Model and Methods of Analysis

3.3.1 Measurement of Overeducation

Multiple measures of overeducation have been identified in the relevant literature. In a review of various studies, Hartog (2000) describes three key measurement frameworks. First, there is "job analysis" in which analysts formally declare required levels of education for each occupation. Second is "worker self-assessment". In this system, workers self-report the level of education required for their jobs. Third, Hartog describes "realized matches" by which required education levels are derived from data on what level of education individuals in a given job have actually attained. Realized matching can use, for example, the mean or mode of the distribution of education levels within an occupation.

In this chapter, I opt for a job analysis approach to measuring overeducation. Hartog advocates for this method under the assumption that professional job analysts, who can take many factors (technology, role of on-the-job training, etc.) into account, are in the best position to determine required schooling levels. Additionally, Hartog argues that worker self-assessment measures of overeducation can be biased upward by a number of factors, most notably prolonged increases in educational attainment.

3.3.2 Use of Logit in Overeducation Analysis

To quantify overeducation propensities among young college educated individuals, I use a logit regression approach. I model the likelihood of overeducation as a function of a number of relevant covariates. A further note on why I use the logit model is in Section 3.5. Numerous studies of overeducation have adopted the same approach.

Table 3.1.
Sample Selection Criteria

Variable	Criterion
time period	survey years 2003, 2004, 2005, 2006, 2007, 2008, 2010, 2011, 2012, 2013
education	bachelor's degree
age	22 to 30 years old
labor force status	in the labor force and currently employed
armed forces status	not an active member of the armed forces

Kiker et al. (1997) use a logit model to examine overeducation propensities among workers in Portugal. Studying overeducation in the presence of occupational mobility (changing tasks resulting in a new occupation, or changing firms), Sicherman (1991) makes use of logit regressions. In the effort to distinguish between "apparently" and "genuinely" overeducated workers, Chevalier (2003) uses a logit with controls for demographics as well as major field of university study. Additionally, Battu and Sloane (2004) take a logit approach to documenting overeducation among minority residents of Britain.

3.4 Data

3.4.1 Dataset

The data used in the analysis of overeducation are sourced from the March supplement of the Current Population Survey (CPS), which is based on a random sample of the overall U.S. population. It is accessed via IPUMS CPS. New selection criteria mean that there is no overlap between observations used here and those used previously.

Table 3.1 presents the selection criteria for the individual-level observations that are relevant to the overeducation analysis. I am studying individuals who have attained bachelor's degrees, but not advanced degrees. Only individuals aged 22 to

Table 3.2.
Variables and their Definitions

Variable	Definition
dependent variable	
overeducated	= 1 if respondent reports an occupation needing less than a bachelor's degree level of education for entry
key independent variable	
mover	= 1 if respondent migrated for job-related reasons across county boundary
personal characteristics	
age	= age of respondent [yrs]
female	= 1 if respondent is female
married	= 1 if respondent is married
children	= 1 if respondent lives with his/her own children
white	= 1 if respondent is white
immigrant	= 1 if respondent was born outside the United States
hispanic	= 1 if respondent reported Hispanic origin
boomerang	= 1 if respondent reports being the child of the household head
locational characteristics	
metro	= 1 if respondent lives in a metropolitan area
coastal	= 1 if respondent's current state of residence is CA, CT, DC, FL, IL, MD, MA, NJ, NY, NC, OR, PA, RI, TX, VA, WA

30 are considered in the analysis. I use observations from 2003 to 2008 and 2010 to 2013. I examine people who self-report to be active participants in the labor force. Active members of the armed forces are excluded, following the convention of labor market analysis. The dataset is a pooled cross section of individuals' self-reported socioeconomic characteristics from annual March CPS.

Table 3.2 is a comprehensive list of the variables used and their definitions. First, I list the dependent variable, "overeducated". It is a binary variable that takes a value of 1 if the individual reports a job requiring a level of education lower than a bachelor's degree, and 0 otherwise. Given that each observation represents an individual with a bachelor's degree, it follows that anyone employed in a job requiring a lower level of education can be considered overeducated. The definitions of required education levels for occupations are based on a detailed table of assignments by the U.S. Bureau of Labor Statistics' Employment Projections program (more information and a detailed table corresponding to the definitions used in the analysis are included in Appendix A). Hence, "overeducated" is constructed by combining these definitions and the IPUMS CPS variable "EDUC". "EDUC", for the dataset at hand, classifies

individuals according to the highest level of education they have attained based on degrees and/or diplomas awarded. The result is a variable that counts the number of the individuals in question who are overeducated for their jobs.

One key independent variable is used to stratify the analysis. This is the "mover" variable, which I use to distinguish between movers and stayers. Once again, people are identified as movers if they report having moved to a different county for "job reasons" in the past year, based on the IPUMS CPS variable "WHYMOVE". In order to qualify, the individual must respond to "WHYMOVE" with one of the following: "New job or job transfer" or "To look for work or lost job". "mover" is a dummy variable, meaning it takes a value of 1 if associated with a mover, and 0 if not.

The model includes several personal and locational characteristics associated with the individuals surveyed. These include age, marital status, gender, presence of respondents' own children in their households, race, immigrant status, whether an individual is of Hispanic origin, whether individuals are "boomerang movers" (i.e. people who move in with their parents after graduating college), whether individuals live in metro areas, and finally in which region of the United States a given individual lives.

U.S. Census Bureau definitions are used to determine metro status. The regional variable "coastal" is included to identify migrants based on where they reside. Specifically, "coastal" denotes individuals coming from regions where economic activity is high relative to the rest of the United States.[2] In defining areas of high economic activity, I include the following states: California, Connecticut, Washington D.C., Florida, Illinois, Maryland, Massachusetts, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Texas, Virginia, and Washington. Individuals living in any one of these economically advanced states are identified by "coastal".

The selection of covariates in the model is informed by research studies on the determinants of overeducation. In terms of race, Chevalier (2003) reports a higher risk

[2]By and large, these are the states on the east and west coasts of the United States, hence the variable name "coastal".

of (apparent) overeducation among white college graduates.[3] Discrepancies across ethnic minority groups in the United Kingdom have been found as well (Battu and Sloane, 2004). Beckhusen et al. (2013) uncover differences in overeducation propensities when comparing immigrants to natives of the United States, especially at the highest levels of human capital. Verhaest and Omey (2010) study overeducation determinants among school leavers in Belgium. Under certain definitions of the dependent variable, they find increased overeducation propensities among women, as well as immigrants. The authors also include an indicator variable measuring whether individuals are cohabiting with their partners, arguing this behavior is indicative of a spatial constraint for job search activity. This motivates the inclusion of variables regarding children, marriage, and housing status. The expectation is of a diminished job mobility correlation (and thereby increased overeducation propensities) for individuals who are married or have children. Given that overeducation varies across occupations, the rural-urban occupation and occupational requirement divide (Abel et al. 2012) informs the "metro" variable's presence in the model. Finally, I base the inclusion of the regional variable ("coastal") on the assumption of labor market heterogeneity across regions, which I adopt from Battu et al. (1999).

In the analysis that follows, I use 2009 as the reference year for a given observation's timing relative to the recession. Observations from before (after) 2009 are considered pre- (post-) recession. In the context of the recession, 2009 was the year in which structural labor market changes hit the economy hardest. Due to this volatility, 2009 observations are dropped from the analysis altogether.

Table 3.3 gives summary statistics for the CPS sample. Estimates for mean, standard deviation, and difference values are reported in the table alongside (weighted) observation numbers. These are grouped according to the job mobility of individuals as well as (pre- and post-) recession status of the observations. To better represent the United States population as a whole, the estimates are probability weighted.

[3]Chevalier (2003) makes a distinction between "apparent" and "genuine" overeducation. Individuals in non-graduate jobs who report being satisfied with their employment are apparently overeducated. Those in non-graduate jobs who report dissatisfaction are genuinely overeducated.

Table 3.3.
Summary Statistics

	CPS 2003-2008			CPS 2010-2013		
	Mover	Stayer	Difference	Mover	Stayer	Difference
dependent variable						
overeducated	0.505	0.536	-0.031	0.441	0.539	-0.098***
	(0.020)	(0.004)	(0.020)	(0.025)	(0.005)	(0.025)
personal characteristics						
age	25.254	26.362	-1.108***	25.252	26.367	-1.116***
	(0.095)	(0.020)	(0.097)	(0.116)	(0.023)	(0.118)
female	0.482	0.543	-0.061***	0.496	0.534	-0.038
	(0.020)	(0.004)	(0.020)	(0.025)	(0.005)	(0.026)
married	0.278	0.364	-0.086***	0.235	0.316	-0.081***
	(0.017)	(0.004)	(0.018)	(0.021)	(0.004)	(0.021)
children	0.092	0.185	-0.093***	0.088	0.164	-0.076***
	(0.009)	(0.003)	(0.010)	(0.013)	(0.003)	(0.013)
white	0.866	0.818	0.048***	0.888	0.809	0.079***
	(0.013)	(0.003)	(0.014)	(0.015)	(0.004)	(0.016)
immigrant	0.074	0.127	-0.053***	0.069	0.106	-0.037***
	(0.009)	(0.003)	(0.010)	(0.012)	(0.003)	(0.012)
hispanic	0.052	0.076	-0.024***	0.070	0.093	-0.023*
	(0.008)	(0.002)	(0.008)	(0.012)	(0.003)	(0.012)
boomerang	0.028	0.179	-0.151***	0.027	0.196	-0.169***
	(0.006)	(0.003)	(0.007)	(0.008)	(0.004)	(0.009)
locational characteristics						
metro	0.895	0.908	-0.012	0.920	0.922	-0.003
	(0.011)	(0.002)	(0.011)	(0.012)	(0.002)	(0.012)
coastal	0.592	0.607	-0.015	0.594	0.630	-0.036
	(0.019)	(0.004)	(0.019)	(0.024)	(0.005)	(0.024)
observations	957	20,721		578	15,204	
estimated weighted observations	1,725,629	35,706,167		1,090,158	27,107,076	

Means and standard deviations (in parentheses) are based on probability weights "WTSUPP". Significance indicators ***, ** and * mean that the difference of means is significantly different from zero at the 1%, 5% and 10% levels, respectively.

At the bottom of Table 3.3, I give numbers of observations; for transparency's sake unweighted values are reported, but the weighted values alone are relevant for the statistical testing. The statistical tests in Table 3.3 and hereafter are based on an estimated 1.998 million movers before the recession, 42.503 million stayers before the recession, 1.331 million movers after the recession, and 33.859 million stayers after the recession.

Table 3.3 quantifies a number of differences in characteristics among the groupings. Examining the dependent variable reveals across three of the four groupings (all but movers after the recession) more than 50 percent of the 22 to 30 year old gradu-

ates sampled are overeducated. This statistic coincides with estimates by Tsang et al. (1991). The authors define overeducation in terms of an objective measure similar to the one used in this study. Then, examining survey data from the 1972-1973 Quality of Employment, they find 57 percent of all workers (68 percent of female workers) to be overeducated for their occupations by at least 1 year of schooling. In terms of the differences, group overeducation discrepancies seem to be in accordance with this study's stated hypothesis. Before 2009, relatively fewer movers are overeducated, although the difference estimate lacks significance. In the post-recession period, however, a highly significant difference term confirms that a relatively large proportion of stayers are overeducated. This offers preliminary evidence of improved labor market performance coinciding with job-related migration.

The data reveal differences in personal characteristics across the groupings as well. Individuals demonstrating mobility are generally younger than their stayer counterparts. Average ages are lower for job-related movers by more than 1 year both before and after the recession, with both difference terms significant at the 1 percent level. Before 2009, women make up 48 percent of the mover subpopulation, and 54 percent of the stayer. In other words, the proportion of women in the stayer population is around 6 percent greater than that in the mover population, significant at the 1 percent confidence level. After the recession the mover-stayer difference lacks statistical significance, indicating roughly the same proportions of women comprise both subgroups. The proportion of movers who are married is more than 8 percentage points lower than that of stayers before the recession. This discrepancy and its statistical significance persist after the recession. Similarly, prior to the recession 19 percent of stayers cohabit with their own children, compared to 9 percent of movers. This difference is significant before 2009, and coincides with a similar measurement (also significant) after 2009. Highly significant estimates suggest before (after) the recession, movers are disproportionately white compared to stayers. They are also disproportionately U.S.-born and non-Hispanic in origin. Mean estimates for "boomerang" indicate movers are, in general, much less likely (15 to 17 percentage points) to be

Table 3.4.
Most Common Occupations, 2003-2008

Rank	OCC	Description	Overeducated	Observations	Percent
1	2310	Elementary and middle school teachers	No	2,421,006	6.47
2	800	Accountants and auditors	No	1,370,788	3.66
3	3255	Registered nurses	Yes	1,111,154	2.97
4	430	Managers, all other	Yes	960,179	2.57
5	2320	Secondary school teachers	No	920,364	2.46
6	4700	First-line supervisors of retail sales workers	Yes	870,621	2.33
7	2200	Postsecondary teachers	No	815,737	2.18
8	4760	Retail salespersons	Yes	802,595	2.14
9	5700	Secretaries and administrative assistants	Yes	687,017	1.84
10	1020	Software developers, applications and systems software	No	662,693	1.77
11	4850	Sales representatives, wholesale and manufacturing	No	653,937	1.75
12	5240	Customer service representatives	Yes	604,043	1.61
13	2630	Designers	No	568,733	1.52
14	4110	Waiters and waitresses	Yes	563,630	1.51
15	2010	Social workers	No	542,900	1.45

Observations and percentages of total employment are estimates based on probability weights "WTSUPP".

currently living with their own mother and/or father. In other words, people moving for job reasons are generally living independent of their parents.

The lowermost section of Table 3.3 is devoted to locational characteristics. Regardless of grouping, between 90 and 92 percent of individuals live in metro areas, and cross-grouping differences in metro residence propensities are not significant. The same can be said for individuals living in economically active coastal parts of the U.S. Upwards of 60 percent of the sample resides in these areas and the various estimates are not significantly different across groupings.

Given that occupations are at the center of the analysis, it is instructive to explore the types of jobs in which the surveyed college graduates find themselves. Table 3.4 provides a listing of the fifteen most commonly held occupations before 2009. It is worth noting that roughly 36 percent of the individuals in the sample are working in one of these fifteen occupations. The results reported are estimates calculated based on probability weighting. The most common occupation is primary school teaching. In total, around 6.5 percent of individuals in the overall sample report working as "Elementary and middle school teachers". Based on BLS-defined requirements (Appendix A), this occupation requires a bachelor's degree, meaning these individuals

Table 3.5.
Most Common Occupations, 2010-2013

Rank	OCC	Description	Overeducated	Observations	Percent
1	2310	Elementary and middle school teachers	No	1,363,936	4.84
2	3255	Registered nurses	Yes	1,102,877	3.91
3	800	Accountants and auditors	No	940,934	3.34
4	4760	Retail salespersons	Yes	709,016	2.51
5	4700	First-line supervisors of retail sales workers	Yes	685,665	2.43
6	5240	Customer service representatives	Yes	628,040	2.23
7	430	Managers, all other	Yes	567,796	2.01
8	2320	Secondary school teachers	No	564,964	2.00
9	5700	Secretaries and administrative assistants	Yes	538,170	1.91
10	1020	Software developers, applications and systems software	No	508,476	1.80
11	2200	Postsecondary teachers	No	494,729	1.75
12	4110	Waiters and waitresses	Yes	469,618	1.67
13	50	Marketing and sales managers	No	447,132	1.59
14	2630	Designers	No	416,596	1.48
15	120	Financial managers	No	383,110	1.36

Observations and percentages of total employment are estimates based on probability weights "WTSUPP".

are not overeducated. Among occupations for which college graduates are not overeducated, grade school teachers are followed by accountants (2^{nd} overall, 3.7 percent of the sample), secondary school teachers (5^{th}, 2.5 percent), postsecondary teachers (7^{th}, 2.2 percent), software developers (10^{th}, 1.8 percent), sales representatives (11^{th}, 1.8 percent), designers (13^{th}, 1.5 percent), and finally social workers (15^{th}, 1.5 percent). The remaining occupations require less than a bachelor's degree. These include registered nurses (3^{rd} overall, 3.0 percent of the overall sample), miscellaneous managers (4^{th}, 2.6 percent), retail supervisors (6^{th}, 2.3 percent), retail salespersons (8^{th}, 2.1 percent), secretaries/assistants (9^{th}, 1.8 percent), customer service representatives (12^{th}, 1.6 percent), and waiters and waitresses (14^{th}, 1.5 percent). Before 2009, eight of the fifteen most common occupations for college graduates require a bachelor's degree, and seven do not.

Table 3.5 is the post-recession ranking of occupations by percentage of the sample, once again produced using probability weights. Among individuals in the after-recession sample, around 35 percent report working in one of these fifteen occupations. The bachelor's degree-level positions of primary school teacher (ranked 1^{st} with 4.8 percent of the sample), accountant (3^{rd}, 3.3 percent), secondary school teacher (8^{th},

2.0 percent), software developer (10^{th}, 1.8 percent), postsecondary teacher (11^{th}, 1.8 percent), marketing and sales manager (13^{th}, 1.6 percent), designer (14^{th}, 1.5 percent), and financial manager (15^{th}, 1.4 percent) appear in the top ten. College graduates are overeducated for the remainder of the top fifteen occupations. These jobs are ordered as follows: second, registered nurses (3.9 percent); fourth, retail salespersons (2.5 percent); fifth, retail supervisors (2.4 percent); sixth, customer service personnel (2.3 percent); seventh, miscellaneous managers (2.0 percent); ninth, secretaries/assistants (1.9 percent); and twelfth, waiters and waitresses (1.7 percent). Of the top fifteen occupations among college graduates after the recession, eight require a degree and seven do not.

3.4.2 CPS Data in Overeducation Analyses

Various studies of overeducation in the United States have made use of CPS data. Rubb (2003) employs annual March supplement data to examine overeducation in a recessionary period (1991-1992) and an expansionary period (1995-1999). The same author examines overeducation among older American workers in a later study, again using March CPS supplement data (Rubb, 2003). In constructing datasets to analyze trends in U.S. overeducation, Rumberger (1981) uses CPS data on job distributions matched with skill requirements from the Dictionary of Occupational Titles. Halaby (1994) adopts a similar approach, primarily employing data from the Quality of Employment Surveys, but matching this to education data per occupation from the CPS.

Aside from the CPS, a host of other datasets has been used for U.S. overeducation studies. Sicherman (1991) analyzes a sample of male household heads from the Panel Study of Income Dynamics. The same data source is tapped for Duncan and Hoffman (1981) study of the economic impact of overeducation among groups of U.S. residents. In a dedicated study of U.S. college graduates, Tsang et al. (1991) take data from the Survey of Working Conditions and the Quality of Employment Surveys. Additionally,

Burris (1983) makes use of a national sample survey from the University of Chicago's National Opinion Research Center.

For justification of the use of CPS data, I refer to a general discussion of the dataset's suitability by Rothstein (2011). For one, CPS data are current. For another, the CPS affords large sample sizes. Further, survey redesigns have ameliorated previously existing issues with individuals self-reporting labor market characteristics.

3.5 Analysis and Results

Using the measurement of overeducation discussed previously, and incorporating a number of relevant covariates, I can test the previously stated hypotheses on overeducation and its association with job mobility using a logit model. The logit model is chosen as the estimator because the dependent variable, overeducation, is dichotomous (i.e. an individual is either overeducated or not). A linear model such as ordinary least squares would not be appropriate because using it would be an attempt to fit a line over nonlinear data. The logit model estimates the probability that the dependent variable will be equal to 1, or in the case of this study, the probability that the event that an individual is overeducated will occur.

In this setup, the likelihood of being overeducated is modeled as a function of mobility and additional covariates, both before and after the recent global recession. The model takes the form

$$\begin{aligned} P\left(y_i = 1 | mover_i, \boldsymbol{x}_i\right) &= F[\delta + \alpha mover_i + \boldsymbol{x}_i\boldsymbol{\beta} + (mover_i \times \boldsymbol{x}_i)\boldsymbol{\lambda}] \\ &= F[u], \end{aligned} \tag{3.1}$$

where $\boldsymbol{y}_i$ is a dummy variable indicating whether individual i is overeducated, $\boldsymbol{x}_i$ is a vector of the remaining independent variables (aside from "mover") for individual i, F is the logit cumulative distribution function, δ is the constant term, α is the parameter estimate for the variable "mover" for the ith individual, $\boldsymbol{\beta}$ is a vector of parameters associated with the remaining independent variables, $\boldsymbol{\lambda}$ is a vector

of parameters associated with the terms obtained by interacting "mover" with the remaining independent variables for the ith individual, and u denotes the index $\delta + \alpha mover_i + \boldsymbol{x}_i\boldsymbol{\beta} + (mover_i \times \boldsymbol{x}_i)\boldsymbol{\lambda}$.

After a logit regression it is common to do a post-estimation of the marginal effects. The marginal effects measure the effect of the percentage change in probability associated with a change in a given independent variable while holding all other variables at some value. In the context of the model used in this study, the marginal effect of a given independent variable x^* is

$$\begin{aligned}\frac{\partial F[u]}{\partial x^*} = \; & \beta_{x^*} F[\alpha mover + \boldsymbol{x}\boldsymbol{\beta} + (mover \times \boldsymbol{x})\boldsymbol{\lambda}] \\ & \times (1 - F[\alpha mover + \boldsymbol{x}\boldsymbol{\beta} + (mover \times \boldsymbol{x})\boldsymbol{\lambda}]),\end{aligned} \tag{3.2}$$

where $\boldsymbol{x}$ is the vector of the constant term and all personal and locational covariates with parameter vectors $\boldsymbol{\beta}$ and $\boldsymbol{\lambda}$. Furthermore, in a logit specification with interaction terms, the interaction effect when interacting one continuous variable and one dummy variable takes on a particular form. In the model, I interact the continuous variable "age" with the dummy variable "mover". Using this example, the interaction effect is the discrete difference (w.r.t. "mover") of the single derivative (w.r.t. "age"), written as

$$\begin{aligned}\frac{\Delta \frac{\partial F[u]}{\partial age}}{\Delta mover} = \; & (\beta + \lambda)\left(F[(\beta + \lambda)age + \alpha + \boldsymbol{x}\boldsymbol{\beta}](1 - F[(\beta + \lambda)age + \alpha + \boldsymbol{x}\boldsymbol{\beta}])\right) \\ & - \beta\left(F[\beta age + \boldsymbol{x}\boldsymbol{\beta}](1 - F[\beta age + \boldsymbol{x}\boldsymbol{\beta}])\right),\end{aligned} \tag{3.3}$$

where $\boldsymbol{x}$ is the vector of the constant term and all other personal and locational covariates (aside from "age") with a vector of respective parameters $\boldsymbol{\beta}$. Likewise, the interaction effect when interacting two dummy variables takes a particular form. The remainder of the covariates used in this analysis are dummy variables. Using "female" as an example, the interaction effect is the discrete double difference, written as

$$\frac{\Delta^2 F[u]}{\Delta female \Delta mover} = \frac{1}{1+e^{-(\beta+\alpha+\lambda+\boldsymbol{x\beta})}} - \frac{1}{1+e^{-(\beta+\boldsymbol{x\beta})}} - \frac{1}{1+e^{-(\alpha+\boldsymbol{x\beta})}} - \frac{1}{1+e^{-\boldsymbol{x\beta}}}, \tag{3.4}$$

where $\boldsymbol{x}$ is the vector of the constant term and all other personal and locational covariates (aside from "female") with a vector of respective parameters $\boldsymbol{\beta}$. In Equation 3.4 I only use "female" as an example for illustrative purposes. The interaction effect applies to all the other personal and locational covariates with which I interact "mover" in my model as well.

Table 3.6.
Logit Estimates Before the Recession

	(1)	(2)	(3)
Variable	Mover = 1	Mover = 0	Difference = (1) - (2)
constant	-1.881**	0.700***	-2.581***
	(0.954)	(0.214)	(0.978)
age	0.073**	-0.014*	0.087**
	(0.036)	(0.008)	(0.036)
female	0.278*	-0.030	0.308*
	(0.162)	(0.034)	(0.165)
married	-0.468**	-0.283***	-0.185
	(0.207)	(0.043)	(0.211)
children	0.243	0.172***	0.071
	(0.276)	(0.047)	(0.280)
white	-0.310	-0.067	-0.242
	(0.256)	(0.045)	(0.260)
immigrant	-0.074	0.133**	-0.207
	(0.311)	(0.053)	(0.315)
hispanic	-0.071	0.225***	-0.296
	(0.341)	(0.058)	(0.346)
boomerang	-0.132	0.141***	-0.273
	(0.440)	(0.048)	(0.443)
metro	0.334	-0.006	0.340
	(0.252)	(0.055)	(0.258)
coastal	0.019	-0.173***	0.192
	(0.164)	(0.035)	(0.167)
observations	21,678		
no. of subjects	37,431,797		

Robust standard errors in parentheses. Probability weighted based on the IPUMS CPS variable "wtsupp". ***, **, and * refer to significance at the 0.01, 0.05, and 0.1 levels, respectively.

Table 3.6 shows the estimates of the logit model for the sample of individuals before 2009. The values reported in columns (1) and (2) are partial effects calculated

as described in Equation 3.2. The value reported in the "age" row of column (3) is a partial effect calculated as described in Equation 3.3. The remaining values reported in column (3) are partial effects calculated as described in Equation 3.4. Using statistical software to run the mover-specified model as outlined in Equation 3.2 gives the stayer (column (2)) and difference (column (3)) partial effect estimates. To obtain estimates for movers (column (1)), I run an analogous model specified for stayers,

$$P\left(y_i = 1 | stayer_i, \boldsymbol{x}_i\right) \quad = \quad F[\alpha stayer_i + \boldsymbol{x}_i\boldsymbol{\beta} + (stayer_i \times \boldsymbol{x}_i)\boldsymbol{\lambda}], \tag{3.5}$$

where "stayer" = 0 wherever "mover" = 1 and "stayer" = 1 wherever "mover" = 0.

A discussion of issues with heteroskedasticity as they apply to this thesis is in Chapter 2, Section 2.4.3. The concerns related to the unemployment analysis in that chapter closely coincide with those related to the overeducation analysis at hand in this chapter. As a result, I account for the possibility of heteroskedasticity in the data by using robust standard errors in the logit model as well.

The parameters in the logit model are in log-odds units, and show the amount of increase in the predicted log odds of overeducation being equal to 1 that would be predicted by a 1 unit increase in the covariate, holding all other covariates constant. While the parameters are in log-odds units and thus their magnitudes are less straightforward to interpret, there is a positive relationship between log-odds and success. This means that if the coefficient of an independent variable increases, then the odds that an individual will be overeducated also increases. Nearly 26 thousand observations are taken into account. These are probability weighted, meaning the estimates refer to 44.5 million subjects.

Commonly, when calculating the marginal effects via post-estimation (as in Equations 3.2, 3.3, and 3.4) the values at which all other variables are held are the sample means of each variable. However, this type of approach has limited merit in a model of the type used in this analysis, because dichotomous variables are not interpretable

at non-integer values. For example, attempting to assign a value of 0.6 for the variable "immigrant" for a given individual is not meaningful. Furthermore, the marginal effects of interaction variables (as shown in Equations 3.3 and 3.4) are not correctly calculated by the margins command in STATA (Ai and Norton, 2003). For these reasons, I choose to analyze and interpret the predicted probabilities of specific scenarios that are both of interest to this research and interpretable. This allows for the study of more direct research questions, such as: "how does job mobility relate to the overeducation propensity of men of a certain age, who are unmarried, and have no children (etcetera)?"

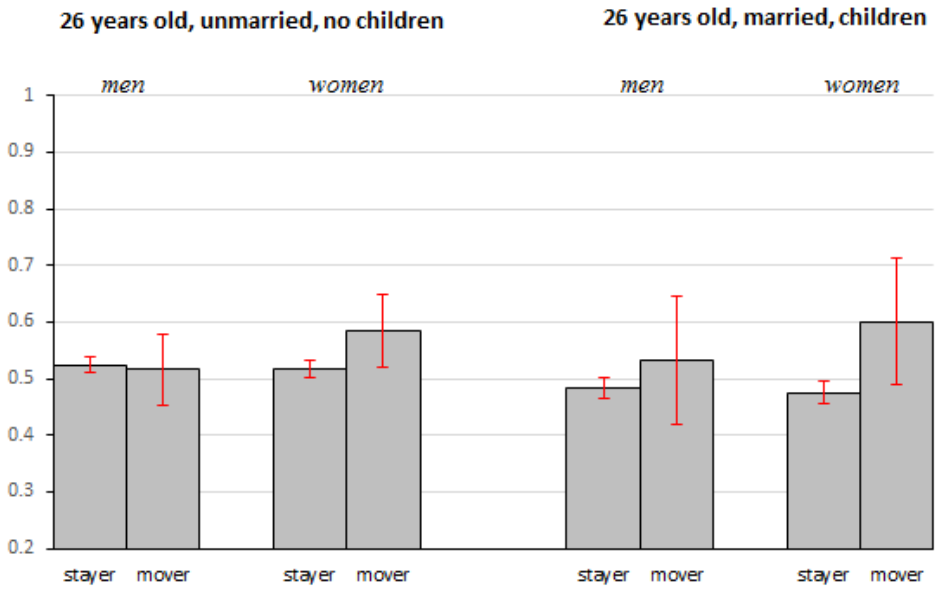

Figure 3.1. Estimated Overeducation Probabilities and 90% Confidence Intervals for Selected* Groups, pre-2009

Source: author's own calculations using data from IPUMS CPS, probability weighted with IPUMS variable "WTSUPP".
* All groups refer to white, non-Hispanic, nonimmigrant, non-boomerang, employed college graduates residing in metro-areas in a coastal state.

Figure 3.1 presents results of marginal overeducation propensity estimates from before the recession for given examples of individuals who can be found in the dataset, with a focus on job mobility. Calculations for the figure come from post-estimation

of the results of the logit model reported in Table 3.6. Hence, the figure represents analysis conducted on roughly 37.5 million subjects.

Figure 3.1 reports results for two different specifications of individuals. Conditional on the subjects being non-Hispanic, nonimmigrant, non-boomerang, employed college graduates who live in metro-areas in coastal states, the results differentiate between individuals who are 26 years of age, unmarried, and have no children, and those who are 30 years of age, married, and with children. The correlation between job mobility and overeducation among these groups is then compared on the basis of gender. From the figure, one can observe that 26 year old unmarried childless men who move for job reasons are also subject to a decreased likelihood of overeducation. Mobile men of those characteristics are roughly 1 percentage point less likely to be overeducated than their counterparts who are not mobile. However, this difference is not significant at the chosen level (90 percent) of confidence. While 26 year old unmarried childless women appear to experience an increased likelihood of overeducation associated with job mobility, the difference is not significant at the stated confidence level. Job mobility appears to have a positive correlation with overeducation for the subsample of individuals who are slightly older and have spouses and children. Although the effects are not statistically significant, it still appears those who are mobile exhibit increased probabilities of being overeducated for their occupations. This seems especially true among women. This suggests perhaps a stronger amenity preference among women who move for job reasons. Bakens and Nijkamp (2013) argue that locations (cities, in particular) become more attractive to prospective residents if they have greater amenity offerings. It could be that women are more strongly influenced than men by the amount of amenities available in a given area, to the extent that even when they move "primarily" for job reasons, they accept overall worse jobs in favor of access to better amenities. Adopting this line of reasoning, it follows that the 30 year old married women with children in the sample experience a positive correlation (greater likelihood of overeducation) associated with their job mobility.

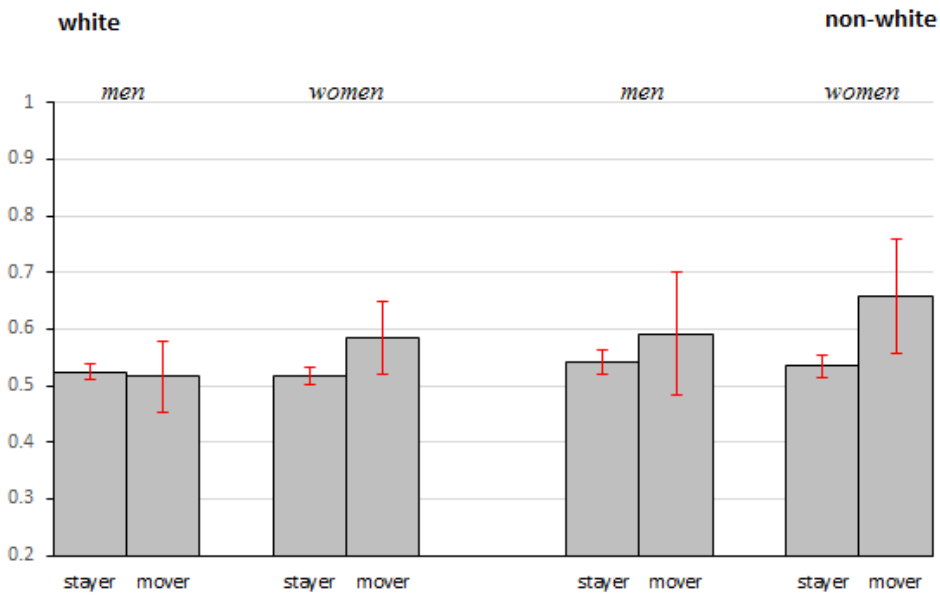

Figure 3.2. Estimated Overeducation Probabilities and 90% Confidence Intervals for Selected* Groups, pre-2009

Source: author's own calculations using data from IPUMS CPS, probability weighted with IPUMS variable "WTSUPP".
* All groups refer to 26 year old unmarried, childless, non-Hispanic, nonimmigrant, non-boomerang, employed college graduates residing in metro-areas in a coastal state.

In Figure 3.2, a comparison of differences in job mobility's correlation with overeducation among college graduates along racial lines before the recession is presented. The columns on the left correspond to white individuals who are 26 years old, unmarried, childless, are not of Hispanic origin, are not immigrants, do not exhibit boomerang migration, reside in metropolitan areas, and live in coastal states. These are the same as the leftmost columns in Figure 3.1, and thus bear the same interpretation. The sets of columns on the right side of the figure refer to non-white individuals with otherwise identical personal characteristics. Non-white men appear to have a higher propensity for overeducation associated with job migration, but the effect is not significant. In Figure 3.2, non-white women exhibiting mobility are significantly more likely to be overeducated than those not exhibiting mobility. As with white

women, non-white women could be influenced disproportionately by a preference for amenities.

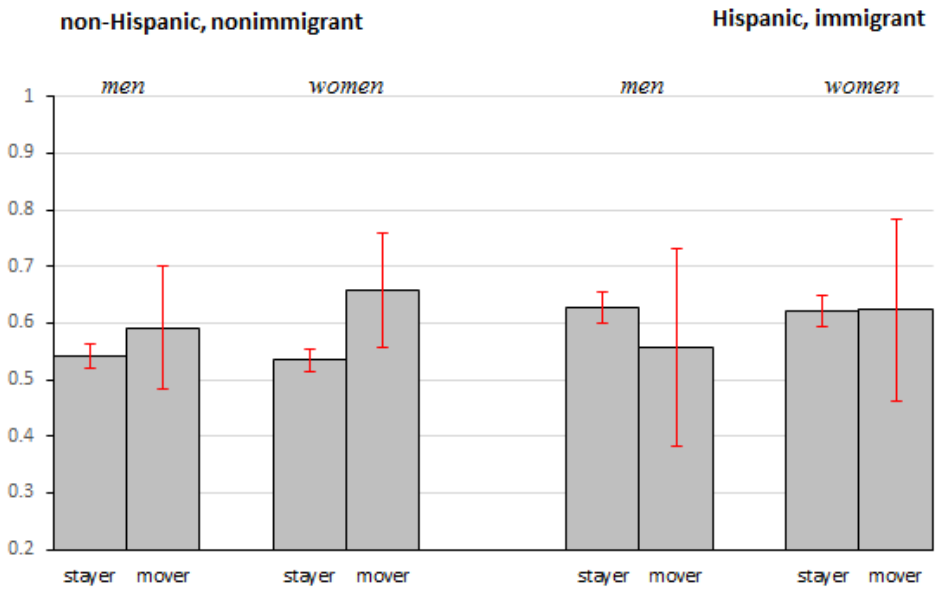

Figure 3.3. Estimated Overeducation Probabilities and 90% Confidence Intervals for Selected* Groups, pre-2009

Source: author's own calculations using data from IPUMS CPS, probability weighted with IPUMS variable "WTSUPP".
* All groups refer to 26 year old unmarried, childless, non-white, non-boomerang, employed college graduates residing in metro-areas in a coastal state.

Figure 3.3 compares non-white individuals who are not immigrants and do not have Hispanic origins to Hispanic immigrants who are non-white. The figure reveals a number of interesting characteristics of the subpopulations. For one, Hispanic immigrant stayers are more likely to be overeducated than their non-Hispanic, nonimmigrant stayer counterparts. Additionally, mover-stayer differences are inconclusive at the given confidence level among Hispanic immigrants themselves. Men in this subpopulation appear to see benefits associated with job mobility, but significance is lacking.

Figure 3.4 presents results of a comparison between boomerang movers and people who do not exhibit boomerang migration in the pre-recession period. Like male

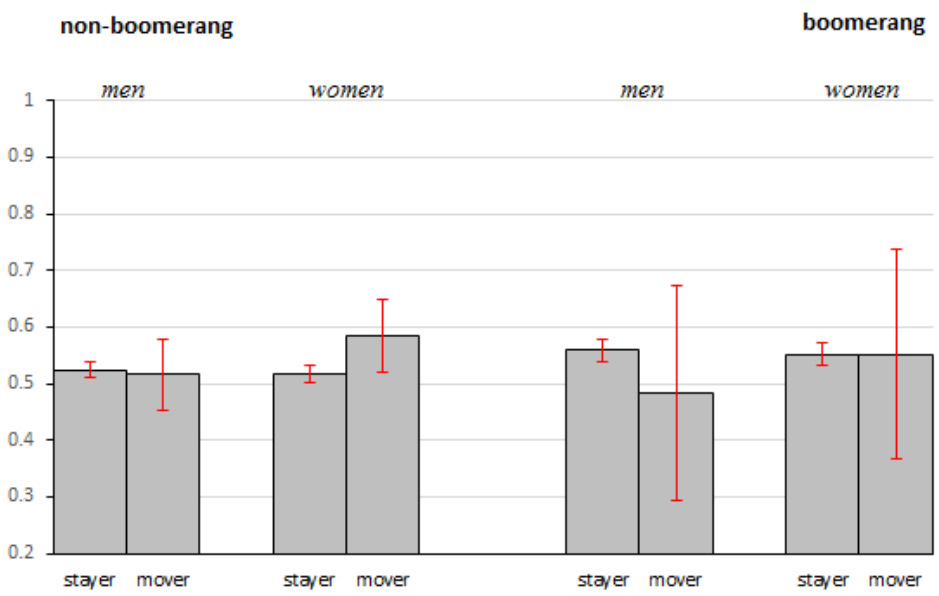

Figure 3.4. Estimated Overeducation Probabilities and 90% Confidence Intervals for Selected* Groups, pre-2009

Source: author's own calculations using data from IPUMS CPS, probability weighted with IPUMS variable "WTSUPP".
* All groups refer to 26 year old unmarried, childless, white, non-Hispanic, nonimmigrant, employed college graduates residing in metro-areas in a coastal state.

non-boomerang movers, male boomerang movers seem less likely to be overeducated (although differences lack significance). Boomerang-moving women have a nearly identical point estimate for the likelihood of overeducation across job mobility.

In order to examine urban/regional differences in the overeducation-job mobility correlation, I compare individuals who live in cities in coastal and other economically active areas to those in non-metro, non-coastal regions. Figure 3.5 presents the results of this comparison before the recession. Slightly higher overeducation propensities exist for stayers residing in less-active rural regions, relative to stayers in active economies. Women who move have virtually the same likelihood of being overeducated whether they end up in "better" or "worse" local labor markets.

Logit model estimates for data from the post-2009 period are presented in Table 3.7. Once again, the table reports estimates, calculated using statistical software,

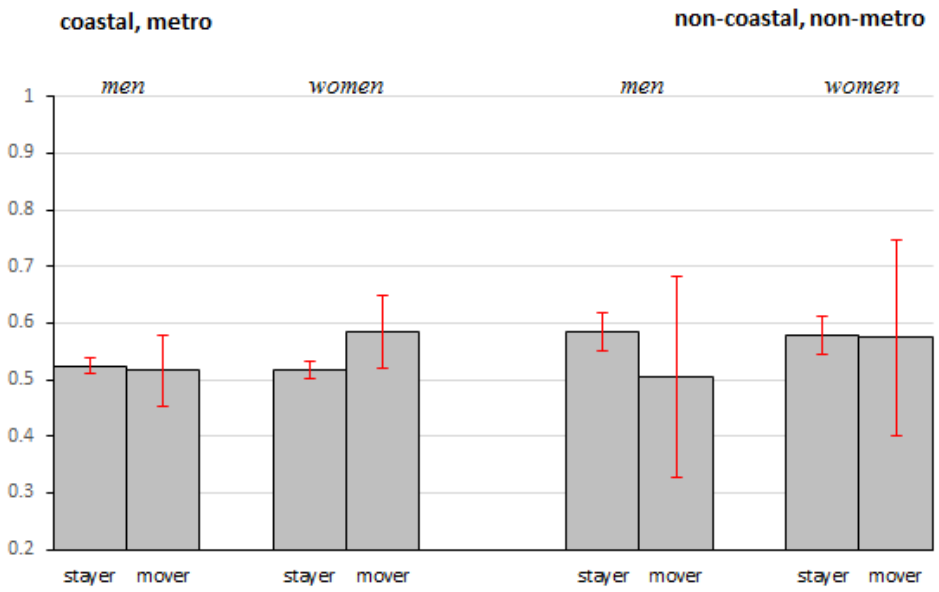

Figure 3.5. Estimated Overeducation Probabilities and 90% Confidence Intervals for Selected* Groups, pre-2009

Source: author's own calculations using data from IPUMS CPS, probability weighted with IPUMS variable "WTSUPP".
* All groups refer to 26 year old unmarried, childless, white, non-Hispanic, nonimmigrant, non-boomerang, employed college graduates.

based on the logit model framework described by Equations 3.2 and 3.5. Estimates in columns (1) and (2) are calculated in the manner of Equation 3.2, the age value in column (3) is calculated in the manner of Equation 3.3 and the remaining values in column (3) are calculated as in the manner of Equation 3.4. More than 19 thousand observations yield 28.2 million subjects for analysis, after probability weighting.

Again, differences in job mobility impacts from the model with interactions are best illustrated using marginal probabilities of overeducation. Figure 3.6 is the post-recession analogue to Figure 3.1, with identical analysis groups for the years after 2009. The results show that for younger (26 year old) unmarried/childless men, mobility is associated with significantly (at 90 percent confidence) lower overeducation propensities. The same is true for mobile women who are younger, unmarried, and childless. This suggests that, at least for women having these particular personal

Table 3.7.
Logit Estimates After the Recession

	(1)	(2)	(3)
Variable	Mover = 1	Mover = 0	Difference = (1) - (2)
constant	-0.223	1.031***	-1.255
	(1.322)	(0.251)	(1.346)
age	0.003	-0.028***	0.030
	(0.049)	(0.009)	(0.050)
female	0.392*	0.101***	0.291
	(0.206)	(0.039)	(0.210)
married	0.516*	-0.147***	0.663**
	(0.282)	(0.051)	(0.286)
children	-0.063	0.197***	-0.260
	(0.390)	(0.056)	(0.394)
white	-0.541	-0.116**	-0.426
	(0.339)	(0.051)	(0.342)
immigrant	0.023	0.031	-0.008
	(0.450)	(0.064)	(0.455)
hispanic	0.694*	0.297***	0.398
	(0.367)	(0.064)	(0.372)
boomerang	1.198*	0.324***	0.874
	(0.727)	(0.054)	(0.729)
metro	0.100	-0.070	0.170
	(0.340)	(0.069)	(0.347)
coastal	-0.150	-0.192***	0.041
	(0.210)	(0.041)	(0.214)
observations	15,782		
no. of subjects	28,197,234		

Robust standard errors in parentheses. Probability weighted based on the IPUMS CPS variable "wtsupp". ***, **, and * refer to significance at the 0.01, 0.05, and 0.1 levels, respectively.

characteristics, job mobility's negative correlation with overeducation becomes more pronounced after the recession. Male and female alike, post-recession 30 year olds who are married and have children do not experience significantly different probabilities of overeducation associated with job mobility.

Figure 3.7 compares job mobility impacts among otherwise identical white and non-white individuals in the sample after the recession. While moving for job reasons seems linked to reduced overeducation among non-white men and increased overeducation among non-white women, differences are not significant at the 90 percent confidence level. This is an indication that after the recession job mobility's correlation with overeducation is less robust for non-whites, relative to whites.

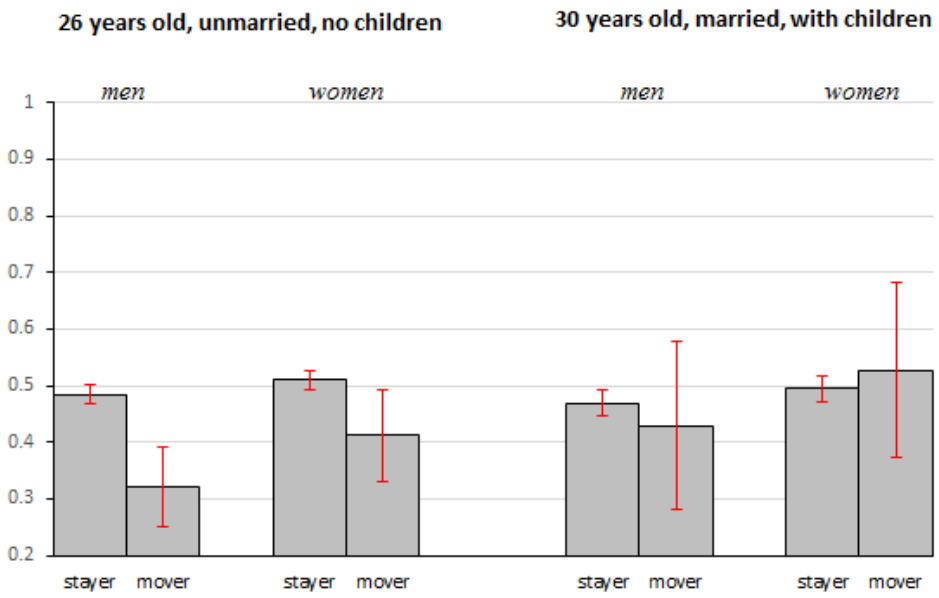

Figure 3.6. Estimated Overeducation Probabilities and 90% Confidence Intervals for Selected* Groups, post-2009

Source: author's own calculations using data from IPUMS CPS, probability weighted with IPUMS variable "WTSUPP".
* All groups refer to non-Hispanic, nonimmigrant, non-boomerang, employed college graduates residing in metro-areas in a coastal state.

In Figure 3.8 I report the post-recession results of predicted overeducation probabilities for non-white individuals who are not Hispanic and are native-born Americans alongside Hispanic immigrant non-white individuals. Hispanic immigrants in this subpopulation tend to fare worse than their counterparts in terms of overeducation propensities in general. However, confidence intervals overlap for all comparison groups, meaning job mobility does not seem to correlate positively or negatively with overeducation propensities among these subpopulations. From Figure 3.6, otherwise similar white U.S. college graduates do experience decreased overeducation propensities associated with job mobility. That non-white U.S. residents (hispanic/immigrant or otherwise) do not suggests that they share the amenity preference likely exhibited by some young women in the sample.

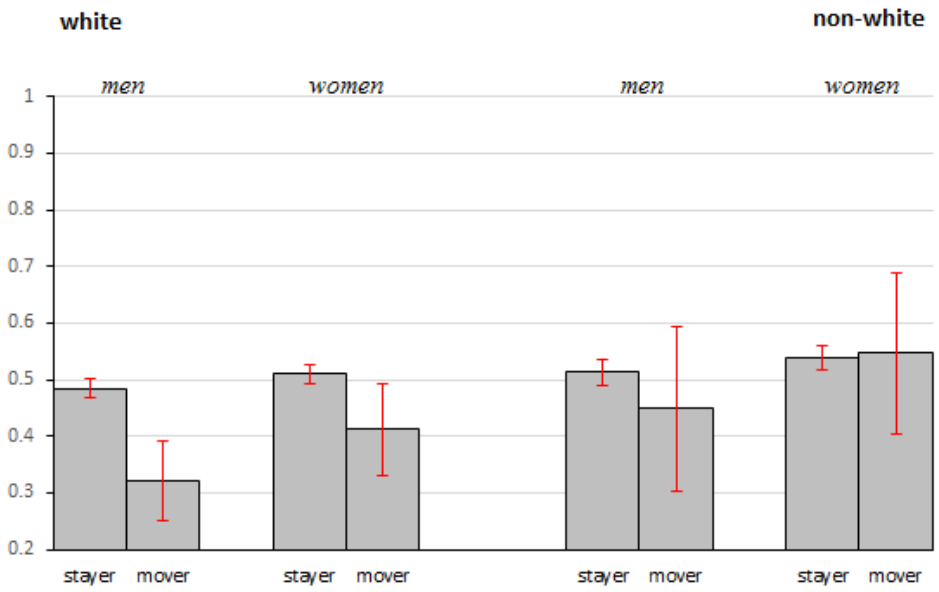

Figure 3.7. Estimated Overeducation Probabilities and 90% Confidence Intervals for Selected* Groups, post-2009

Source: author's own calculations using data from IPUMS CPS, probability weighted with IPUMS variable "WTSUPP".
* All groups refer to 26 year old unmarried, childless, non-Hispanic, nonimmigrant, non-boomerang, employed college graduates residing in metro-areas in a coastal state.

Boomerang movers who return to their parents' houses after the recession are likely to have labor market experiences that are distinct from those of college graduates not living with their parents. Figure 3.9 presents the results of a post-2009 comparison between boomerang and non-boomerang college graduates. In general, individuals living with their parents seem more likely to be overeducated. Looking at job mobility, it appears to positively correlate with overeducation among people living with their parents. In other words, people moving in with their parents for job reasons are more likely to be overeducated than individuals who lived with their parents all along. However, this observed difference is not significant at the given confidence level.

Figure 3.10 shows marginal overeducation probabilities after the recession for those who live in metro and coastal areas separately from those who do not. Results for men and women are parallel. Non-coastal, non-metro stayers are more likely to be

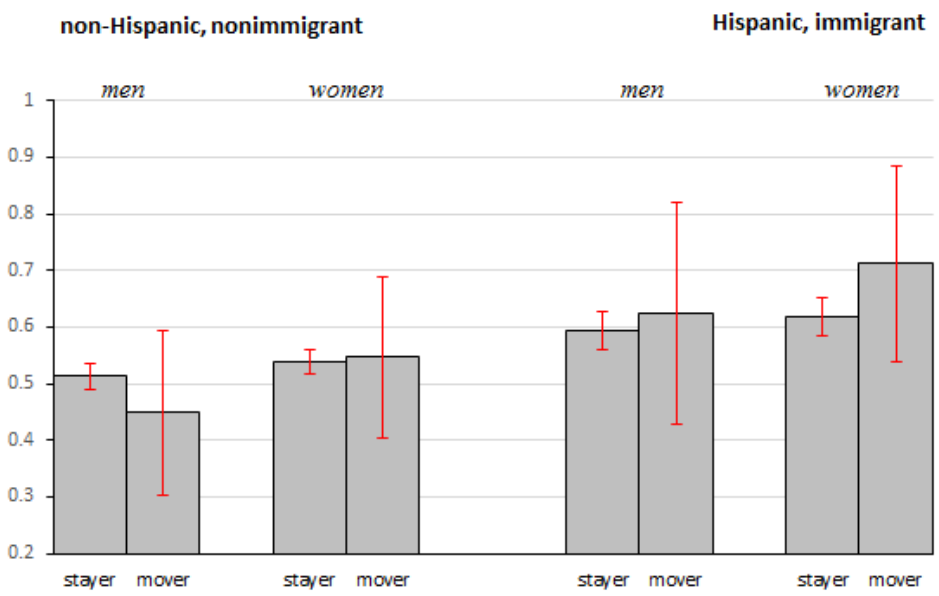

Figure 3.8. Estimated Overeducation Probabilities and 90% Confidence Intervals for Selected* Groups, post-2009

Source: author's own calculations using data from IPUMS CPS, probability weighted with IPUMS variable "WTSUPP".
* All groups refer to 26 year old unmarried, childless, non-white, non-boomerang, employed college graduates residing in metro-areas in a coastal state.

overeducated than other stayers. Aside from this, no new inferences can be drawn. Movers to non-coastal, non-metro regions seem less likely to be overeducated for their jobs, but this fails the test of statistical significance.

3.6 Conclusion

In this chapter, I have explored the overeducation propensity of the young college educated population in the contexts of job mobility and the recent economic crisis. Under the assumption that job-related migration relates to discrepancies in the likelihood of overeducation, I examined recent college graduates on the basis of a number of relevant personal characteristics, both before and after the recession. I uncovered a number of interesting findings. First, I find that job mobility is indeed correlated with the overeducation propensities of certain young college graduates.

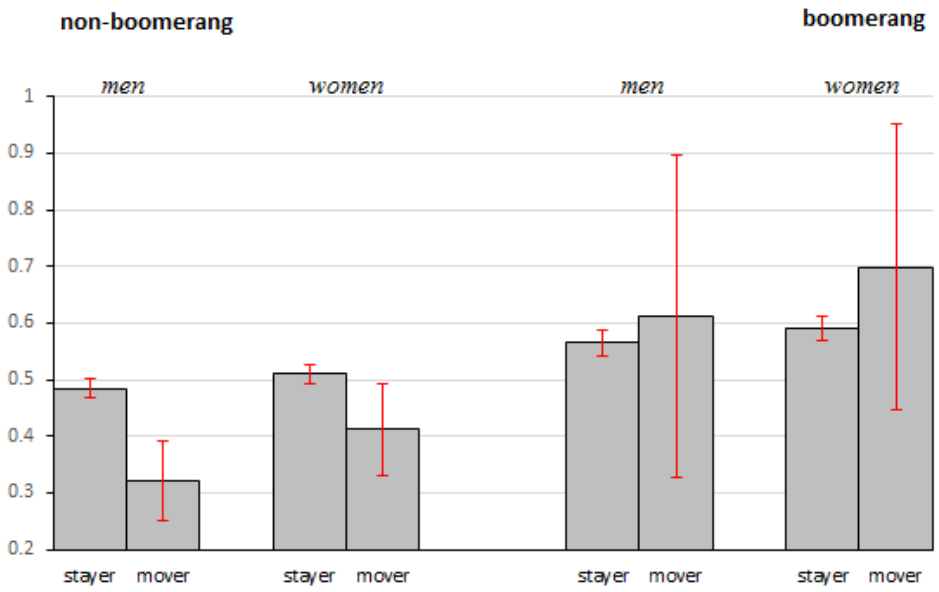

Figure 3.9. Estimated Overeducation Probabilities and 90% Confidence Intervals for Selected* Groups, post-2009

Source: author's own calculations using data from IPUMS CPS, probability weighted with IPUMS variable "WTSUPP".
* All groups refer to 26 year old unmarried, childless, white, non-Hispanic, nonimmigrant, employed college graduates residing in metro-areas in a coastal state.

Before the recession, non-white women experience significant increases in overeducation probabilities associated with job mobility. After the recession young, unmarried, and childless white men and women are subject to a negative overeducation-mobility correlation. But by and large, job mobility does not appear to have a relationship with the likelihood of overeducation for individuals in the sample.

One result that warrants special attention is the positive correlation between job mobility and overeducation observed among non-white women before the recession. This positive correlation indicates that when women in this subpopulation move for job reasons, they also happen to have an increased likelihood of being poorly matched with the job they take. This is counterintuitive. In explaining this result, it is important to remember that job mobility is inherently a form of migration. This means there could be larger forces at play. Migration holds a key place and significance

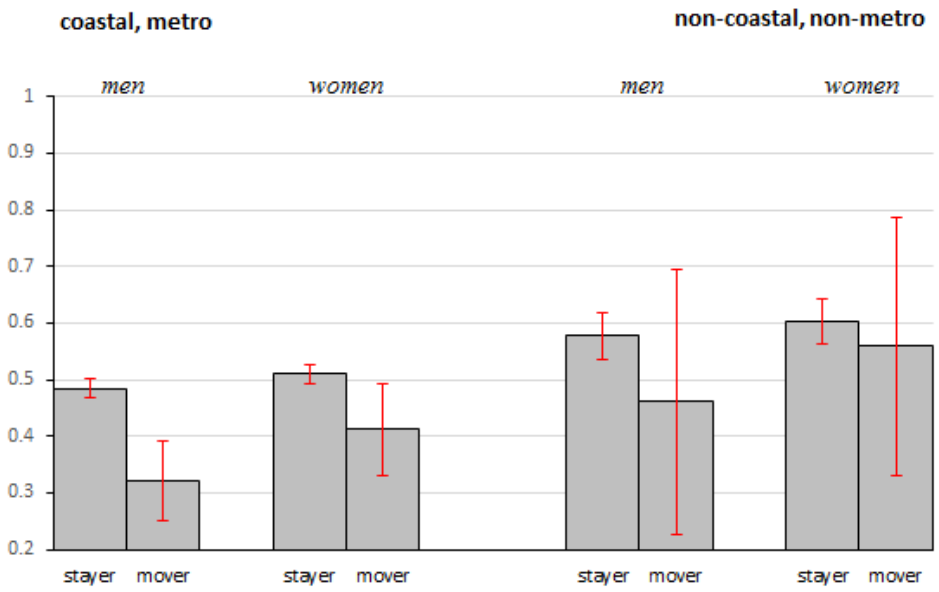

Figure 3.10. Estimated Overeducation Probabilities and 90% Confidence Intervals for Selected* Groups, post-2009

Source: author's own calculations using data from IPUMS CPS, probability weighted with IPUMS variable "WTSUPP". * All groups refer to 26 year old unmarried, childless, white, non-Hispanic, nonimmigrant, non-boomerang, employed college graduates.

in the life-course of a given individual. In addition to the work by Bakens and Nijkamp (2013), Whisler et al. (2008) argue that young college educated individuals look for particular amenities when deciding where to migrate, including varied goods and services, socially tolerant environments, and options for recreation. It could be that certain individuals in the sample (namely these non-white women, pre-recession) who experience worse outcomes associated with job-related moves are in fact limiting their own job migration based on the availability of these or other amenities. This analysis has no way of addressing the possible confounding aspects of this phenomenon.

Among the groups of men studied before the recession, predicted overeducation probabilities reveal that no subpopulations of the sample studied experience lower overeducation propensities associated with job-related moves. For women before 2009, no negative correlation between job migration and overeducation propensities is observed (and, in fact, one aforementioned case exhibits a positive correlation). After

the recession, 26 year old, unmarried, childless, white, non-Hispanic, nonimmigrant, non-boomerang women living in metropolitan areas who live in coastal areas are less likely to be overeducated if they have moved for job reasons. The same is true for men of those characteristics. The other groups of women studied after the recession (married with children, non-white, non-white/Hispanic/immigrant, boomerang, and non-coastal) do not experience correlation between job migration and overeducation, and generally appear to have higher overeducation propensities than comparable men, though significance is lacking. Post-recession men experience a negative job mobility-overeducation correlation only if they are young, white, unmarried, childless, non-immigrant, non-boomerang movers not of Hispanic origin who live in metro-coastal areas. However, this contrasts with the pre-recession results, where no men experienced a negative correlation as such. This is evidence that, for select few individuals, a beneficial labor market association between job mobility and overeducation came into effect after the recession. In general, the conclusions reached by this research should be taken with caution. While in some cases a link has been established between overeducation and the act of moving for job reasons, it is ultimately uncertain in which direction the causality points. One the one hand, it could be the case that individuals who are able to exercise job mobility are better able to land jobs for which they are properly educated. But on the other hand, it could be the case that individuals who land the appropriate jobs are better able to migrate on the basis of their jobs.

Adjustments to research design in the presence of improved data could benefit this study of job mobility. For one, a means of controlling for the potential cofounding effect of amenity preference is desirable. The current design begs the question, "do individuals who move 'primarily' for job reasons really condition completely on their jobs, or do they limit their job searches based on their desires for locations with better amenities?" With a lack of more granular geographical data, there is no way to address this concern using the dataset I employ currently. Furthermore, evidence has been found for the importance of regional unemployment rates in determining overe-

ducation (Verhaest and Omey, 2010). Although structural changes in unemployment rates are implicitly included in the model via its before-after recession specifications, future research would do well to address this more directly.

CHAPTER 4. WAGES AND JOB MOBILITY IN THE YOUNG COLLEGE-EDUCATED WORK FORCE

4.1 Introduction

Individual wages offer crucial insight into modern economies and societies. Wages are an inextricable cog in the functioning of labor markets, and play a key role in determining quality of life. The importance of wages has begotten countless studies on the topic, with a broad range of applications. Many wage studies focus on inequality, both in terms of wage levels and wage growth. On the one hand, wage discrimination across a number of demographic characteristics has been documented. In a meta-analysis of the literature, Jarrell and Stanley (2004) affirm that evidence of a gender pay gap in the United States is nearly ubiquitous. On the other hand, disparate growth means wage inequality has been increasing over many dimensions. Inequality has risen within socioeconomic groups, as well as for varying levels of educational attainment, age, and occupations (Autor et al., 2008).

At first glance, the economic climate seems to favor college graduates. College wage premiums are large and have been growing in the past three decades (James, 2012). But although they grow, they have not kept pace with tuition increases (Rothstein, 2011). At the same time, student debt burdens are increasing. These debts can impact individuals' wages for years after they leave college. Minicozzi (2005) finds evidence that men who accumulate more student debt are increasingly likely to take jobs with high initial wages, but low wage growth. Furthermore, the recent recession hampered employment opportunities and depressed wages for college graduates as a whole. In combination, these factors worsen the outlook for college graduates considerably.

To the extent that labor markets are heterogeneous across regions (Topel, 1986), migration can emerge as a possible solution to the wage concerns of college graduates. College graduates who engage in migration toward the end of improving their labor market outcomes should, in theory, earn higher wages than those who are not. This chapter investigates that possibility by comparing the wages of young college graduates who reside in the United States, in the presence and absence of migration for job reasons. I address a number of explicit research questions. For one, how does job-related migration relate to the wages of young college graduates? For another, has the recent global recession changed this relationship? And finally, do individuals' personal characteristics have any bearing on the correlation between job migration and wages? I hypothesize that wages are generally larger among individuals who migrate for job reasons. In addition, I surmise that the wage increases correlated with job migration are amplified in the period following the recession. I assume a number of individual-level socioeconomic factors, such as race, marital status, and age, will have substantial and significant impacts on this correlation.

I make contributions to the labor migration literature with this research. While a number of studies have addressed wages (International Labor Organization, 2010b; Daly et al., 2012; Oreopoulos et al., 2012) and job mobility (Roosaar et al., 2014) as they relate to the great recession, no efforts exist that synthesize both domains in the context of the economic downturn. I do so, applying analysis specifically to the population of young college graduates in the United States.

This chapter unfolds as follows. First, I synthesize relevant takeaways from literature on wages, in general as well as in the contexts of job mobility and young college graduates. Second, I describe the data underpinning these analytical tools. Third, I present the results and discussion surrounding them. Lastly, I cover policy implications and future research opportunities.

4.2 Literature Review

4.2.1 Migration and Wages

The concept of migration as an investment can be traced back to Sjaastad (1962), who postulates that migration amounts to a comparison of costs and benefits for a given individual. Returns to migration can be quantified in this framework. In a brief survey of related literature, Greenwood (1975) notes some pertinent results: (1) higher earnings for geographical migrants within an industry, relative to those who stay put; and (2) higher earnings for migrants originating from the southern United States and moving to the northern parts of the country. Both of these empirical findings suggest a positive role for interregional migration in wage determination. In a more recent study of young Dutch college and university graduates, Venhorst and Cörvers (2010) find that migration appears to positively affect wages. However, this impact disappears when controlling for self-selection.

4.2.2 College Graduate Wages

A very basic tenet of human capital theory is that increased education leads to higher wages. Labor economists tend to agree on this relationship, whether it comes from actual productivity gains that educated workers can offer to firms, or from education signaling some other innate ability in workers (Acemoglu and Autor, 2009). Much of the related literature endeavors to quantify wages both within and across levels of human capital, measured by educational attainment. Regarding college graduates, a number of studies focus on their wage premiums relative to individuals with lower levels of educational attainment. Looking at this college wage premium, Mishel et al. (2012) estimate its 2011 values to be 44.8 percent for men and 48.7 for women. The authors note a general trend of growth in the premium since the early 1970s. Grogger and Eide (1995) conclude that premiums are different across

college majors, also noting the substantial impact of a shift in the 1980s from low- to high-skill majors.

Mishel et al. (2012) look at trends in wages for college graduates in the entry-level job market (people with 1 to 7 years of labor market experience). They find a period of marked wage increases in the late 1990s, followed by declines in the 2000s. As a result, real wages for male college graduates have only grown by around 5.2 percent since the late 1970s. Female entry-level college graduates have experienced wage increases of 15.4 percent. Notably, the authors express that young college graduate wages have been falling in the past decade in spite of productivity increases across the economy as a whole during that period.

4.2.3 Wage impacts of the Recession

Recessions are understood to impact labor market outcomes, including wages. Recent literature has addressed this phenomenon from numerous angles. A global study (International Labor Organization, 2010b) finds continued overall wage growth during the financial crisis in 2008 and 2009. However, the report indicates considerable slowing in the rate of wage growth, from 2.2 percent in 2007 to 0.8 and 0.9 percent in 2008 and 2009, respectively (excluding China). In the United States real wages also grew, but slowly, during the recent global financial crisis. Daly et al. (2012) find that real wages have grown at more than 1 percent on average since 2008. They cite downward wage rigidity as a primary contributor to this, and show its incidence using data from the Current Population Survey.

Labor market entrants, however, do not appear to be benefitting from the overall wage growth exhibited in the recessionary U.S. labor market. Looking broadly at all young college graduates, Mishel et al. (2012) document declines in real wages beginning in the early 2000s, but worsening from 2007 to 2011, corresponding to the recent global crisis. Overall, their results suggest young people are experiencing difficulty when entering the current labor market, which is still reeling from the recession. Ex-

Table 4.1.
Sample Selection Criteria

Variable	Criterion
time period	survey years 2003, 2004, 2005, 2006, 2007, 2008, 2010, 2011, 2012, 2013
education	bachelor's degree
age	22 to 30 years old
hourly wage	2.55 to 255.55 dollars (1999)
labor force status	in the labor force and currently employed
armed forces status	not an active member of the armed forces

amining individuals who graduate college during a recession, Oreopoulos et al. (2012) find evidence that earnings losses begin at 9 percent, and persist up to 10 years. They also find that the effects brought on by poor labor market conditions are felt most strongly by individuals in their first year after graduation. Individuals in the labor force with 2 to 3 years of experience are subject to smaller wage decreases resulting from recessions. The authors additionally account for "skills" in their model by including major fields of study, as well as universities themselves, in their models. They find that individuals at the lowest skill levels (e.g. humanities graduates) experience the effects of bad labor markets more strongly.

4.3 Data and Model

I use data from the March supplement of the Current Population Survey (CPS), accessed via IPUMS CPS. The observations represent a random sample of the overall U.S. population.

Selection criteria for the sample of observations are given in Table 4.1. These criteria are applied to yearly cross sectional samples of self-reported individual-level demographic characteristics. The goal is to analyze the particular wage characteristics of young college educated individuals. Toward that end, I include in the sample individuals aged 22 to 30 years old. The study is limited to individuals who have attained bachelor's degrees (not advanced degrees). I base the exclusion of advanced

degree holders on the assumption that they are subject to markedly different labor market experiences, especially in the age range that I have selected. Indeed, it is likely that the first career-oriented labor market activity for advanced degree holders begins substantially later than age 22, whereas a large number of bachelor's degree holders are able to take their first career job at that age. To situate the analysis around the recent economic crisis, I limit the years from which the cross-sectional data are sourced. As such, the years 2003 to 2008 correspond to the period prior to the recession, and the years 2010 to 2013 correspond to the post-recession era. After constructing an hourly wage variable by which to compare individuals in the sample (detailed below), I elect to eliminate extreme values of this variable. Following the example of Card and DiNardo (2002), I convert values to 1979 USD, and eliminate those values that are less than one dollar and greater than one hundred dollars. Finally, I adopt the convention of numerous labor/wage analyses by including only those individuals who are both employed and not actively engaged in military service at the time of the survey.

Table 4.2 gives variables used in the analysis of graduate wages, as well as definitions detailing their construction. Crucial to this analysis is the means by which individual wage earnings are measured. To best compare differences in this variable across workers, I use the log of their average hourly earnings. Calculating this variable for each of the observations amounts to a three step process: (1) I obtain a measure of hourly wage by dividing a given individual's total reported wage and salary earnings for the previous year by the product of the number of weeks the individual worked in that year and the usual hours they worked per week; (2) I adjust for inflation by multiplying the (nominal) hourly wages for each individual by the year in the sample by an adjustment factor corresponding to the year in which the individual was surveyed (given by IPUMS CPS variable CPI99) to produce values that are consistent (in 1999 dollars) across observations; and (3) I take the natural logarithm of the resulting term for each individual. It is this process through which I obtain the dependent variable, "logwage".

Table 4.2.
Variables and their Definitions

Variable	Definition
dependent variable	
logwage	natural logarithm of respondent's hourly wage in USD (nominal wages converted to 1999 values using CPI)
key independent variable	
mover	= 1 if respondent migrated for job-related reasons across county boundary
personal characteristics	
overeducated	= 1 if respondent is overeducated (employed in a position requiring less than a bachelor's degree)
age	= age of respondent [yrs]
female	= 1 if respondent is female
married	= 1 if respondent is married
children	= 1 if respondent lives with his/her own children
black	= 1 if respondent is black
immigrant	= 1 if respondent was born outside the United States
hispanic	= 1 if respondent reported Hispanic origin
boomerang	= 1 if respondent reports being the child of the household head
locational characteristics	
metro	= 1 if respondent lives in a metropolitan area
coastal	= 1 if respondent's current state of residence is CA, CT, DC, FL, IL, MD, MA, NJ, NY, NC, OR, PA, RI, TX, VA, WA

The goal is to structure the analysis around individuals' job-related migrations. Toward that end, I make use of a "key independent variable", i.e. "mover". The variable "mover" is a dummy identifying individuals who move for job reasons. More specifically, movers are people who, based on IPUMS CPS variable "WHYMOVE", report moving to a different county for one of two reasons: (1) "New job or job transfer"; or (2) "To look for work or lost job".

I add nuance to this analysis by incorporating a host of additional variables regarding demographics and location. Foremost among these is the binary variable "overeducated". Bearing in mind the individuals in the sample are all college graduates, "overeducated" takes a value of 1 if a given individual reports a job requiring

less than a bachelor's degree, and 0 if not. For this variable, I use a detailed list of job requirements from the U.S. Bureau of Labor Statistics' Employment Projections program (for more information, see Appendix A). The age of a given individual is enumerated in the following variable, ranging from 22 to 30 based on the selection of the sample. Values for the "female" variable are 1 for women and 0 for men. An analogous coding scheme applies for the variables "married", "children", "black", "immigrant", and "hispanic". The variable "boomerang" is used in conjunction with "mover" to analyze individuals who live with their parents after having gone to university in a different location. I borrow the term boomerang from previous migration literature, where it has been used to describe a temporary migration spell in which individuals move to new locations to increase their human capital with the intent to return to their original locations afterward (Stenning et al., 2006).

The "metro" binary variable identifies individuals who live in metropolitan areas, based on U.S. Census Bureau definitions. The coding scheme for the "coastal" variable assigns a value of 1 to respondents living in states with relatively high levels of economic activity (generally coastal states). This variable is included as a measure of local economic conditions, which are hypothesized to have a positive effect on employee wages.

Prior studies of individual wages motivate the choices for the covariates documented in Table 4.2. Chevalier (2003) finds "pay penalties" for people at various degrees of overeducation. Background for racial wage differentials comes from Blinder (1973). In an oft-cited study, the author uncovers substantial wage discrepancies between white and black men in the United States. The analysis breaks the overall difference down into components as follows: 30 percent to lower endowments among blacks of variables exogenous to the analysis, 30 percent to lower endowments among blacks of variables endogenous to the analysis, and 40 percent to pure pay discrimination. This breakdown suggests that at least part of the wage difference is due to racial discrimination alone, which is the basis upon which a race-based covariate ("black") is included in this analysis. Duleep and Regets (1997) document lower mean and me-

dian wages among immigrants in the U.S., relative to their native-born counterparts. Their study suggests wage growth is higher among foreign-born workers, however. In a comprehensive meta-analysis of gender wage gap studies, Jarrell and Stanley (2004) affirm unanimity in the literature on discriminatory low pay for women relative to men. They note that while this gap has declined over time, it remains significant. Hill (1979) details "robust findings" that men who are married have higher wages than unmarried men, as well as a lack of negative marital wage effects among women (contrary to results from earlier studies). The study also finds strong wage increases for white men and black women who have many children compared to those who do not. Overall, the results of this study suggest that marital status and children have some impact of wages, thereby informing this study's inclusion of these variables.[1]

Covariates relating to location appear next in Table 4.2. I include the "metro" variable as a control for the urban wage premium. To motivate this choice, I look to Yankow (2006). This study revolves around decomposing the urban premium into several components. The author finds a large contribution from unobserved heterogeneity among city residents and a smaller (but substantial) contribution from city-specific factors, namely higher-efficiency firms and improved job mobility. The final covariate appearing in Table 4.2 is "coastal", which attempts to quantify regional differences in wages. Topel (1986) finds that market heterogeneity is responsible for differences in the wages across regions.

Finally, it is instructive to explain the exclusion of one covariate commonly appearing in wage equations, namely experience. A common proxy framework for experience is observed in Oaxaca (1973), where an individual's "potential experience" equals his or her age minus years of schooling minus six. However, this type of experience variable is decidedly less relevant in this analysis, which is based on the early labor market experience of individuals aged 30 or below. Hence, I do not include it in the regression specifications.

[1]Notably, Hill (1979) study also provides counterevidence to earlier research suggesting that, in measuring wage differentials, marital status and children only functioned as proxies for (formerly) difficult to quantify human capital variables.

The analysis that follows hinges on the pre- and post-recession groupings of observations. I choose the reference year for recessionary timing to be 2009. In other words, observations from earlier than 2009 are considered pre-recession, and observations later than 2009 are considered post-recession. I choose 2009 as the reference year because - in the context of the recession - it is the year in which most of the large structural changes in employment characteristics occurred.

Table 4.3.
Summary Statistics

	CPS 2003-2008			CPS 2010-2013		
	Mover	Stayer	Difference	Mover	Stayer	Difference
dependent variable						
wage	16.325	16.763	-0.438	16.226	16.019	0.207
	(12.648)	(13.606)	(0.475)	(17.802)	(12.576)	(0.919)
personal characteristics						
overeducated	0.521	0.554	-0.032	0.465	0.553	-0.087***
	-0.5	-0.497	-0.02	-0.499	-0.497	-0.025
age	25.368	26.364	-0.996***	25.335	26.376	-1.041***
	(2.446)	(2.387)	(0.099)	(2.322)	(2.363)	(0.118)
female	0.493	0.549	-0.056***	0.510	0.540	-0.03
	(0.500)	(0.498)	(0.020)	(0.500)	(0.498)	(0.025)
married	0.293	0.368	-0.074***	0.256	0.319	-0.063***
	(0.456)	(0.482)	(0.018)	(0.437)	(0.466)	(0.022)
children	0.103	0.188	-0.084***	0.116	0.167	-0.051***
	(0.304)	(0.390)	(0.011)	(0.320)	(0.373)	(0.015)
black	0.064	0.085	-0.021**	0.050	0.081	-0.032***
	(0.246)	(0.279)	(0.010)	(0.217)	(0.273)	(0.011)
immigrant	0.068	0.126	-0.058***	0.072	0.104	-0.031***
	(0.252)	(0.332)	(0.009)	(0.259)	(0.305)	(0.012)
hispanic	0.048	0.074	-0.026***	0.069	0.092	-0.023**
	(0.214)	(0.262)	(0.008)	(0.253)	(0.289)	(0.012)
boomerang	0.032	0.175	-0.143***	0.026	0.191	-0.165***
	(0.176)	(0.380)	(0.008)	(0.160)	(0.393)	(0.009)
locational characteristics						
metro	0.893	0.909	-0.016	0.918	0.923	-0.005
	(0.310)	(0.288)	(0.012)	(0.274)	(0.266)	(0.012)
coastal	0.590	0.606	-0.016	0.585	0.629	-0.043*
	(0.492)	(0.489)	(0.020)	(0.493)	(0.483)	(0.024)
observations	944	20,586		585	15,040	
estimated weighted observations	1,691,530	35,527,241		1,111,541	26,856,822	

values reported are mean (standard deviation) estimates based on the author's own data from IPUMS CPS, calculated using probability weights via the "WTSUPP" variable, using Stata12. Differences and significance are calculated using Stata12 survey postestimation linear combinations. for ease of interpretation, wage summary statistics refer to hourly wages, instead of the log of hourly wages.

Summary statistics for the sample are listed in Table 4.3. The reported values are based on probability weighted calculations, thereby representing the overall popula-

tion of the United States. I separate the figures into columns based on job mobility and timing (before versus after 2009). The numbers of observations belonging to each category are listed at the foot of the table, along with the more relevant weighted values used to compute the statistics. In practical terms, the calculated values in Table 4.3 (as well as those in the analysis hereafter) are based on the following estimated numbers of observations: 1.692 million movers before the recession; 35.527 million stayers before the recession; 1.112 million movers after the recession; and 26.857 million stayers after the recession.

Within the sample of college graduates, differences abound across the groupings reported in Table 4.3. Before the recession, "wage" differs only slightly between groups, with stayers appearing to exhibit marginally higher hourly wages. However, the difference is small in magnitude and not statistically significant. Furthermore, this estimation is made without controls for relevant covariates. As per the previously outlined hypotheses, I anticipate different results in the estimates of the regression equations to come. After 2009, the values of "wage" are slightly higher for people who migrate compared to those who do not. However, this difference once again fails to return statistical significance. Post-recession, 55 percent of stayers are overeducated, relative to 47 percent of movers. On average, stayers are significantly older in both time periods. A highly significant difference term confirms women comprise a disproportionate share of stayers before the recession, although not afterward. Perhaps unsurprisingly, married individuals are less likely to migrate for job reasons in each time period. The same can be said for individuals with children. People in the black, immigrant, and Hispanic subpopulations are also disproportionately likely to be stayers. People living with their own parents after graduating college (boomerang movers) are overly likely to be stayers, pre- and post-recession. This suggests that those who move in with their parents are doing so for non-job reasons. Metropolitan area residency is statistically equivalent across migration behavior before and after 2009. Lastly, people living in coastal areas are relatively more likely to be stayers in the wake of the recession.

4.4 Analysis and Results

To test this study's hypotheses on how job migration and overeducation correlate with wages, I estimate a wage function. In part, I use an ordinary least squares (OLS) estimator to calculate the effect that moving has on wages. OLS finds the line that best fits the model by minimizing the sum of the squared difference between observed responses and a linear approximation of the data. In labor economics, it is customary to calculate the effect on log of wage, as opposed to wage. This is because when looking at the log of wage, the results can be interpreted as the percent change in wage after a one unit change in the independent variable. For example, I will observe the percent change in wage for immigrants versus native-born U.S. residents (and, subsequently, compare this effect for movers versus stayers). The model takes the basic form

$$\log wage = \delta + \alpha mover_i + \boldsymbol{x_i}\boldsymbol{\beta} + (mover_i \times \boldsymbol{x_i})\,\boldsymbol{\lambda}, \tag{4.1}$$

where δ is the constant term, α is the parameter estimate associated with "mover" for the ith individual, $\boldsymbol{x_i}$ is a vector of the remaining independent variables (aside from "mover"), $\boldsymbol{\beta}$ is a vector of parameters associated with the remaining independent variables, and $\boldsymbol{\lambda}$ is a vector of parameters associated with the terms obtained by interacting "mover" with the remaining independent variables for the ith individual. With this regression framework, the partial effect of a given variable x^* can be different for movers versus stayers. For movers, the partial effect of x^* is as follows:

$$\Delta\widehat{\log wage} = (\hat{\beta_{x^*}} + \hat{\lambda_{x^*}})\Delta x^*. \tag{4.2}$$

For stayers, the partial effect of x^* is as follows:

$$\Delta\widehat{\log wage} = \hat{\beta_{x^*}}\Delta x^*. \tag{4.3}$$

Finally, the model with interactions allows me to test the differences in estimates between movers and stayers. The partial effect for the difference between movers and stayers of x^* is as follows:

$$\Delta \widehat{\log wage} = \hat{\lambda_{x^*}} \Delta x^*. \tag{4.4}$$

The results tables that follow report the coefficient estimates from this OLS framework. I model wages separately both before and after the recession.

Table 4.4.
Wage Regression Estimates, 2003-2008

	(1)	(2)	(3)
Variable	Mover = 1	Mover = 0	Difference = (1) - (2)
constant	1.271***	1.240***	0.030
	(0.240)	(0.058)	(0.247)
overeducated	-0.095**	-0.124***	0.029
	(0.045)	(0.009)	(0.046)
age	0.053***	0.050***	0.004
	(0.009)	(0.002)	(0.009)
female	-0.175***	-0.099***	-0.076*
	(0.044)	(0.009)	(0.045)
married	0.041	0.055***	-0.014
	(0.055)	(0.011)	(0.057)
children	0.019	0.024*	-0.005
	(0.081)	(0.012)	(0.082)
black	0.025	-0.064***	0.089
	(0.085)	(0.015)	(0.086)
immigrant	0.107	-0.018	0.124
	(0.084)	(0.016)	(0.086)
hispanic	-0.057	-0.095***	0.038
	(0.082)	(0.015)	(0.083)
boomerang	0.214***	-0.121***	0.335***
	(0.075)	(0.013)	(0.076)
metro	0.138*	0.176***	-0.038
	(0.074)	(0.014)	(0.075)
coastal	0.108**	0.107***	0.001
	(0.044)	(0.009)	(0.045)
observations	21,530		
no. of subjects	37,219,000		
r-squared	0.117		

Robust standard errors in parentheses. Probability weighted based on the IPUMS CPS variable "wtsupp". ***, **, and * refer to significance at the 0.01, 0.05, and 0.1 levels, respectively.

Table 4.4 provides OLS regression estimates from observations corresponding to the years before 2009. Column (1) values are calculated in the manner of Equation 4.2 for each $x^* \in \boldsymbol{x}$. Column (2) values are calculated in the manner of Equation 4.3, and column (3) values are calculated in the manner of Equation 2.8. Two separate regression models are run to obtain all of the estimates and standard errors. First, the model is run as outlined in Equation 4.1, specified for the movers, yielding the stayer (column (2)) and difference (column (3)) partial effect estimates. Then, an analogous model is run which is specified for the stayers,

$$\log wage = \alpha stayer_i + \boldsymbol{x_i}\boldsymbol{\beta} + (stayer_i \times \boldsymbol{x_i})\,\boldsymbol{\lambda}, \tag{4.5}$$

where "stayer" = 0 wherever "mover" = 1 and "stayer" = 1 wherever "mover" = 0. The slightly varied specification in Equation 4.5 yields the mover (column (1)) partial effect estimates.

With probability weighting, it is not possible to test for heteroskedasticity (probability weights in and of themselves are a measure to correct for varied error terms among observations). However, I take the step of running a Breusch-Pagan test for heteroskedasticity on the unweighted sample. This test rejects the null hypothesis for homoskedasticity. However, with survey data the test is very sensitive to outliers. I also plotted the residuals from the unweighted sample, and they appear to have no trend. Since models run with probability weighted data automatically generate heteroskedasticity robust standard errors, those are the standard errors I use in my OLS wage model.

In accordance with the model specification (with log wage as the dependent variable) coefficients are interpreted as percentage changes in wage. The statistics are computed using the weighted value of 37.2 million subjects. In light of this study's hypotheses, the results beget a number of interesting findings.

For one, women earn significantly lower wages than men. This is true among people who move for job reasons (reported in column 1), as well as those who do not (column 2). However, the depression of wages is larger for women who move.

This suggests job migration itself is not correlated with wage benefits for women, an implication that is reaffirmed by the negative and significant difference term reported in column 3. The model indicates job-moving women endure wage deficits of 7.6 percent relative to other women. A possible interpretation of this statistic involves an amenity preference (Bakens and Nijkamp, 2013) among women who move. In the migration/relocation process, a strong enough preference for amenities could be associated with a decreased emphasis on other factors – namely, job quality. In this manner, women who ostensibly move primarily for "job reasons" could actually be accepting worse terms of employment in favor of better amenities. Given that the CPS dataset only includes information on individuals' primary reasons for moving, it necessarily ignores all other factors. However, these factors, despite not being "primary", can still be influential in migration decisions. This is a reflection of two aspects of the study of migration: its inherent, confounding life-course aspects and the paucity of data that can be used to address them.

Another variable with a significant difference column estimate is "boomerang". Boomerang movers, i.e. people living with their parents who have migrated for job reasons, are subject to wages that are 21.4 percent higher than those received by individuals not living with their parents. Conversely, people living with their parents who have not moved for job reasons in the past year garner significantly lower wages than other stayers by a measure of 12.1 percent. The difference term reported in column 3 is positive and highly significant, indicating a 33.5 percent wage differential between job-moving and non-job-moving children of household heads. Non-job reasons for moving include housing, health, and family considerations. It is logical that an individual moving in with his or her parent/s for one of those reasons would put less emphasis on negotiating a high wage.

The remaining variables do not yield coefficients that are significantly different positively or negatively across job mobility. Despite this, there are more interesting results to be analyzed. For example, urban wage premiums of more than 10 percent can be observed for both movers and stayers living in metropolitan areas. Similarly,

there are significant pecuniary benefits associated with living in more economically active (or "coastal") states. These benefits amount to roughly 11 percent higher wages among both movers and stayers in the CPS sample. Hispanics and black stayers suffer relatively low wages, suggesting some amount of wage discrimination along racial and ethnic lines before the recession. From the model estimates, I cannot conclusively say that job migration is associated with improvements in this dimension. While the difference terms for "black" and "hispanic" are positive, they are not statistically significant. People who are married or have children, but do not exhibit job mobility, experience comparatively high wage earnings. This could be a reflection of relatively long job tenure among individuals with strong familial or cultural ties to a location. Lastly, regardless of mobility, overeducation tends to dampen wages while age increases them. Looking broadly at these results, it is clear that many of them are akin to the findings of traditional wage inequality studies.

Table 4.5 is the post-recession analogue to Table 4.4, presenting OLS regression estimates for the wage equation describing observations from 2010 onward. The estimates presented in the table result from running a regression framework identical to that outlined in Equations 4.1 and 4.5, only for post-recession observations. As a result, columns (1), (2), and (3) in Table 4.5 are the result of computations carried out as described in Equations 4.2, 4.3, and 4.4, respectively. A weighted value of roughly 28.0 million subjects is used for the computation. In the period after the recession, a single variable exhibits a statistically significant difference across job-related mobility, namely "immigrant". Decomposing this difference term, the effect is coming primarily from the relative wage premiums observed among immigrants who move. From column 2, immigrant stayers appear to earn less than other stayers, but the magnitude is small and the estimate lacks statistical significance. On the other hand, job-moving immigrants earn wages that are more than 21 percent higher than other movers. Differencing the two estimates results in a 22.2 percent wage bonus correlated with job mobility among immigrants after the recession. This coefficient is highly statistically significant. In the United States, immigrants often live

Table 4.5.
Wage Regression Estimates, 2010-2013

	(1)	(2)	(3)
Variable	Mover = 1	Mover = 0	Difference = (1) - (2)
constant	1.153***	1.411***	-0.258
	(0.352)	(0.069)	(0.359)
overeducated	-0.088	-0.160***	0.072
	(0.054)	(0.010)	(0.055)
age	0.050***	0.044***	0.006
	(0.013)	(0.002)	(0.013)
female	-0.096*	-0.121***	0.025
	(0.056)	(0.011)	(0.057)
married	0.045	0.045***	0.000
	(0.070)	(0.013)	(0.071)
children	-0.066	0.005	-0.071
	(0.089)	(0.014)	(0.090)
black	-0.065	-0.099***	0.034
	(0.120)	(0.018)	(0.121)
immigrant	0.214**	-0.009	0.222***
	(0.083)	(0.018)	(0.085)
hispanic	-0.121	-0.085***	-0.036
	(0.088)	(0.018)	(0.089)
boomerang	-0.018	-0.110***	0.092
	(0.127)	(0.016)	(0.128)
metro	0.259***	0.150***	0.110
	(0.079)	(0.018)	(0.081)
coastal	0.093	0.088***	0.005
	(0.057)	(0.011)	(0.058)
observations	15,625		
no. of subjects	27,968,000		
r-squared	0.109		

robust standard errors in parentheses. probability weighted based on the IPUMS CPS variable "wtsupp". ***, **, and * refer to significance at the 0.01, 0.05, and 0.1 levels, respectively.

in "enclaves" with other immigrants to take advantage of benefits related to support and assimilation into U.S. culture. Moreover, there is evidence that enclave assimilation benefits accrue to highly educated immigrants more than to those with low educational attainment (Duncan and Waldorf, 2009). With that in mind, the college

educated immigrants in the sample could be heavily reliant on their immigrant enclaves. For a given immigrant this reliance would engender reluctance to leave the enclave, raising his or her "mobility reservation wage", or the wage required to move to a new area for employment. In this scenario, only the prospect of very high wages could incentivize immigrants to move for job reasons. Naturally, the immigrants who go on to exhibit job mobility in this scenario would garner wages that are relatively high.

Table 4.5 provides evidence for other important results. Age is once again shown to positively affect wages among young college graduates. An additional year of age results in a statistically significant wage premium between 4 and 5 percent. Overeducated stayers experience reduced wages by 16 percent relative to stayers who are at most adequately educated. This estimate is highly significant. A gender pay gap appears to exist, with women earning significantly less than men. Female stayers suffer wage deficits of 12.1 percent relative to male stayers, with high statistical significance. To a lesser degree of significance, women who move for job reasons have lower wages than comparable men by 9.6 percent. In results mirroring those before the recession, married stayers earn relatively good wages, while black and Hispanic stayers receive low earnings. Statistical significance is high among these coefficient estimates. Boomerang movers do not receive any wage advantages after the recession. In fact, boomerang movers who are not job-mobile face wage earnings that are lower by 11 percent. Post-recession urban wage premiums are high, at 25.9 percent for movers and 15.0 percent for stayers. And finally, "coastal" stayers earn 8.8 percent more than stayers in less economically active regions.

4.5 Conclusion

In this chapter, I have analyzed wages among individuals in the early stages of post-university employment. I use samples of young United States college graduates. Several personal and locational variables are present in the regression analysis, for ex-

ample race, age, ethnicity, immigrant and marital status, and metropolitan residency. The wage modeling is centered on the distinctions between moving for job reasons and staying, and the period of time before and after the recent global recession. As such, I stratify the samples based on these variables, and model differences across mobility and time.

Some key findings have arisen. Job mobility correlates strongly with wages of young college graduates belonging to certain demographic groups. In particular, it has a significant positive correlation with wages among boomerang movers before the recession and immigrants after the recession. On the other hand, it has a significant negative correlation with wage for women before the recession, perhaps due to amenity preference effects. However, the anticipated evidence for a broad-ranging job mobility correlation is not found. In the case of young college graduates, it seems demographics are a much more important factor in wages outcomes. Accordingly, I find in favor of urban wage premiums, the wage benefits of ageing, and gender and racial pay gaps, before and after the recession.

Given that migration is inherently a major life-course decision, a number of possible confounding factors exist and are not directly addressed in this study's wage models. For one, movers in this analysis could be self-selecting. In this scenario, an individual's propensity to move for job reasons could depend on inherent skills that I do not measure. This would bias the analysis' estimates for the association between job mobility and wages. It is important to bear this in mind when interpreting the results of these models. While they do provide some evidence on the aforementioned correlation, they should be taken with caution.

In a labor market context, migration is often thought of as an investment. As such, individuals needing higher entry-level wages to help defray college debt burdens may consider migration as a solution. For them, this study has interesting implications. Broadly, the results suggest migration for a job's sake may not be an effective route. In all likelihood, an individual's own personal characteristics will play a larger role in determining the entry-level wage he or she earns.

Future research would benefit from improved data. For one, more granular spatial data on residence before and after migration would be useful. This would allow for a more precise measure of job mobility. For another, data on amenities and the level of urbanization for residences could be useful for parsing out the effect of the amenity preference. Finally, added data on immigrants could allow for measurement of their reliance on enclaves, enabling one to account for its possible impact on the reservation wage individuals require in order to move for job reasons.

CHAPTER 5. CONCLUSION

5.1 Analyzing Graduate Labor Market Outcomes in the Presence of Job Mobility

United States college graduates currently in their early stages of labor market participation face strong competition, pressure from third parties, and a weak economy, among other challenges. Undergraduate enrollment has risen from 13.2 million students in 2000 to 18.1 million in 2011, and is projected to grow more Autor et al. (2008). A related phenomenon is the marked increase in the number of postsecondary degrees awarded by U.S. institutions. Measured from the academic year of 2000 to 2001 until the academic year 2010 to 2011, the number of bachelor's degrees awarded rose by 37.9 percent Autor et al. (2008). These increases come in spite of the fact that graduates are saddled by an historical amount of student loan debt, both individually and collectively. Housing prices are rebounding from recessionary troughs, and are once again approaching all-time highs. Universities themselves are putting increased emphasis on immediate job success for graduates. Individuals who do not balance considerations for overall career earnings and future unemployment in their initial job choices may suffer in the long run. Finally, the great recession of 2008 has heaped added importance upon all of these factors. Taken together, present conditions make for an extremely competitive labor market for young graduates. As a result, migration to access new labor markets arises as a likely option for improving outcomes. U.S. college graduates who are able to leverage migration to pursue jobs at the national level are likely to see improved labor market performances relative to those who cannot.

The goal of this thesis is to measure the correlation between job mobility and labor market outcomes, with special considerations for the great recession and demographic

variation among graduate workers. I select three separate labor market outcomes as dependent variables in these analyses: unemployment duration, overeducation, and wages. To make comparisons of unemployment durations across job migration behaviors, I use two related event history analysis techniques, namely Kaplan-Meier estimation and Cox Proportional Hazards modeling. Based on actual unemployment durations graduates have experienced within a given year, I model durations in terms of hazard ratios of exiting unemployment, i.e. finding a job. I conduct analysis on overeducation by constructing a measure of overeducation based on employment requirements assessed by the United States Bureau of Labor Statistics, and estimating a logit regression model with this overeducation variable as the dependent. I also examine wages for the sample of college graduates, while controlling for the measure of overeducation previously constructed. In each of the regression analyses, I make use of an interaction term framework in order to directly test differences in coefficient estimates across job mobility for individuals.

5.2 The Impacts of Job Mobility before and after the Great Recession

Broadly, unemployment durations are found to vary when compared across job mobility. I find strong evidence for significant differences when comparing Kaplan-Meier survival curves for movers versus stayers. Specifically, the Kaplan-Meier estimation indicates movers in the overall sample experience shorter durations of unemployment. Strong statistical significance also is found for differences among observations from before versus after the great recession, with individuals pre-recession enduring shorter unemployment spells. Looking only at individuals prior to the recession (before 2009 in this study's sample data), I find some evidence that moving is associated with quicker unemployment exits. After the recession, evidence that movers are quicker to exit unemployment is strong. Taken together, these results suggest that job mobility correlates positively with labor market performance, and that this correlation is reinforced in the looser post-recession labor market.

I also incorporate controls for relevant demographic and locational confounders using Cox Proportional Hazards modeling. This analysis yields a number of additional conclusions related to the unemployment duration-job mobility association for young highly educated individuals. The association is largely shown not to vary based on demographic characteristics. However, there is strong evidence that women who move for job reasons perform worse in relative unemployment duration terms than women who do not. Additionally, weak evidence surfaces that mobile Hispanic individuals face longer unemployment durations than Hispanics who stay, relative to other individuals in the sample. Relative to movers overall (aside from the aforementioned women and Hispanics), boomerang movers who live with their parents after college graduation experience exceptionally long unemployment durations. For stayers, individuals experience decreased hazard rates of exiting unemployment as they age, and if they live in the most economically active (generally coastal) regions of the United States. White graduates who stay do well relative to their counterparts of other races. After the recession, a similar general effect of relatively worse labor market performance among women who move for job reasons is strongly evidenced. Movers are observed to perform similarly across the board. For stayers, the age, race, and ethnicity effects mimic those observed before the recession. Additionally, stayers with children after the recession perform relatively poorly.

Like the duration of unemployment, overeducation propensity exhibits differences across job mobility. Interpretation of the results of the logit model with interaction terms requires conditioning upon specific "baskets" of individual personal characteristics. For some of these selected demographic groups, job mobility is associated with lower overeducation propensities. For example, before and after the great recession, job mobility has a significant negative correlation with overeducation for men who: have no children, are white, partake in boomerang migration, and live in coastal areas.[1] A similar negative correlation is also observed for women with the same

[1]These estimates are also conditional on the individuals being 26 years of age, white, non-Hispanic, non-immigrants who reside in metropolitan areas.

characteristics, but the corresponding estimates generally lack statistical significance. After the recession, both men and women with the aforementioned demographic characteristics are generally observed to have decreased overeducation propensities when they also exhibit job mobility. Statistical significance for the post-recession difference estimates is high. Overall, this suggests that the correlation linking job mobility to decreased overeducation propensity is strengthened by the recent recession.

I find two significant differences in the correlation between wages and job mobility before the recession. First, in relative terms female movers earn significantly lower wages than female stayers. This is evidenced by the estimates, albeit with weak statistical significance. Second, boomerang movers achieve higher earnings than people living with their parents who don't move for job reasons, an estimate which carries high statistical significance. Other demographic variables do not measurably change the correlation between job mobility and wages. Among mobile graduates, higher wages are observed as ages increase, for boomerang movers, and for people living in cities and economically active coastal states, while lower wages exist for women and the overeducated. Ceteris paribus, being older, male, married, a parent, a metro resident, or a coastal resident corresponds to higher wages for stayers before the recession. Wage penalties exist for female stayers and those who are overeducated, as well as for individuals who are black or Hispanic. Post-recession, immigrants experience the greatest benefits associated with job mobility. This result is strongly evidenced, with high statistical significance. Additional estimates mimic those before the recession, with urban and regional wage premiums, wage bonuses for ageing, and wage penalties for being female, overeducated, black, or Hispanic.

Overall, the results lead to some salient takeaways. First, job mobility, by and large, appears to correlate with improved labor market outcomes among young college graduates. I find strong evidence that accessing new labor markets is correlated with reduced unemployment durations and overeducation propensities (among certain demographic groups). The evidence for a linkage between wage improvements and job mobility is, however, less robust. Another key finding of this work is that the great

recession generally worsens labor market outcomes, but, importantly, increases the correlation between job mobility and improved labor market outcomes in some cases. A final conclusion is that previously documented phenomena impacting labor market outcomes persist, often regardless of mobility and the recession. Amenity preference effects seem to dominate for women and individuals who have established families. The labor market benefits of living in urban areas and more active regional economies are clear. Racial and ethnic gaps in labor market success appear to persist. Lastly, evidence for boomerang movers is mixed. Individuals moving in with their parents after college suffer longer unemployment, but end up less likely to be overeducated, and more likely to have high wage earnings.

5.3 Implications of the Labor Market Influence of Job Mobility

In terms of policymaking, it is difficult to say that this study offers any resounding conclusions. Regions and metropolitan areas looking to attract and retain young, highly educated people have many tools at their disposal. As Domina (2006) describes, opinion has historically been divided on whether economic factors or consumer preference factors are more important in inducing migration. This research offers scant resolution to this debate. While I do find some evidence in favor of the influence of economic factors, what I find is only evidence of correlations. I am not able to make any conclusions on causation, namely whether moving for job reasons directly improves labor market outcomes, or whether having improved labor market outcomes results in more job mobility. In fact, I find instances where (for certain demographic groups) job mobility appears to associate with worse labor market outcomes. In these instances, I am left to conclude that consumer preference factors for which I cannot control are confounding and dominating the possible effect (or, at least, the linkage) of economic factors. It is possible that shoring up local job opportunities is a successful strategy for policymakers looking to bolster in-migration

of the young highly educated. However, based on this research, it is also possible that the optimal strategy would be to improve good and service offerings to consumers.

This research may be relevant to individuals preparing to enter the job market can benefit from this study's findings as well. However, it is impossible for me to say whether job mobility is directly a boon to employment outcomes. Despite the lack of a broad conclusion such as that, some of my ancillary results could benefit young college graduates in their efforts toward adequate occupational attainment. For one, metropolitan areas still seem to offer better job opportunities, as do particularly active regional economies. For another, settling for a job for which one is overeducated has a predictable negative impact on wages. Young college graduates able to act upon these results may find themselves in favorable labor market positions.

5.4 Limitations of this Study

This study provides useful evidence for the correlation between job mobility and labor market performance. However, it is not without its caveats. While it is a benefit to have data that describe labor market characteristics of a representative sample of United States residents, it is true that the data are not optimized precisely for the study at hand. Panel data tracking migration history, unemployment, job education requirements, and wages for set individuals over time would be ideal. Additionally, a more pertinent analysis would cover only the initial career-oriented labor market participation of college graduates. It is not possible to achieve this level of nuance with the CPS data used in this study. Another set of issues arises from self-reporting, as well as the possibility of response bias, in CPS data, but this has largely been addressed with survey design improvements over the years Rothstein (2011). As a final note, data allowing for a more precise measure of job-related migration would greatly improve this study. Some of the intercounty or interstate job-related migrations among the observations may not actually result in a change of labor markets. It

would be difficult to achieve this level of granularity in data, but doing so would elevate the level of this work.

5.4.1 A Discussion of Causality and Selection

There are two issues in the data that are worth discussing. The first issue deals with the lack of causal inference in the study, and the second with the selection of individuals into categories of moving or staying. In this study I am interested in looking at the effect that job mobility has on different economic outcomes, such as duration of unemployment, appropriate matching into education requirements of employment, and wages. As previously discussed, this issue is of relevance right now as college graduates are leaving school with ever-growing debt burdens. While I would like to find whether moving has an effect on economic outcomes, with the sample data used in this study I cannot separate whether moving causes an individual to obtain a better job offer, or whether a person moves because they received a better offer elsewhere. For example, while looking at a regression of mobility on wage, I cannot infer whether job mobility led to a higher wage (whereby an individual moves, then finds a good match of a job, and thus receives a high wage) or whether an individual first received an offer for a high-wage job in a different locality, and thus moved in order to take that job. In the second scenario, the higher wage would be causing the move. While this study does not lead to causal inferences, it does lend itself to a study of correlations. Following the previous example, a positive outcome of mobility in the wage equation can be interpreted as a correlation between moving and higher wages.

The second issue is referred to as selection bias. I will illustrate an example based on the material from Chapter 2 of this study, where the topic investigated is the relation between job mobility and the duration of unemployment. I find that higher levels of job mobility are associated with lower levels of unemployment. This could give the impression that being more mobile will lead to a lower number of

unemployed weeks (suggesting that unemployed recent graduates should move for work). However, it is also possible that the reason why I observe such a result is that graduates who are either more motivated, or more innately capable, are selecting themselves into moving. These more-motivated individuals who are moving are less likely to be unemployed. On the other hand, the less-motivated individuals could be likelier to both stay in their home county and be unemployed.

Thinking about mobility as a binary treatment variable $D_i = \{0, 1\}$, equal to 0 if a person stays or 1 if a person moves, and unemployment duration as the outcome variable Y_i, then what I would like to know is whether or not Y_i is associated with mobility. I can observe the unemployment duration status for a person i who has moved (Y_{1i}) or stayed (Y_{0i}), and I would like to know how Y changes for this individual if he or she were to move. Unemployment duration can be written as,

$$Y_i = Y_{0i} + (Y_{1i} - Y_{0i})D_i \tag{5.1}$$

Assuming that inference is possible, then $Y_{1i} - Y_{0i}$ would be the causal effect of moving. Selection bias arises because for an individual who did not move (and vise versa), because the outcome had they moved (or stayed) cannot be captured. Following the reasoning that more capable individuals are likelier to move while less capable individuals are likelier to stay, it is possible to imagine a situation in which a less-motivated or less-capable individual would be worse off had they moved in terms of weeks of unemployment.

While I do not solve this problem in this analysis, it is still an important thought to keep in mind while analyzing the results. If there truly is a problem of sample selection, it would lead to biased estimates. Depending on the chapter of this thesis, this could have a different impact on the analysis. For example, in Chapter 2, the effects of moving would be overstated. As another example, in Chapter 3 I find that after the recession, white men and women who move for job reasons are also less likely to be overeducated. Once again, it could be possible that motivated or capable individuals are selecting themselves into relocation, and are also less likely to

be overeducated. In that case, the effect of mobility would once again be overstated. In Chapter 4, I do not find that moving has a significant impact on income. However, had I found such an effect, I could be finding that more capable individuals are moving and thus earning a higher income exactly because they are more capable.

One way to approach this problem would be to gather data on motivation or capability (which is not available from the CPS) and then use a matching algorithm to compare individuals with the same level of motivation/capability. A matching method estimates the average effect of the treatment variable (e.g. mobility) on the outcome variable (e.g. weeks of unemployment duration), and allows for the comparison of identical (or very similar) individuals along demographic characteristics that only differ along their treatment and outcome variables. The difference in the outcome variable between the treated and untreated is called the sample average treatment effect (SATE). The technique works by estimating the average effect of a binary treatment variable (e.g. job mobility) on a continuous outcome (e.g. an individual's wage earnings). I am unable to observe a person who has both moved for job reasons and stayed, and therefore I cannot directly compare income differences across job mobility for this individual. Instead, the matching framework allows for the comparison of two individuals who are share similar qualities of the other variables measured, but vary in the treatment variable. Given data on capability, I would estimate the association of moving for individuals who have similar levels of capability. If I were to find that, for individuals of similar capability levels, moving still does have an effect on unemployment, then it would be safe to rule out a selection issue.

5.5 Future Research Directions

Accurately characterizing the labor market impacts of job-related migration is no simple task. This thesis is a positive step, but more work remains to be done. This study is based solely on young college graduates in the United States, and the conclusions herein may therefore suffer from a lack of generalizability. Other

developed, not to mention developing, countries may have different labor market and job acquisition minutiae which soften the applicability of the conclusions. Future work should address how job-related migration to spatially distinct labor markets impacts outcomes for highly educated youths in other countries. Furthermore, while we have evidence for the size and direction of job mobility's correlation with labor market outcomes for young U.S. college graduates, it remains to be seen what its impact may be for other population groups. Older college graduates are inherently different from younger ones, meaning job mobility's correlation may apply to them differently. Based on this study's findings, it is also unclear how moving for job reasons correlates with the labor market performance of individuals who do not have college degrees in the U.S. and elsewhere. A final step toward achieving better generalizability involves more directly addressing the time frames during which job mobility is taking place. Time frames are relevant at the individual level, in terms of the specific period of a migrant's life course. They are also relevant in a more general sense, in terms of changes in job migration propensities over time. Ideally, future work would address these issues with panel data tracking a given set of individuals over a longer period of time.

Additionally, in terms of the highly educated, bachelor's degree holders are not the only individuals facing pressure and uncertainty in their early labor market experiences. Interesting results could come from extending this work to advanced and professional degree holders. Parallel to undergraduate enrollment, postbaccalaureate enrollment is increasing at historical levels as well Autor et al. (2008). A logical consequence is higher advanced degree attainment, and associated increases in competition among advanced degree holders. These labor market shifts would make for worthy research fodder.

With access to other datasets, future research could directly address the problems of endogeneity that one encounters when studying job migration. For example, in this research it is unclear whether job mobility is driving changes in unemployment durations, or unemployment durations are driving changes in job mobility. This

endogeneity could perhaps be overcome by a more precise definition of "moving for job reasons". The definition used in this study does not precisely separate people who actually exhibit a willingness to move to outside labor markets for employment (genuine movers) from people who simply move to one faraway location because they happened to get a job there (apparent movers). In addition to ameliorating endogeneity, this change would represent a substantial overall improvement to this line of research. Having an optimal measure of job mobility would logically allow for more accurate measurements of its effects and how it correlates with other variables.

As a final remark, this line of research would benefit substantially from longitudinal data. Incorporating long-term individual level data into the analysis of job mobility and labor market outcomes would improve many of the measurements at hand. Having access to more than a single year's worth of unemployment, education, and wage data for a given individual would be an immediate improvement. Furthermore, the life course nature of migration and its interaction with other key life course events could be better characterized using longitudinal data. Finally, if the data spanned multiple business cycle booms and busts, attempts to quantify recessionary impacts would improve. While the drawbacks of the pooled cross-sectional data do not completely impugn this study's conclusions, there is no doubt that improvements to the research could be realized with matched individual data spanning longer time period.

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APPENDIX

Appendix

Table 1.: CPS Occupations and Typical Education Levels

IPUMS CPS code	CPS occupational title	Typical education needed for entry
10	Chief executives	Bachelor's degree
20	General and operations managers	Bachelor's degree
40	Advertising and promotions managers	Bachelor's degree
50	Marketing and sales managers	Bachelor's degree
60	Public relations and fundraising managers	Bachelor's degree
100	Administrative services managers	Bachelor's degree
110	Computer and information systems managers	Bachelor's degree
120	Financial managers	Bachelor's degree
135	Compensation and benefits managers	Bachelor's degree
136	Human resources managers	Bachelor's degree
137	Training and development managers	Bachelor's degree
140	Industrial production managers	Bachelor's degree
150	Purchasing managers	Bachelor's degree
160	Transportation, storage, and distribution managers	High school diploma or equivalent

205	Farmers, ranchers, and other agricultural managers	High school diploma or equivalent
220	Construction managers	Bachelor's degree
230	Education administrators	Bachelor's degree
300	Architectural and engineering managers	Bachelor's degree
310	Food service managers	High school diploma or equivalent
325	Funeral service managers	Associate's degree
330	Gaming managers	High school diploma or equivalent
340	Lodging managers	High school diploma or equivalent
350	Medical and health services managers	Bachelor's degree
360	Natural sciences managers	Bachelor's degree
410	Property, real estate, and community association managers	High school diploma or equivalent
420	Social and community service managers	Bachelor's degree
425	Emergency management directors	Bachelor's degree
430	Managers, all other	High school diploma or equivalent
500	Agents and business managers of artists, performers, and athletes	Bachelor's degree
510	Buyers and purchasing agents, farm products	High school diploma or equivalent
520	Wholesale and retail buyers, except farm products	High school diploma or equivalent
530	Purchasing agents, except wholesale, retail, and farm products	High school diploma or equivalent
540	Claims adjusters, appraisers, examiners, and investigators	High school diploma or equivalent
565	Compliance officers	Bachelor's degree

600	Cost estimators	Bachelor's degree
630	Human resources workers	Bachelor's degree
640	Compensation, benefits, and job analysis specialists	Bachelor's degree
650	Training and development specialists	Bachelor's degree
700	Logisticians	Bachelor's degree
710	Management analysts	Bachelor's degree
725	Meeting, convention, and event planners	Bachelor's degree
726	Fundraisers	Bachelor's degree
735	Market research analysts and marketing specialists	Bachelor's degree
740	Business operations specialists, all other	High school diploma or equivalent
800	Accountants and auditors	Bachelor's degree
810	Appraisers and assessors of real estate	Bachelor's degree
820	Budget analysts	Bachelor's degree
830	Credit analysts	Bachelor's degree
840	Financial analysts	Bachelor's degree
850	Personal financial advisors	Bachelor's degree
860	Insurance underwriters	Bachelor's degree
900	Financial examiners	Bachelor's degree
910	Credit counselors and loan officers	Bachelor's degree
930	Tax examiners and collectors, and revenue agents	Bachelor's degree

940	Tax preparers	High school diploma or equivalent
950	Financial specialists, all other	Bachelor's degree
1005	Computer and information research scientists	Doctoral or professional degree
1006	Computer systems analysts	Bachelor's degree
1007	Information security analysts	Bachelor's degree
1010	Computer programmers	Bachelor's degree
1020	Software developers, applications and systems software	Bachelor's degree
1030	Web developers	Associate's degree
1050	Computer support specialists	Associate's degree
1060	Database administrators	Bachelor's degree
1105	Network and computer systems administrators	Bachelor's degree
1106	Computer network architects	Bachelor's degree
1107	Computer occupations, all other	Bachelor's degree
1200	Actuaries	Bachelor's degree
1210	Mathematicians	Master's degree
1220	Operations research analysts	Bachelor's degree
1230	Statisticians	Master's degree
1240	Miscellaneous mathematical science occupations	Bachelor's degree
1300	Architects, except naval	Bachelor's degree
1310	Surveyors, cartographers, and photogrammetrists	Bachelor's degree

1320	Aerospace engineers	Bachelor's degree
1330	Agricultural engineers	Bachelor's degree
1340	Biomedical engineers	Bachelor's degree
1350	Chemical engineers	Bachelor's degree
1360	Civil engineers	Bachelor's degree
1400	Computer hardware engineers	Bachelor's degree
1410	Electrical and electronics engineers	Bachelor's degree
1420	Environmental engineers	Bachelor's degree
1430	Industrial engineers, including health and safety	Bachelor's degree
1440	Marine engineers and naval architects	Bachelor's degree
1450	Materials engineers	Bachelor's degree
1460	Mechanical engineers	Bachelor's degree
1500	Mining and geological engineers, including mining safety engineers	Bachelor's degree
1510	Nuclear engineers	Bachelor's degree
1520	Petroleum engineers	Bachelor's degree
1530	Engineers, all other	Bachelor's degree
1540	Drafters	Associate's degree
1550	Engineering technicians, except drafters	Associate's degree
1560	Surveying and mapping technicians	High school diploma or equivalent
1600	Agricultural and food scientists	Bachelor's degree

1610	Biological scientists	Bachelor's degree
1640	Conservation scientists and foresters	Bachelor's degree
1650	Medical scientists	Doctoral or professional degree
1660	Life scientists, all other	Bachelor's degree
1700	Astronomers and physicists	Doctoral or professional degree
1710	Atmospheric and space scientists	Bachelor's degree
1720	Chemists and materials scientists	Bachelor's degree
1740	Environmental scientists and geoscientists	Bachelor's degree
1760	Physical scientists, all other	Bachelor's degree
1800	Economists	Master's degree
1815	Survey researchers	Master's degree
1820	Psychologists	Master's degree
1830	Sociologists	Master's degree
1840	Urban and regional planners	Master's degree
1860	Miscellaneous social scientists and related workers	Master's degree
1900	Agricultural and food science technicians	Associate's degree
1910	Biological technicians	Bachelor's degree
1920	Chemical technicians	Associate's degree
1930	Geological and petroleum technicians	Associate's degree
1940	Nuclear technicians	Associate's degree

1950	Social science research assistants	Associate's degree
1965	Miscellaneous life, physical, and social science technicians	Associate's degree
2000	Counselors	Master's degree
2010	Social workers	Bachelor's degree
2015	Probation officers and correctional treatment specialists	Bachelor's degree
2016	Social and human service assistants	High school diploma or equivalent
2025	Miscellaneous community and social service specialists, including health educators and community health workers	Bachelor's degree
2040	Clergy	Bachelor's degree
2050	Directors, religious activities and education	Bachelor's degree
2060	Religious workers, all other	Bachelor's degree
2100	Lawyers, judges, magistrates, and other judicial workers	Doctoral or professional degree
2105	Judicial law clerks	Doctoral or professional degree
2145	Paralegals and legal assistants	Associate's degree
2160	Miscellaneous legal support workers	High school diploma or equivalent
2200	Postsecondary teachers	Doctoral or professional degree
2300	Preschool and kindergarten teachers	Bachelor's degree
2310	Elementary and middle school teachers	Bachelor's degree
2320	Secondary school teachers	Bachelor's degree
2330	Special education teachers	Bachelor's degree
2340	Other teachers and instructors	Bachelor's degree

2400	Archivists, curators, and museum technicians	Master's degree
2430	Librarians	Master's degree
2440	Library technicians	Postsecondary non-degree award
2540	Teacher assistants	Some college, no degree
2550	Other education, training, and library workers	Bachelor's degree
2600	Artists and related workers	High school diploma or equivalent
2630	Designers	Bachelor's degree
2700	Actors	Some college, no degree
2710	Producers and directors	Bachelor's degree
2720	Athletes, coaches, umpires, and related workers	High school diploma or equivalent
2740	Dancers and choreographers	High school diploma or equivalent
2750	Musicians, singers, and related workers	High school diploma or equivalent
2760	Entertainers and performers, sports and related workers, all other	High school diploma or equivalent
2800	Announcers	Bachelor's degree
2810	News analysts, reporters and correspondents	Bachelor's degree
2825	Public relations specialists	Bachelor's degree
2830	Editors	Bachelor's degree
2840	Technical writers	Bachelor's degree
2850	Writers and authors	Bachelor's degree
2860	Miscellaneous media and communication workers	High school diploma or equivalent

2900	Broadcast and sound engineering technicians and radio operators	Associate's degree
2910	Photographers	High school diploma or equivalent
2920	Television, video, and motion picture camera operators and editors	Bachelor's degree
2960	Media and communication equipment workers, all other	High school diploma or equivalent
3000	Chiropractors	Doctoral or professional degree
3010	Dentists	Doctoral or professional degree
3030	Dietitians and nutritionists	Bachelor's degree
3040	Optometrists	Doctoral or professional degree
3050	Pharmacists	Doctoral or professional degree
3060	Physicians and surgeons	Doctoral or professional degree
3110	Physician assistants	Master's degree
3120	Podiatrists	Doctoral or professional degree
3140	Audiologists	Doctoral or professional degree
3150	Occupational therapists	Master's degree
3160	Physical therapists	Doctoral or professional degree
3200	Radiation therapists	Associate's degree
3210	Recreational therapists	Bachelor's degree
3220	Respiratory therapists	Associate's degree
3230	Speech-language pathologists	Master's degree
3235	Exercise physiologists	Bachelor's degree

3245	Therapists, all other	Bachelor's degree
3250	Veterinarians	Doctoral or professional degree
3255	Registered nurses	Associate's degree
3256	Nurse anesthetists	Master's degree
3257	Nurse midwives	Master's degree
3258	Nurse practitioners	Master's degree
3260	Health diagnosing and treating practitioners, all other	Master's degree
3300	Clinical laboratory technologists and technicians	Bachelor's degree
3310	Dental hygienists	Associate's degree
3320	Diagnostic related technologists and technicians	Associate's degree
3400	Emergency medical technicians and paramedics	Postsecondary non-degree award
3420	Health practitioner support technologists and technicians	Associate's degree
3500	Licensed practical and licensed vocational nurses	Postsecondary non-degree award
3510	Medical records and health information technicians	Postsecondary non-degree award
3520	Opticians, dispensing	High school diploma or equivalent
3535	Miscellaneous health technologists and technicians	High school diploma or equivalent
3540	Other healthcare practitioners and technical occupations	Bachelor's degree
3600	Nursing, psychiatric, and home health aides	High school diploma or equivalent
3610	Occupational therapy assistants and aides	Associate's degree
3620	Physical therapist assistants and aides	Associate's degree

3630	Massage therapists	Postsecondary non-degree award
3640	Dental assistants	Postsecondary non-degree award
3645	Medical assistants	Postsecondary non-degree award
3646	Medical transcriptionists	Postsecondary non-degree award
3647	Pharmacy aides	High school diploma or equivalent
3648	Veterinary assistants and laboratory animal caretakers	High school diploma or equivalent
3649	Phlebotomists	Postsecondary non-degree award
3655	Healthcare support workers, all other, including medical equipment preparers	High school diploma or equivalent
3700	First-line supervisors of correctional officers	High school diploma or equivalent
3710	First-line supervisors of police and detectives	High school diploma or equivalent
3720	First-line supervisors of fire fighting and prevention workers	Postsecondary non-degree award
3730	First-line supervisors of protective service workers, all other	High school diploma or equivalent
3740	Firefighters	Postsecondary non-degree award
3750	Fire inspectors	High school diploma or equivalent
3800	Bailiffs, correctional officers, and jailers	High school diploma or equivalent
3820	Detectives and criminal investigators	High school diploma or equivalent
3830	Fish and game wardens	High school diploma or equivalent
3840	Parking enforcement workers	High school diploma or equivalent
3850	Police and sheriff's patrol officers	High school diploma or equivalent
3860	Transit and railroad police	High school diploma or equivalent

3900	Animal control workers	High school diploma or equivalent
3910	Private detectives and investigators	High school diploma or equivalent
3930	Security guards and gaming surveillance officers	High school diploma or equivalent
3940	Crossing guards	High school diploma or equivalent
3945	Transportation security screeners	High school diploma or equivalent
3955	Lifeguards and other recreational, and all other protective service workers	High school diploma or equivalent
4000	Chefs and head cooks	High school diploma or equivalent
4010	First-line supervisors of food preparation and serving workers	High school diploma or equivalent
4020	Cooks	Less than high school
4030	Food preparation workers	Less than high school
4040	Bartenders	Less than high school
4050	Combined food preparation and serving workers, including fast food	Less than high school
4060	Counter attendants, cafeteria, food concession, and coffee shop	Less than high school
4110	Waiters and waitresses	Less than high school
4120	Food servers, nonrestaurant	Less than high school
4130	Dining room and cafeteria attendants and bartender helpers	Less than high school
4140	Dishwashers	Less than high school
4150	Hosts and hostesses, restaurant, lounge, and coffee shop	Less than high school
4160	Food preparation and serving related workers, all other	Less than high school
4200	First-line supervisors of housekeeping and janitorial workers	High school diploma or equivalent

4210	First-line supervisors of landscaping, lawn service, and groundskeeping workers	High school diploma or equivalent
4220	Janitors and building cleaners	Less than high school
4230	Maids and housekeeping cleaners	Less than high school
4240	Pest control workers	High school diploma or equivalent
4250	Grounds maintenance workers	Less than high school
4300	First-line supervisors of gaming workers	High school diploma or equivalent
4320	First-line supervisors of personal service workers	High school diploma or equivalent
4340	Animal trainers	High school diploma or equivalent
4350	Nonfarm animal caretakers	Less than high school
4400	Gaming services workers	High school diploma or equivalent
4410	Motion picture projectionists	Less than high school
4420	Ushers, lobby attendants, and ticket takers	Less than high school
4430	Miscellaneous entertainment attendants and related workers	High school diploma or equivalent
4460	Embalmers and funeral attendants	Postsecondary non-degree award
4465	Morticians, undertakers, and funeral directors	Associate's degree
4500	Barbers	Postsecondary non-degree award
4510	Hairdressers, hairstylists, and cosmetologists	Postsecondary non-degree award
4520	Miscellaneous personal appearance workers	Postsecondary non-degree award
4530	Baggage porters, bellhops, and concierges	High school diploma or equivalent
4540	Tour and travel guides	High school diploma or equivalent

4600	Childcare workers	High school diploma or equivalent
4610	Personal care aides	Less than high school
4620	Recreation and fitness workers	Bachelor's degree
4640	Residential advisors	High school diploma or equivalent
4650	Personal care and service workers, all other	High school diploma or equivalent
4700	First-line supervisors of retail sales workers	High school diploma or equivalent
4710	First-line supervisors of non-retail sales workers	High school diploma or equivalent
4720	Cashiers	Less than high school
4740	Counter and rental clerks	Less than high school
4750	Parts salespersons	Less than high school
4760	Retail salespersons	Less than high school
4800	Advertising sales agents	High school diploma or equivalent
4810	Insurance sales agents	High school diploma or equivalent
4820	Securities, commodities, and financial services sales agents	Bachelor's degree
4830	Travel agents	High school diploma or equivalent
4840	Sales representatives, services, all other	High school diploma or equivalent
4850	Sales representatives, wholesale and manufacturing	Bachelor's degree
4900	Models, demonstrators, and product promoters	High school diploma or equivalent
4920	Real estate brokers and sales agents	High school diploma or equivalent
4930	Sales engineers	Bachelor's degree

4940	Telemarketers	Less than high school
4950	Door-to-door sales workers, news and street vendors, and related workers	High school diploma or equivalent
4965	Sales and related workers, all other	High school diploma or equivalent
5000	First-line supervisors of office and administrative support workers	High school diploma or equivalent
5010	Switchboard operators, including answering service	High school diploma or equivalent
5020	Telephone operators	High school diploma or equivalent
5030	Communications equipment operators, all other	High school diploma or equivalent
5100	Bill and account collectors	High school diploma or equivalent
5110	Billing and posting clerks	High school diploma or equivalent
5120	Bookkeeping, accounting, and auditing clerks	High school diploma or equivalent
5130	Gaming cage workers	High school diploma or equivalent
5140	Payroll and timekeeping clerks	High school diploma or equivalent
5150	Procurement clerks	High school diploma or equivalent
5160	Tellers	High school diploma or equivalent
5165	Financial clerks, all other	High school diploma or equivalent
5200	Brokerage clerks	High school diploma or equivalent
5210	Correspondence clerks	High school diploma or equivalent
5220	Court, municipal, and license clerks	High school diploma or equivalent
5230	Credit authorizers, checkers, and clerks	High school diploma or equivalent
5240	Customer service representatives	High school diploma or equivalent

5250	Eligibility interviewers, government programs	High school diploma or equivalent
5260	File clerks	High school diploma or equivalent
5300	Hotel, motel, and resort desk clerks	High school diploma or equivalent
5310	Interviewers, except eligibility and loan	High school diploma or equivalent
5320	Library assistants, clerical	High school diploma or equivalent
5330	Loan interviewers and clerks	High school diploma or equivalent
5340	New accounts clerks	High school diploma or equivalent
5350	Order clerks	High school diploma or equivalent
5360	Human resources assistants, except payroll and timekeeping	High school diploma or equivalent
5400	Receptionists and information clerks	High school diploma or equivalent
5410	Reservation and transportation ticket agents and travel clerks	High school diploma or equivalent
5420	Information and record clerks, all other	High school diploma or equivalent
5500	Cargo and freight agents	High school diploma or equivalent
5510	Couriers and messengers	High school diploma or equivalent
5520	Dispatchers	High school diploma or equivalent
5530	Meter readers, utilities	High school diploma or equivalent
5540	Postal service clerks	High school diploma or equivalent
5550	Postal service mail carriers	High school diploma or equivalent
5560	Postal service mail sorters, processors, and processing machine operators	High school diploma or equivalent
5600	Production, planning, and expediting clerks	High school diploma or equivalent

5610	Shipping, receiving, and traffic clerks	High school diploma or equivalent
5620	Stock clerks and order fillers	Less than high school
5630	Weighers, measurers, checkers, and samplers, recordkeeping	High school diploma or equivalent
5700	Secretaries and administrative assistants	High school diploma or equivalent
5800	Computer operators	High school diploma or equivalent
5810	Data entry keyers	High school diploma or equivalent
5820	Word processors and typists	High school diploma or equivalent
5830	Desktop publishers	Associate's degree
5840	Insurance claims and policy processing clerks	High school diploma or equivalent
5850	Mail clerks and mail machine operators, except postal service	High school diploma or equivalent
5860	Office clerks, general	High school diploma or equivalent
5900	Office machine operators, except computer	High school diploma or equivalent
5910	Proofreaders and copy markers	Bachelor's degree
5920	Statistical assistants	Bachelor's degree
5940	Office and administrative support workers, all other	High school diploma or equivalent
6005	First-line supervisors of farming, fishing, and forestry workers	High school diploma or equivalent
6010	Agricultural inspectors	Bachelor's degree
6020	Animal breeders	High school diploma or equivalent
6040	Graders and sorters, agricultural products	Less than high school
6050	Miscellaneous agricultural workers	Less than high school

6100	Fishers and related fishing workers	Less than high school
6110	Hunters and trappers	Less than high school
6120	Forest and conservation workers	High school diploma or equivalent
6130	Logging workers	High school diploma or equivalent
6200	First-line supervisors of construction trades and extraction workers	High school diploma or equivalent
6210	Boilermakers	High school diploma or equivalent
6220	Brickmasons, blockmasons, and stonemasons	High school diploma or equivalent
6230	Carpenters	High school diploma or equivalent
6240	Carpet, floor, and tile installers and finishers	High school diploma or equivalent
6250	Cement masons, concrete finishers, and terrazzo workers	Less than high school
6260	Construction laborers	Less than high school
6300	Paving, surfacing, and tamping equipment operators	High school diploma or equivalent
6310	Pile-driver operators	High school diploma or equivalent
6320	Operating engineers and other construction equipment operators	High school diploma or equivalent
6330	Drywall installers, ceiling tile installers, and tapers	Less than high school
6355	Electricians	High school diploma or equivalent
6360	Glaziers	High school diploma or equivalent
6400	Insulation workers	Less than high school
6420	Painters, construction and maintenance	Less than high school
6430	Paperhangers	High school diploma or equivalent

6440	Pipelayers, plumbers, pipefitters, and steamfitters	High school diploma or equivalent
6460	Plasterers and stucco masons	Less than high school
6500	Reinforcing iron and rebar workers	High school diploma or equivalent
6515	Roofers	Less than high school
6520	Sheet metal workers	High school diploma or equivalent
6530	Structural iron and steel workers	High school diploma or equivalent
6540	Solar photovoltaic installers	High school diploma or equivalent
6600	Helpers, construction trades	Less than high school
6660	Construction and building inspectors	High school diploma or equivalent
6700	Elevator installers and repairers	High school diploma or equivalent
6710	Fence erectors	High school diploma or equivalent
6720	Hazardous materials removal workers	High school diploma or equivalent
6730	Highway maintenance workers	High school diploma or equivalent
6740	Rail-track laying and maintenance equipment operators	High school diploma or equivalent
6750	Septic tank servicers and sewer pipe cleaners	Less than high school
6765	Miscellaneous construction and related workers	High school diploma or equivalent
6800	Derrick, rotary drill, and service unit operators, oil, gas, and mining	Less than high school
6820	Earth drillers, except oil and gas	High school diploma or equivalent
6830	Explosives workers, ordnance handling experts, and blasters	High school diploma or equivalent
6840	Mining machine operators	High school diploma or equivalent

6910	Roof bolters, mining	High school diploma or equivalent
6920	Roustabouts, oil and gas	Less than high school
6930	Helpers–extraction workers	High school diploma or equivalent
6940	Other extraction workers	High school diploma or equivalent
7000	First-line supervisors of mechanics, installers, and repairers	High school diploma or equivalent
7010	Computer, automated teller, and office machine repairers	Some college, no degree
7020	Radio and telecommunications equipment installers and repairers	Associate's degree
7030	Avionics technicians	Associate's degree
7040	Electric motor, power tool, and related repairers	Postsecondary non-degree award
7050	Electrical and electronics installers and repairers, transportation equipment	Postsecondary non-degree award
7100	Electrical and electronics repairers, industrial and utility	Postsecondary non-degree award
7110	Electronic equipment installers and repairers, motor vehicles	Postsecondary non-degree award
7120	Electronic home entertainment equipment installers and repairers	Postsecondary non-degree award
7130	Security and fire alarm systems installers	High school diploma or equivalent
7140	Aircraft mechanics and service technicians	Postsecondary non-degree award
7150	Automotive body and related repairers	High school diploma or equivalent
7160	Automotive glass installers and repairers	High school diploma or equivalent
7200	Automotive service technicians and mechanics	High school diploma or equivalent
7210	Bus and truck mechanics and diesel engine specialists	High school diploma or equivalent
7220	Heavy vehicle and mobile equipment service technicians and mechanics	High school diploma or equivalent

7240	Small engine mechanics	High school diploma or equivalent
7260	Miscellaneous vehicle and mobile equipment mechanics, installers, and repairers	High school diploma or equivalent
7300	Control and valve installers and repairers	High school diploma or equivalent
7315	Heating, air conditioning, and refrigeration mechanics and installers	Postsecondary non-degree award
7320	Home appliance repairers	High school diploma or equivalent
7330	Industrial and refractory machinery mechanics	High school diploma or equivalent
7340	Maintenance and repair workers, general	High school diploma or equivalent
7350	Maintenance workers, machinery	High school diploma or equivalent
7360	Millwrights	High school diploma or equivalent
7410	Electrical power-line installers and repairers	High school diploma or equivalent
7420	Telecommunications line installers and repairers	High school diploma or equivalent
7430	Precision instrument and equipment repairers	High school diploma or equivalent
7440	Wind turbine service technicians	Some college, no degree
7510	Coin, vending, and amusement machine servicers and repairers	High school diploma or equivalent
7520	Commercial divers	Postsecondary non-degree award
7540	Locksmiths and safe repairers	High school diploma or equivalent
7550	Manufactured building and mobile home installers	High school diploma or equivalent
7560	Riggers	High school diploma or equivalent
7600	Signal and track switch repairers	High school diploma or equivalent
7610	Helpers–installation, maintenance, and repair workers	High school diploma or equivalent

7630	Other installation, maintenance, and repair workers	High school diploma or equivalent
7700	First-line supervisors of production and operating workers	Postsecondary non-degree award
7710	Aircraft structure, surfaces, rigging, and systems assemblers	High school diploma or equivalent
7720	Electrical, electronics, and electromechanical assemblers	High school diploma or equivalent
7730	Engine and other machine assemblers	High school diploma or equivalent
7740	Structural metal fabricators and fitters	High school diploma or equivalent
7750	Miscellaneous assemblers and fabricators	High school diploma or equivalent
7800	Bakers	Less than high school
7810	Butchers and other meat, poultry, and fish processing workers	Less than high school
7830	Food and tobacco roasting, baking, and drying machine operators and tenders	Less than high school
7840	Food batchmakers	High school diploma or equivalent
7850	Food cooking machine operators and tenders	High school diploma or equivalent
7855	Food processing workers, all other	Less than high school
7900	Computer control programmers and operators	High school diploma or equivalent
7920	Extruding and drawing machine setters, operators, and tenders, metal and plastic	High school diploma or equivalent
7930	Forging machine setters, operators, and tenders, metal and plastic	High school diploma or equivalent
7940	Rolling machine setters, operators, and tenders, metal and plastic	High school diploma or equivalent
7950	Cutting, punching, and press machine setters, operators, and tenders, metal and plastic	High school diploma or equivalent
7960	Drilling and boring machine tool setters, operators, and tenders, metal and plastic	High school diploma or equivalent

8000	Grinding, lapping, polishing, and buffing machine tool setters, operators, and tenders, metal and plastic	High school diploma or equivalent
8010	Lathe and turning machine tool setters, operators, and tenders, metal and plastic	High school diploma or equivalent
8020	Milling and planing machine setters, operators, and tenders, metal and plastic	High school diploma or equivalent
8030	Machinists	High school diploma or equivalent
8040	Metal furnace operators, tenders, pourers, and casters	High school diploma or equivalent
8060	Model makers and patternmakers, metal and plastic	High school diploma or equivalent
8100	Molders and molding machine setters, operators, and tenders, metal and plastic	High school diploma or equivalent
8120	Multiple machine tool setters, operators, and tenders, metal and plastic	High school diploma or equivalent
8130	Tool and die makers	High school diploma or equivalent
8140	Welding, soldering, and brazing workers	High school diploma or equivalent
8150	Heat treating equipment setters, operators, and tenders, metal and plastic	High school diploma or equivalent
8160	Layout workers, metal and plastic	High school diploma or equivalent
8200	Plating and coating machine setters, operators, and tenders, metal and plastic	High school diploma or equivalent
8210	Tool grinders, filers, and sharpeners	High school diploma or equivalent
8220	Metal workers and plastic workers, all other	High school diploma or equivalent
8250	Prepress technicians and workers	Postsecondary non-degree award
8255	Printing press operators	High school diploma or equivalent
8256	Print binding and finishing workers	High school diploma or equivalent

8300	Laundry and dry-cleaning workers	Less than high school
8310	Pressers, textile, garment, and related materials	Less than high school
8320	Sewing machine operators	Less than high school
8330	Shoe and leather workers and repairers	High school diploma or equivalent
8340	Shoe machine operators and tenders	High school diploma or equivalent
8350	Tailors, dressmakers, and sewers	Less than high school
8360	Textile bleaching and dyeing machine operators and tenders	High school diploma or equivalent
8400	Textile cutting machine setters, operators, and tenders	High school diploma or equivalent
8410	Textile knitting and weaving machine setters, operators, and tenders	High school diploma or equivalent
8420	Textile winding, twisting, and drawing out machine setters, operators, and tenders	High school diploma or equivalent
8430	Extruding and forming machine setters, operators, and tenders, synthetic and glass fibers	High school diploma or equivalent
8440	Fabric and apparel patternmakers	High school diploma or equivalent
8450	Upholsterers	High school diploma or equivalent
8460	Textile, apparel, and furnishings workers, all other	High school diploma or equivalent
8500	Cabinetmakers and bench carpenters	High school diploma or equivalent
8510	Furniture finishers	High school diploma or equivalent
8520	Model makers and patternmakers, wood	High school diploma or equivalent
8530	Sawing machine setters, operators, and tenders, wood	High school diploma or equivalent
8540	Woodworking machine setters, operators, and tenders, except sawing	High school diploma or equivalent

8550	Woodworkers, all other	High school diploma or equivalent
8600	Power plant operators, distributors, and dispatchers	High school diploma or equivalent
8610	Stationary engineers and boiler operators	High school diploma or equivalent
8620	Water and wastewater treatment plant and system operators	High school diploma or equivalent
8630	Miscellaneous plant and system operators	High school diploma or equivalent
8640	Chemical processing machine setters, operators, and tenders	High school diploma or equivalent
8650	Crushing, grinding, polishing, mixing, and blending workers	High school diploma or equivalent
8710	Cutting workers	High school diploma or equivalent
8720	Extruding, forming, pressing, and compacting machine setters, operators, and tenders	High school diploma or equivalent
8730	Furnace, kiln, oven, drier, and kettle operators and tenders	High school diploma or equivalent
8740	Inspectors, testers, sorters, samplers, and weighers	High school diploma or equivalent
8750	Jewelers and precious stone and metal workers	High school diploma or equivalent
8760	Medical, dental, and ophthalmic laboratory technicians	High school diploma or equivalent
8800	Packaging and filling machine operators and tenders	High school diploma or equivalent
8810	Painting workers	High school diploma or equivalent
8830	Photographic process workers and processing machine operators	High school diploma or equivalent
8840	Semiconductor processors	Associate's degree
8850	Adhesive bonding machine operators and tenders	High school diploma or equivalent
8860	Cleaning, washing, and metal pickling equipment operators and tenders	Less than high school

8900	Cooling and freezing equipment operators and tenders	High school diploma or equivalent
8910	Etchers and engravers	High school diploma or equivalent
8920	Molders, shapers, and casters, except metal and plastic	High school diploma or equivalent
8930	Paper goods machine setters, operators, and tenders	High school diploma or equivalent
8940	Tire builders	High school diploma or equivalent
8950	Helpers–production workers	Less than high school
8965	Production workers, all other	High school diploma or equivalent
9000	Supervisors of transportation and material moving workers	High school diploma or equivalent
9030	Aircraft pilots and flight engineers	Bachelor's degree
9040	Air traffic controllers and airfield operations specialists	Associate's degree
9050	Flight attendants	High school diploma or equivalent
9110	Ambulance drivers and attendants, except emergency medical technicians	High school diploma or equivalent
9120	Bus drivers	High school diploma or equivalent
9130	Driver/sales workers and truck drivers	High school diploma or equivalent
9140	Taxi drivers and chauffeurs	Less than high school
9150	Motor vehicle operators, all other	High school diploma or equivalent
9200	Locomotive engineers and operators	High school diploma or equivalent
9230	Railroad brake, signal, and switch operators	High school diploma or equivalent
9240	Railroad conductors and yardmasters	High school diploma or equivalent
9260	Subway, streetcar, and other rail transportation workers	High school diploma or equivalent

9300	Sailors and marine oilers	Less than high school
9310	Ship and boat captains and operators	Bachelor's degree
9330	Ship engineers	Bachelor's degree
9340	Bridge and lock tenders	High school diploma or equivalent
9350	Parking lot attendants	Less than high school
9360	Automotive and watercraft service attendants	Less than high school
9410	Transportation inspectors	High school diploma or equivalent
9415	Transportation attendants, except flight attendants	High school diploma or equivalent
9420	Other transportation workers	High school diploma or equivalent
9500	Conveyor operators and tenders	Less than high school
9510	Crane and tower operators	High school diploma or equivalent
9520	Dredge, excavating, and loading machine operators	Less than high school
9560	Hoist and winch operators	Less than high school
9600	Industrial truck and tractor operators	Less than high school
9610	Cleaners of vehicles and equipment	Less than high school
9620	Laborers and freight, stock, and material movers, hand	Less than high school
9630	Machine feeders and offbearers	Less than high school
9640	Packers and packagers, hand	Less than high school
9650	Pumping station operators	Less than high school
9720	Refuse and recyclable material collectors	Less than high school

9730	Mine shuttle car operators	Less than high school
9740	Tank car, truck, and ship loaders	Less than high school
9750	Material moving workers, all other	Less than high school