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The Great Recession and the Effects of Higher Education

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ABSTRACT OF THE DISSERTATION

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This dissertation uses panel data to quantitatively assess the effects of college completion and elite college attendance on individual labor market outcomes during the Great Recession (2007-09). The effects of the Great Recession, the most protracted and severe economic downturn experienced in the U.S. since World War II, were felt unevenly across levels of educational attainment. After controlling for observable precollege variables such as cognitive ability, socioeconomic and demographic background, and high school experiences, substantial treatment effects of college completion remained during the Great Recession, though these were heterogeneous across the type of outcome and across individuals. Disadvantaged individuals benefitted the most from college completion on measures of employment, while more advantaged individuals benefitted greatest from college on measures of job quality. Furthermore, comparing effects of college among young workers who experienced expansionary economic contexts to those who experienced recessionary contexts showed that the

patterns of effects described above were specific to recessionary contexts. Thus, experiencing a recessionary context led to an increase in the effect of college on employment among those least likely to complete college, and an increase in the effect of college on job quality for those most likely to complete college, conditional on employment. These results are consistent with the job competition model of the labor market, which utilizes a labor queue and predicts occupational downgrading at the top of the labor queue and crowding out of employment near the bottom of the labor queue. A similar hypothesis was not supported for the effects of elite college attendance during the Great Recession. The findings of this dissertation suggest that the economic context interacts with the effects of educational attainment on individual labor market outcomes in uneven ways, producing a unique constellation of education effects according to the economic context. Therefore, fluctuations in the business cycle can contribute to the stratification of individuals by affecting their labor market outcomes directly, but also by affecting the relationships between preexisting individual characteristics, educational attainment, and labor market outcomes.

The dissertation of Matthew Curry is approved.

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CHAPTER 1: INTRODUCTION

The Great Recession (2007-09), with its corresponding "jobless recovery," was an unusual and perhaps transformative event in our country's history, extreme in its severity, length, and potential for enduring and wide-ranging effects (Grusky, Wimmer, and Western 2011). The Great Recession caused large losses in employment and increases in poverty, home foreclosures, and welfare program participation. The U.S. government bailed out elements of two of its largest sectors, the automotive and financial industries, and even some municipalities were forced to declare bankruptcy as tax revenues declined faster than spending on public services. As the results of the Great Recession were beginning to be understood, a common storyline in the popular press concerned the adverse effects being experienced by young college graduates. Headlines declared, "1 in 2 new graduates are jobless or unemployed[1]," that the "Current crop of California college grads can't find jobs they want[2]," and even questioned, "In a recession, is college worth it?[3]" These headlines suggest lower returns to college in recessions than in expansions and a breakdown in the link between higher education and upward social mobility. However, the quotes also at least implicitly suggest declining inequality between education levels during times of economic stress, which could have long-term impacts on stratification processes more generally.

[1] Yen, Hope. 2012. "1 in 2 new college graduates are jobless or underemployed." Associated Press.

[2] Reese, Phillip. 2011. "Current Crop of California College Grads Can't Find Jobs They Want." The Sacramento Bee.

[3] Block, Sandra. 2009. "In a recession, is college worth it?" USA Today.

Stratification researchers have, on the other hand, cited statistics showing that less-educated workers suffered greater consequences as a result of the recession than college graduates. While these findings are only associative (Elsby et al. 2010; Hout et al. 2011; Hout 2012; Hoynes, Miller, and Schaller 2012), they suggest increasing inequality between educational groups as a result of a worsening economy. According to these results, large shocks such as the Great Recession may transform societies, leaving them more unequal immediately after their wake, although the long term effects of recessions on educational wage differentials are unclear (Oreopoulos, Wachter, and Heisz 2012).

These contrasting narratives raise a set of questions that have not yet been answered systematically. First, in the context of a recession, how does college completion affect workers, particularly during the early career? Estimates of college effects on socioeconomic outcomes such as income, employment, and occupation, reflect a given population at a particular point in time. While the zero-order difference between high school and college graduates can be ascertained relatively straightforwardly using Census data or other large data sets, attempting to control for selection into college requires more detailed data sources. Thus, one goal of this dissertation is to estimate the effects of college experienced by workers during the Great Recession net of observable pre-college differences. Furthermore, I investigate the heterogeneity of these potential effects, seeing whether certain portions of the sample stood to gain more from a college degree than others during the recession. Second, does a changing economic context actually lead to differences in the effects of college for early career workers? In a poor economy, college completion may act as a buffer, shielding educated workers from the adverse effects. On the other hand, perhaps the increasing wage and employment differentials between high

school and college graduates are due to differences that pre-date differences in educational attainment. To this end, I estimate college effects across states with differing economic contexts for early career workers. Third, did all colleges provide similar returns to students during the Great Recession, or did elite colleges protect students better from the negative consequences of the downturn? With fewer high-quality jobs available, college quality's importance may increase during recessions, leading to effects that may only be significant during economic downturns or other contexts where there are more college graduates than jobs typically suited for college graduates. My dissertation uses propensity score matching methods on longitudinal data to assess, controlling for observable precollege factors, the effects of college on labor market outcomes during and prior to the Great Recession. Additionally, I investigate heterogeneity of these effects across the propensity to undergo the treatment, across cohort (early vs. late career), and across colleges.

The remainder of this chapter provides an overview of the literature on individual college effects, economic context and college effects, and a short history of the Great Recession. Next, I provide an outline of the analytic strategy and data used throughout the dissertation. Finally, I provide a brief outline of the subsequent dissertation chapters.

LABOR MARKET RETURNS TO COLLEGE

Educational attainment is among the most important predictors of socioeconomic outcomes, and is the key driver in upward social mobility (Blau and Duncan 1967). College is especially important for social mobility because it is often the perceived pathway to middle class jobs and economic security. College graduates are more likely

than non-graduates to earn high wages, be steadily employed, and have high status jobs (Hout 2012). However, it is widely known that the selection process into college is not random. Instead, applicants are stratified based on secondary school performance, standardized test scores, and extra-curricular activities, all of which may also be positively associated with labor market outcomes in and of themselves (Brand and Xie 2010; Carneiro, Heckman, and Vytlacil 2011). Because of this non-random selection into college, simple associations between college completion and socioeconomic outcomes do not necessarily suggest that college increases measures of economic well being, *ceteris paribus*. As a result, social scientists have produced a large literature trying to assess the causal returns to college for individual socioeconomic outcomes (Angrist and Krueger 1991; 1992; Brand and Xie 2010; Card 2001; Hout 2012).

Although eventual college graduates differ from eventual non-college graduates on many characteristics, there is strong evidence that college is beneficial to a myriad of socioeconomic outcomes after accounting for selection (Angrist and Krueger 1992; Card 1999; Hout 2012). Some of the important potential confounders that studies of the causal effects of college must account for include demographic and socioeconomic background, cognitive ability, non-cognitive skills, school quality, and measures of aspirations and peer motivation (Brand and Xie 2010; Carneiro et al. 2011; Hout 2012; Sewell, Haller, and Portes 1969). The chief concern among those who question the existence of causal returns to education is often ability (Hout 2012). Math and verbal skills provide advantages both in school and in the labor market (Hout 2012). Therefore, these cognitive abilities confound the positive relationship between, for example, years of schooling and earnings, because those with high levels of cognitive ability are likely to

complete more years of school and also to have high earnings. Furthermore, measures of cognitive ability are often not included in large data sets, as reliable and valid tests measures of ability are time-intensive and expensive to gather. This makes teasing out the true causal relationships between ability, schooling, and labor market outcomes difficult. However, instrumental variable analyses (Angrist and Krueger 1991; 1992; Card 2001) and observational studies that are able to control for some form of cognitive ability (Brand and Xie 2010; Carneiro et al. 2011) have found consistent positive effects of college on labor market outcomes.

Mechanisms for Positive Returns to College

The dominant narrative explaining positive causal effects of college is human capital theory, which posits that individuals with the highest expected return will invest in education because it increases their productive capacity (Becker 1962; Mincer 1958). This increased productivity is then rewarded in the labor market through increased wages and employment. Employers are willing to pay more for college educated workers because college has imparted skills in those workers that make them better, more productive, and more efficient employees.

Alternatively, college may signal to potential employers that a worker is fit for employment, as the most able students persist in the education system to illustrate their productive capacity to future employers (Arrow 1973; Spence 1973; Stiglitz 1975). Under this theory, the education system screens out and disqualifies those with undesirable traits, such as low cognitive ability, low motivation and work ethic, and those who do not persevere through challenges and lack "grit" (Duckworth, Peterson, and

Matthews 2007). Those who complete college despite its rigors signal their high productive capacities to employers by having survived the screening process (Spence 1973). The primary difference between human capital theory and screening or signaling is that in the former, individual productive capacity is actively increased by schooling, whereas in the latter, productive traits are set before an individual completes college or not. In both of these cases, however, wages are based on productivity, with more educated people being more productive, and thus more highly paid.

Under human capital theory, earnings should increase smoothly with exposure to education. Every day a student is in class, she should be increasing her productive capacity by a small amount. This is consistent with, for example, Angrist and Krueger's (1991) instrumental variables estimates of returns to compulsory schooling. However, there also seems to be evidence of sheepskin effects, which are not strictly consistent with human capital theory. Sheepskin effects exist if the years in which diplomas are awarded are valued more by employers than other years of education. For example, if the wage increase is the same between the tenth and eleventh year of education as it is between the eleventh and twelfth year (when high school diplomas are awarded to graduates), there is a lack of evidence for sheepskin effects. In this scenario, each additional year of education adds the same amount to an individual's earnings, supporting human capital theory. On the other hand, we might imagine a scenario where grades nine through 11 provide no earnings increases, but the granting of a high school diploma at the end of twelfth grade does increase earnings. In this case, a sheepskin effect exists, where the holder of a high school diploma is rewarded with higher earnings for the diploma itself instead of the years of schooling, per se. Here, the diploma acts as a signal to

employers that its holder is productive. Hungerford and Solon (Hungerford and Solon 1987) found that the twelfth and sixteenth years of schooling, which corresponded with high school and college graduation, provided larger returns that the surrounding years of schooling, suggesting the existence of sheepskin effects. Empirical evidence supports the existence of both human capital and signaling as mechanisms that mediate the positive relationship between education and labor market outcomes, though estimates of signaling effects tend to be outweighed by the human capital component of educational attainment (Belman and Heywood 1991; Harmon, Oosterbeek, and Walker 2003; Hungerford and Solon 1987). Educational institutions act as both sieves used to sort students by their abilities and as the imparters of valuable knowledge and skills that contribute positively to students' occupational attainment (Hout 2012; Sorokin 1954).

Human capital theory posits that employers make wage decisions based on the actual marginal productivity of workers, which is positively associated with educational attainment since schooling increases the skills and traits that employers value. On the other hand, signaling theory posits that employers do not have the necessary information to make accurate evaluations of productivity, which is determined mostly by pre-existing abilities, and therefore use educational credentials as imperfect proxies for productivity. In both cases, employees earn wages based on their perceived productivity (Harmon et al. 2003). This is termed wage competition (Thurow 1975). As a worker's productivity increases, his wages also increase. Similarly, when a worker's productivity decreases, his wages also decrease.

In contrast to wage competition, the job competition theory suggests that wages are set through social relations and are largely attached to positions instead of individual

workers' productivity (Thurow 1975). For example, wage competition would suggest that the manager of a grocery store has her salary set by her ability to positively influence profit for her employer. Job competition, on the other hand, posits that the grocery store manager's salary is a set characteristic of the position, and will not change drastically whether the employee is more or less productive than average. Thinking across jobs, the wage competition theory suggests that managers are paid more than clerks because they are more productive. Job competition suggests that social relations and negotiations set wages of those two positions, not the individual productive capacities of the employees who fill those positions. Thus, the wages for grocery clerks and managers may be based on some perception of average productivity or importance, the difficulty or authority level of the job, or collective or individual bargaining and negotiation. However, they are not set strictly by individuals' levels of productivity.

Instead, individuals compete for the best possible positions based on their location in a labor queue. The labor queue ranks potential workers according to the traits that employers value, namely education (Thurow 1975). When employers need to fill an open position, they take the highest-ranking applicant in the labor queue. While Thurow (1975) specifically ranks potential workers in the queue using educational attainment, employers may include other variables they have 'tastes' for in their rankings of potential employees. I expand my explanation of the job competition model, specifically with respect to the business cycle, in a subsequent section of this chapter.

A final explanation for positive college effects on wages occurs not at the individual level, but at the occupational level. Weeden (2002) argues that occupational groups use social closure to restrict the supply of labor, to enhance or channel demand for

their services, or to signal quality. She finds that the most powerful of these methods for increasing wages of an occupational group is restricting the supply of labor, often through educational credentialing. By increasing educational requirements, the number of eligible employees for a given occupation decreases, thus increasing the bargaining power of those workers who are "qualified" assuming the number of jobs remains constant. If education actually provides these workers with the skills necessary to perform their jobs or if education filters out those with the least amount of natural skill or ability that is necessary for the job, this reduction in the labor supply can be beneficial, allowing customers and employers to accurately and efficiently rid the market of substandard workers. However, if the required education level is only loosely related to the occupation, this reduction in labor supply will cause an increase in costs to customers and employers, raising wages of the occupational group unnecessarily. These educational credential requirements are often enforced by organizational groups and norms as opposed to state policy (Weeden 2002).

For example, state policy does not require undergraduate Introduction to Sociology courses at universities to be taught by Ph.D. holders. However, Ph.D. holders teach the vast majority of such classes. Whether or not these individuals are better than sociology master's degree holders at teaching undergraduate introductory courses, the norm that requires a Ph.D. at most universities restricts the supply of labor for these courses. Students and their parents, as customers, and university administration, as employers, may agree that Ph.D. holders learn how to be better teachers through their training or that the crucible of a Ph.D. program separates the best teachers from the less able. In this case, university professors use educational credentials to signal quality to

both employers and customers. Because this restriction narrows the pool of available labor, wages will increase for this occupation as a whole.

Weeden's (2002) use of social closure to explain occupational wage differences relies on group processes instead of strictly individual calculations, such as those in neoclassical economics. However, her findings, especially with regard to educational credentialing, may still explain individual effects of education on labor market outcomes. Increases in wage inequality in the U.S. from the 1980s to the 2000s have been due to increases in inter-occupational inequality more than any other single factor (Mouw and Kalleberg 2010). This suggests that trends and changes in occupational groups and the strategies they employ to increase their value have important consequences for stratification in contrast to more atomized views of the labor market (Mouw and Kalleberg 2010).

Heterogeneity in Returns to College

While much prior research has established positive average effects of college on a variety of labor market and other outcomes, most of this research has implicitly assumed that the size of this effect is constant across individuals. However, college may have heterogeneous effects across the population, providing some individuals with greater returns than others. Instrumental variable analyses have generally found larger positive effects of college than traditional OLS regression (Card 2001; Hout 2012). This is surprising because one limitation of the original OLS studies was the difficulty to control for underlying or natural ability. This was thought to have biased estimates of college effects upward (Hout 2012). When instrumental variable analyses, which should control

for individual differences in ability if properly constructed, returned larger estimates of college effects than OLS analyses, one explanation that emerged was that college effects are heterogeneous across individuals. If individuals who received more education than they would have otherwise expected because of some instrumental variable, such as living close to a college or having a high draft number, receive greater returns to that education than their peers who did not receive a greater than expected amount of education, it would suggest a pattern of negative selection. Under negative selection, those least likely to receive a treatment benefit the most from it.

For example, recent economic work on neighborhood effects found larger positive effects of providing housing vouchers to poor families when the intervention was not optional (Chyn 2015). Chyn (2015) compared estimated neighborhood effects in the Moving to Opportunity project (Chetty, Hendren, and Katz 2016; Clampet Lundquist and Massey 2008; Sampson 2008), where families could opt in to a lottery where they might be given housing vouchers, to the results from families who were living in public housing buildings that were destroyed by the city of Chicago. On average, there were smaller effects in the Moving to Opportunity study because the families who signed up for the lottery, even if they were not chosen, were more concerned about the potential negative effects of living in high-poverty neighborhoods. Thus, even the families who lost the lottery in MTO had already taken other steps to mitigate the dangers of the neighborhood, such as not allowing their children to play outside. On the other hand, when entire buildings were demolished, forcing all families in a given building to receive the treatment of a housing voucher, those children from families who were not as concerned about negative neighborhood effects, and therefore least likely to move out of those

neighborhoods, received a greater benefit from moving. Therefore, it seems that moving out of bad neighborhoods provides the greatest benefit to children who are least likely to do so. On the other hand, children from families who were already very concerned about potential negative effects of the neighborhoods they lived in saw less of a benefit from moving (Chyn 2015).

A similar pattern of negative selection of college has been observed for labor market outcomes, such as wages and earnings, but also for civic participation and fertility (Brand 2010; Brand and Davis 2011; Brand and Xie 2010). This research uses a multi-level approach by first predicting individuals' propensity to receive a treatment, in this case college, and then comparing the treatment effects across the propensity score distribution. If low-propensity individuals have the highest average treatment effects, a pattern of negative selection exists. The negative selection pattern for college on labor market outcomes could exist for multiple reasons. Low-propensity college graduates may be more likely to pursue high-paying occupations because they tend to come from families with fewer material resources (Beattie 2002; Brand and Xie 2010). Even if low- and high-propensity graduates have similar motivations as far as occupations, low-propensity graduates could realize a larger return to college if there are differences in the ability of non-graduates to secure employment in good jobs across the propensity distribution. Family resources or social capital might matter more for non-college graduates. For example, if the son of rich parents does not graduate from college, his parents or extended network may still provide him with the connections to high quality employment. However, among poor individuals with few such valuable social connections, education may be the only way to gain access to such jobs. Another example

is that those at the very high end of the ability distribution are likely to both complete many years of education and to be well-suited for jobs, even if they are learning less at college than those of less cognitive ability. As an example, Hout (2012) uses several very successful college dropout entrepreneurs, who are all very intelligent and innovative. One might argue that these individuals, such as Facebook founder Mark Zuckerberg or Microsoft founder Bill Gates, had little to gain by going to college, as their pre-existing abilities, work ethic, and skills placed them in positions where college could do little to help them. Each of these rationales provides potential explanations for the stronger observed effect of college for individuals who were unlikely to complete college. Thus, while both individual and collective processes may mediate the positive relationship between education and labor market outcomes, there is little evidence that this relationship is constant across individuals. Instead, those who are relatively less likely to receive treatment in the form of education see greater benefits if they do complete college.

ECONOMIC CONTEXT AND RETURNS TO COLLEGE

Returns to College During Recessions

Disadvantaged groups, including racial and ethnic minorities, the poor, and those with less education, have traditionally shouldered the worst consequences of economic recessions (Hoynes et al. 2012). Workers with less education have suffered more severe declines in employment and wages during recessions than workers with high levels of education (Elsby, Hobijn, and Sahin 2010; Hout 2012; Hout, Levanon, and Burak 2011; Hoynes 1999; Hoynes et al. 2012). Using Census data from 1979-1993, Hoynes (1999)

investigated how the 1982 and 1992 recessions affected different types of workers. She found that earnings of less skilled, i.e., less-educated, followed the business cycle more closely than the earnings of high-skilled workers. During these late-twentieth century recessions, less-educated workers experienced greater earnings and employment decreases than more highly educated workers. While Hoynes' (1999) analysis does not directly investigate the mechanisms that caused this divergence between high- and low-skill workers across economic context, she offers three potential explanations for the observed descriptive results. First, educated workers may differ from less-educated workers in their mobility rates. Hoynes (1999) used local labor market conditions measured at the metropolitan statistical area to operationalize economic context. If more educated workers move to areas with stronger labor markets because they have more resources, fewer costs, or are more willing to move, the negative effects of an economic shock might be minimized for that population. Second, labor supply for educated workers may be less elastic than it is for less-educated workers. In this case, the supply of jobs for more educated workers may change at a slower rate in response to an economic downturn. For example, the supply of doctors might not decrease appreciably during a recession because demand for their services is relatively inelastic and because the investment in training and education to become a doctor is so great. On the other hand, a construction firm might experience a greater slowdown in business and be more willing to lay off workers who would be easier to replace in the event of a rebound. Finally, related to both of these prior points is that highly educated workers may tend to be employed in sectors or occupations that are less cyclical than less educated workers (Hoynes 1999; Hoynes et al. 2012). If these occupations or industries, for whatever

reason, experience fewer negative repercussions during recessions, more educated workers will be shielded from the worst effects of recessions relative to less-educated workers. This could hold even if education has no effect on outcomes within these sectors or occupations.

Hoynes (1999) also found, similar to Farber (1996) that the low- and high-skill groups' response to the 1992 recession was more similar than it was during the 1982 recession. Thus, the 1992 recession had more homogenous effects across skill groups than the 1982 recession (Hoynes 1999). Some of this reduction in the magnitude of the recession effects for low-skilled workers may be due to their relatively high unemployment rates even before the onset of the 1992 recession (Hoynes 1999). This pattern also might be due to the idiosyncrasies of those specific recessions. For example, while the 1982 recession caused greater employment losses in the Midwest industrial centers, such as Detroit, Pittsburgh, and Cleveland, the 1992 recession caused greater losses in coastal metropolises, such as New York City, Boston, and San Diego (Hoynes 1999). These geographic patterns could have been caused by the two recessions affecting different industrial sectors, which would then affect different skill groups and regions accordingly. Overall, the recessions of the 20th century tended to produce larger reductions in earnings and employment for less educated workers than more well-educated workers (Hoynes 1999; Hoynes et al. 2012). The workers hardest hit by recessions tend to be employed in sectors such as manufacturing and construction that do not require high levels of formal education, while workers in sectors that generally require more education, such as healthcare, education, finance, and other white collar

occupations, tended to experience relatively mild reductions in employment relatively speaking (Hoynes et al. 2012).

These general trends, where less-educated workers see greater declines in employment and earnings during recessions, held true into the 21st century, during both the 2001 recession and the Great Recession, which began in 2007 (Carnevale, Jayasundera, and Cheah 2012; Elsby et al. 2010; Hout et al. 2011; Hoynes et al. 2012). While I discuss the specifics of the Great Recession in greater detail in a subsequent section, the Great Recession caused employment losses across almost the entire breadth of the U.S. economy, including particularly severe losses for construction and manufacturing (Goodman and Mance 2011). These sectors tend to be dominated by men with less than a college degree, contributing to the increased earnings differential between college and non-college educated workers in the Great Recession (Carnevale et al. 2012; Elsby et al. 2010; Hoynes et al. 2012). Some analyses have suggested that college attainment may act as a buffer against economic downturns, helping workers "weather the storm" (Carnevale et al. 2012). However, the growing gap between high school and college graduates during recessions says little about whether the effects of college are actually cyclical for any given individual. As discussed above, the research on college effects and elite college effects needed to adequately address selection bias before ascribing causation to some observed positive correlations. To date, analyses that have compared high school to college graduates in the aftermath of the Great Recession have not adequately controlled for selection into college. Thus, while these two groups' labor market outcomes have indeed diverged to a greater extent during recessions, it is unclear

whether this acceleration in inequality between educational groups is due to their education or to confounding factors such as cognitive ability.

Effects of Recessions among the More and Less Educated

A different strain of research has investigated how economic context affects workers within a given educational level. Oreopolous, von Wachter, and Heisz (2012) offer evidence that in Canada, new college graduates who experience recessions see immediate wage penalties that persist for roughly a decade on average. Even among college graduates, Oreopoulos et al. (2012) suggest that there may be heterogeneous effects of recessions on young workers. They regressed log earnings on college attended, field of study, and years of study separately by graduation year and province. Then, they used the regression coefficients to predict initial wages for college graduates based on those three factors, using the sorting that colleges already do to group students on both college quality and preexisting abilities. Students with lower predicted initial earnings were most likely to experience persistent earnings penalties even many years after experiencing a recession. Those in the bottom quintile of this distribution had initial earnings penalties of about 15 percent if they graduated during a recession compared to an expansion. Ten years later, this penalty was still significant, having dissipated only by half. On the other hand, those workers in the highest quintile of predicted earnings were able to overcome initial earnings penalties if they graduated during recessions relatively quickly by moving firms. They experienced earnings penalties of about 7.5 percent in recessions. Four years later, though, this group's earnings were only 2 percent less than if they had graduated during an expansion. Thus, even among college graduates, there is

substantial heterogeneity both in the initial effects of recessions and in the persistence of those effects (Oreopoulos et al. 2012). It is important to note here that while college quality may be a factor, Oreopoulos et al. (2012) do not test whether it is a main causal factor in the resilience of these workers, or whether it is merely correlated because colleges tend to sort students based on preexisting characteristics that may also help them successfully navigate recessionary labor markets.

In the U.S., Kahn (2010) found wage and employment penalties that were even more persistent than those reported in Oreopoulos et al. (2012). College graduates entering the labor market during the early 1980s recession experienced significant wage penalties of up to 20 percent compared to those graduating during expansionary periods. Furthermore, these workers' earnings had not increased to the level expected under better economic conditions even ten years after their entrance into the labor market. Entering the labor market during a recession as a college graduate in the U.S. has, "a long-run, negative impact on wages" (Kahn 2010:312). Genda, Kondo, and Ohta (2010) also found that both U.S. and Japanese college graduates suffered long-term penalties for graduating during recessions. They suggest that the closer link between schools and the job market in Japan result in slightly more persistent recessionary effects for Japanese college graduates, though they note that the differences in effects between the two countries are relatively small. Genda et al. (2010) also look at terminal secondary school graduates entering the labor market during, finding that among this lower-skilled population, Japanese workers suffer worse and more persistent penalties for graduating during recessions than their American counterparts. In both countries, high school graduates suffered greater initial penalties than college graduates due to recessions. In the U.S.,

these initially strong penalties proved temporary; low-skill workers were able to recover as the economy improved. This is consistent with findings of greater cyclicality among low-skill workers described above (Hoynes 1999). In Japan, on the other hand the penalties for entering the labor market during a recession were substantially worse both at the time of the recession and many years later for high school graduates. Genda et al. (2010) suggest that the high cost of firing employees in Japan and the tight linkage between high schools and employers make for an inflexible labor market that is unable to reincorporate the unfortunate workers who come of age in contexts with few job openings.

In these three wealthy nations, entering the labor market during an economic recession as opposed to an expansion is associated with decreased employment and earnings. Furthermore, for college graduates, these penalties can persist for ten years or longer. The institutional features of each labor market may lead to differences in how severe and persistent the effects of recessions are, but each analysis suggests that recessions are harmful to the long-run earnings of young workers. By focusing on college-educated workers, Kahn (2010) and Oreopoulos et al. (2012) are able to identify how the absolute value of college changes with economic context both over the short- and intermediate-term. However, these analyses do not compare high school and college graduates directly to one another. Therefore, they are not concerned with how the relative value of college may shift over the business cycle. Although Genda et al. (2010) do include both college and high-school graduates in separate analyses, they, like the associational studies outlined in the previous section, do not control for selection into college. Genda et al. (2010) were interested in how recessions affected the long-term

prospects of college and high school graduates, not whether any differences in those outcomes were actually caused by education or pre-existing characteristics. Thus, while Genda et al.'s (2010) finding that lower-skilled workers suffered greater immediate consequences from entering the labor market during recessions is consistent with zero-order comparisons made between educational groups during the Great Recession, there is still no direct evidence about what happens to the effects of college on individual workers as the economic context changes holding constant pre-existing differences between college and non-college graduates.

In related research, Devereux (Devereux 2003; 2004) found that a process of "occupational downgrading" occurs during recessions. Because of the lack of available jobs during downturns, employers are able to hire more educated workers during recessions than they are normally able to. These workers, in turn, accept downgraded occupations during recessions that offer lower wages than they could have expected during average economic contexts. The opposite happens during booms. When overall unemployment is very low—meaning demand for workers is high—workers have leverage and are able to secure employment in high quality jobs. Thus, during expansions, the average level of workers' education in a given occupation decreases (Devereux 2003). These findings again suggest that college graduates' labor market outcomes are depressed during recessions because they take jobs they are overqualified for initially. Low-skilled workers could experience worse outcomes during recessions due to adjustment costs being different for high- and low-skilled workers. Under this theory, low-ability workers are more likely to be laid off during recessions because the costs of training and hiring these workers should the economy improve are lower

(Devereux 2003). On the other hand, the occupational downgrading or upgrading hypothesis is primarily concerned with new hires as opposed to layoffs. The downgrading hypothesis suggests that more educated workers will be slotted into low-quality jobs during recessions because their options for employment are so limited (Devereux 2004; Léné 2011). These educated workers then displace those less-educated workers who normally would have occupied those positions, forcing them to either seek even lower-quality jobs or be excluded from employment altogether (Devereux 2003; Léné 2011).

Labor Queues and Economic Cycles

The downgrading hypothesis (Devereux 2003) relies on a job competition model (Thurow 1975) of the labor market, discussed in a previous section. To review, in job competition, wages are set by social relationships and attached to jobs instead of the individual productive capacities of individual workers. Thus, wages within a given job or occupation should not fluctuate as strongly with the business cycle as a completely frictionless spot wage market would dictate (Thurow 1975). Workers vie for the best jobs instead of competing for wages, and employers attempt to hire the highest-quality worker for a given job opening. Potential workers are ranked in a labor queue, with employers selecting the highest-ranking member in the queue who is willing to take the job they are offering with the attached wages (Thurow 1975).

This view of the labor market predicts that during recessions, occupational downgrading should occur. As the supply of open jobs shrinks, employers are able to choose employees who are ranked higher in the labor queue to fill the scarce open positions they do have (Devereux 2004). Thus, from the individual's point of view,

average wages and job quality would fall. By occupation, wages would remain relatively stable, and the education level of new employees would rise. During economic booms, the opposite would happen. Jobs that are normally reserved for college graduates might become available to high school graduates or those with some college because the pool of potential workers has shrunk.

In terms of the relative value of college compared to lower levels of education, the job competition model suggests an increasing return to college during recessions. Furthermore, negative effects of recessions should accrue most strongly to those at the bottom of the labor queue. For example, a decrease in the supply of jobs might cause those near the top of the queue to accept slightly lower quality jobs. These workers would displace those below them. If employment declines are distributed evenly throughout the distribution of jobs, these effects become cumulative, increasing more for those lower in the queue. These workers may no longer be competitive even for low-status jobs because of all the displaced workers above them in the labor queue, potentially leaving them without employment prospects at all (Devereux 2003). This is one explanation for the greater cyclicality of low-skilled workers compared to high-skilled workers discussed above (Devereux 2003; 2004; Elsby et al. 2010; Hoynes 1999; Hoynes et al. 2012).

As long as education does not perfectly align with pre-existing differences between, for example, college and non-college graduates, there will be causal effects of education on labor market outcomes under the job competition model. Furthermore, while Thurow (1975) explicitly uses education as the stratifying factor for workers in the labor queue, there may be additional factors, like cognitive ability, that potential workers are ranked on. In a model where workers are ranked in the labor queue both by education

and the characteristics that are positively correlated with education such as ability and parental background, workers near the bottom of the queue should experience greater negative effects of recession. A given increase in position on the labor queue, then, would benefit those near the bottom more than those near the top. Following these propositions, college completion would provide a greater benefit to those who would otherwise be at the bottom of the labor queue based on their pre-college characteristics. Thus, using a job competition model where both observable precollege factors and educational attainment are used to rank potential workers, the effects of college should increase overall, though most notably for those who are lower on the labor queue given their precollege characteristics. If employers also rank college graduates by the prestige of the institutions they have attended, elite college attendance could also increase in salience during economic downturns. Using the same logic, however, these effects may be limited at the high end of the labor queue, but more pronounced among those with relatively lower ability or those who have lower socioeconomic backgrounds.

Additional Contextual Factors and Returns to College

Estimates of the effects of education on various outcomes are always specific to the contexts in which they take place, though this is not always explicitly discussed. However, studies of education effects in different countries or time periods and comparative studies that compare education effects across time and space imply that context matters for education. For example, the effects of education have increased generally over time (Fischer and Hout 2006). The returns to college in the U.S.—used loosely here to indicate the difference between college and non-college graduates—have

increased since a low point in the 1970s (Hout 2012). These changes have generally been ascribed to large-scale changes, such as increased globalization, the international mobility of capital and to a lesser extent labor, and technological innovation (Fischer and Hout 2006; Hout 2012; Taber 2001).

Other structural features of the labor market, education system, and political context may also shape education effects. For example, the German education system, with its greater emphasis on vocational training for those who do not continue on to university, may decrease college effects relative to the U.S. by providing better employment opportunities for those without college degrees (Buechtemann, Schupp, and Soloff 1993).

Contextual factors are also important for explaining trends in higher education for women. DiPrete and Buchmann (2006) found that the overall return to education in terms of household income increased faster for women than for men over the late 20th century. This, in turn, may explain some of the increasing rates of college attendance and completion by women over the same time period. DiPrete and Buchmann (2006) suggest that these measures of overall material well-being may have increased faster for female college graduates compared to female non-college graduates because of trends in marriage and household income. Thus, contextual factors have changed the calculus of a college degree over the past 40 years for women.

I provide this very brief and incomplete survey of some research that contextualizes education effects to suggest that it is already widely understood that the relationship between education and labor market outcomes occurs in specific contexts. Changes in the level of technological advancement, welfare state programs, or marriage

markets may all affect how valuable a college degree is to its holder. However, many of these contextual elements are difficult to measure, and may play out over the course of many decades where they might co-vary with various other potential explanatory factors. Investigating how economic context impacts college effects is another example of this larger body of research that acknowledges contextual factors and their effects on the relationship between education and labor market outcomes. In this dissertation, I seek to estimate the magnitude of the economic context's impact on education effects.

CAUSES AND CONSEQUENCES OF THE GREAT RECESSION

The economic downturn that was termed the "Great Recession" began in late 2007, according to the National Bureau of Economic Research. Before its onset, the economy had been growing steadily since a mild recession in 2001 (Goodman and Mance 2011). Some of this growth was due to education and healthcare sectors, which had been growing for decades, and remained healthy relative to other sectors even through the Great Recession (Goodman and Mance 2011; Hoynes et al. 2012). The other sectors growing at a rapid pace prior to the Great Recession were related to housing, which is not classified as its own industry, including residential construction, retail sales, financial activities, and manufacturing, as home prices increased rapidly throughout the 2000's and construction of new homes reached record levels (Goodman and Mance 2011). These industries, as opposed to education and healthcare, were strongly pro-cyclical during past recessions, a pattern that would continue during the Great Recession (Elsby et al. 2010; Goodman and Mance 2011; Hoynes 1999; Hoynes et al. 2012).

The housing boom contributed positively to economic growth in the early 2000's

by boosting construction-related industries, such as furniture manufacturing and sales and mortgage financing. Rising home prices also encouraged growth indirectly by creating a "wealth effect" (Belsky and Prakken 2004). As homeowners' real estate valuations rose by over one-third on average between 2003 and 2006, they borrowed against this equity to increase their consumption of other goods, such as consumer goods (Goodman and Mance 2011). This increased spending due to rises in home equity may have accounted for one-fourth of the increase in consumer spending (Belsky and Prakken 2004). At the beginning of 2006, housing sales started to decline, and by 2007 foreclosures and home loan delinquency had increased to record levels (Goodman and Mance 2011). Foreclosures and delinquency were especially common among those on sub-prime mortgages, which had increased in frequency as home prices rose. While growth in housing started declining in early 2006, other economic indicators, such as GDP and overall employment, continued to grow. By the end of that year, however, employment growth in many other sectors flattened, and in late 2007, job losses in housing-related sectors, such as construction and finance, accelerated (Goodman and Mance 2011).

In December 2007, the U.S. officially entered a recession (Redbird and Grusky 2016). National unemployment began to increase in January 2008, particularly in cyclical industries such as construction and manufacturing. Home values plummeted in many parts of the country, and energy costs rose as the price of crude oil doubled in a year (Grusky et al. 2011; Redbird and Grusky 2016). Declining wealth and rising costs of energy and other commodities further hurt consumption of so-called durable goods, like appliances and cars, which tend to be cyclical anyways (Goodman and Mance 2011). Still, through September 2008, unemployment had only increased by 1.1 percent, in line

with previous mild recessions. After a crisis in the U.S. financial sector, however, credit markets tightened, loans became widely unavailable, and job losses increased rapidly throughout many sectors (Redbird and Grusky 2016). From September 2008 to October 2009, the seasonally adjusted unemployment rate according to the Bureau of Labor Statistics' Current Population Survey increased from 6.1 percent to 10 percent, though the recession officially ended in June 2009. The slack labor market continued well into the recovery. Total employment continued to decrease until February 2010. The unemployment rate remained high through 2010, only receding below 9 percent for longer than one month in September 2011.

Job losses in the Great Recession were disproportionately concentrated among ethnic minorities and the less-educated (Carnevale et al. 2012; Elsby et al. 2010; Hoynes et al. 2012; Redbird and Grusky 2016). College graduates, for example, only experienced about half of the rise in unemployment as the rest of the population, perhaps due to their overrepresentation in sectors[4] that were spared from the worst cuts in employment (Elsby et al. 2010). Blacks and Hispanics both experienced increases in unemployment roughly 30 percent higher than the general population. Also following trends during previous recessions, unemployment increased faster among men and young workers than women and workers over age 25 (Goodman and Mance 2011).

The Great Recession was notable for its breadth, depth, and length. While the Great Recession has not been the deepest or longest in history, no single economic downturn since before World War II has been worse on all three of these components.

[4] Weeden (2002) might argue for a different interpretation of causality. Instead of the economy 'saving' jobs in sectors that happen to be dominated by educated, powerful groups, she might argue that those groups were able to protect their positions by using status and political power. Therefore, status, with education acting as a proxy, might determine which sectors do well, acting causally prior to the recession affecting industries differently based on organic supply and demand.

Since 1945, the average recession was accompanied by a period of employment loss that was 15 months long and caused employment to drop 3.6 percent at its trough. The Great Recession, however, caused sustained employment losses for 25 months that accounted for a decline of 6.3 percent in employment. The recession in 1945 was worse in terms of employment loss, with a roughly 8 percent drop, but recovered much quicker, having recouped all of the lost jobs after 17 months. Twenty-five months after the start of the 1945 recession, employment had actually increased to 4 percent above the starting point. By contrast, employment caused by the Great Recession was only bottoming out after 25 months at -6.3 percent compared to the start of the recession. Furthermore, while it took 10 months to fully recover from the peak of unemployment by gaining back all of the lost employment caused by the 1945 recession, 10 months after the most recent peak in unemployment, employment had increased by less than one percentage point from its low (Goodman and Mance 2011; Hout et al. 2011).

The consecutive downturn in employment from February 2001 through August 2003 lasted 30 months, five months longer than the Great Recession. However, the 2001 recession was much milder, resulting in only a two percent decrease in employment. The 2001-03 downturn in employment also only comprised a contraction of 11.1 percent of the previous expansion, meaning only 11.1 percent of the employment gained during the previous expansion was lost. The average for employment slumps since 1945 was 23.5 percent. The Great Recession was extraordinary in that it was the only employment downturn that completely erased the employment gains of the preceding expansion, losing 107 percent of the jobs gained in the 2003-2008 expansion. The next highest percentage of employment contraction compared to expansion was 52.7 percent, and

occurred for 14 months beginning in 1952 (Goodman and Mance 2011; Bureau of Labor Statistics 2012).

OVERVIEW OF METHODOLOGY

The following empirical chapters rely on similar methodology to assess the effects of higher education on individual labor market outcomes. I use propensity score matching in each chapter to help control for selection on pre-existing observed factors such as cognitive ability and socioeconomic background. This methodology relies on a counterfactual framework, where each individual has both an observed outcome associated with her treatment status, and an unobserved counterfactual outcome that would have occurred had she been in the opposite treatment group(Morgan and Winship 2015; Rosenbaum and Rubin 1983). For example, when the treatment of interest is college completion, a college graduate's observed outcome might be her income, and the counterfactual outcome would be her income *had she not completed college*. While this counterfactual outcome is not directly observable, it can be estimated using control cases that are similar to the treated case (and vice versa) on a set of factors that predict the likelihood of undergoing treatment (Rosenbaum and Rubin 1983). The effect of treatment on a given outcome can then be ascertained by taking the difference of similar treated and control cases.

To identify similar treated and control cases, I use logistic regression to predict the propensity of each individual to complete college based on a set of precollege characteristics. After ensuring balancing, where scores on any given covariate are not significantly different across matched cases, and that the analysis is confined to the

region of common support (Rosenbaum and Rubin 1983), the propensity score can be used to match similar cases across treatment groups. Thus, I match college graduates to non-college graduates who have similar propensity scores, and then compare their labor market outcomes.

Estimates of treatment effects can correspond to different populations, an important distinction given previous findings of heterogeneous effects of college (Brand 2010; Brand and Xie 2010). I calculate the average treatment effect on the treated (TT) by comparing treated cases to control cases with similar propensity scores, and then averaging the difference in outcomes. Similarly, the average treatment effect on the untreated (TUT) is calculated by comparing control cases to similar treated cases. The primary difference between these two statistics is the population to which they are applicable. Because the estimated propensity to receive the treatment is lower for control group members than treated individuals, the TUT estimates treatment effects mostly for those with relatively lower propensity scores, while the TT is weighted toward those with higher propensities of receiving the treatment. The TT can be interpreted as the estimated bonus in wages, for example, that college graduates received for having completed college. Conversely, the TUT is the estimated bonus that non-college graduates would have received had they attended college.

In two of the following chapters, I also employ hierarchical linear models to assess patterns of potentially heterogeneous effects (Brand and Xie 2010). This methodology uses a similar propensity score estimation based on logistic regression of a set of observable pre-treatment covariates. Cases are then divided into propensity score strata where neither the propensity score nor any individual covariate is significantly

different between the treated and control groups. Next, within each propensity score stratum, the outcome variable of interest is regressed on the treatment variable. The coefficient of the treatment variable in this model is the estimated average treatment effect for the subsample that falls in that particular propensity score stratum. After average treatment effects have been estimated for each of the propensity score strata, they are regressed using variance weighted least squares with the standard errors of the estimated average treatment effects on the propensity strata themselves, yielding a regression line that describes the relationship between the propensity score and the average treatment effect. If the average treatment effect rises over the distribution of propensity scores, a pattern of positive selection exists. In this case, the greatest benefits of college would accrue to those with high propensity scores—the population most likely to receive the treatment. On the other hand, a negative level-2 slope provides evidence for negative selection, with those least likely to experience the treatment standing to gain the most from it (Brand and Xie 2010).

Overview of Data

To control for important pre-college characteristics, I use the National Longitudinal Survey of Youth 1997 (NLSY-97) and the National Longitudinal Survey of Youth 1979 (NLSY-79). These data sources are uniquely well positioned for my analyses because they contain both a set of rich and important pre-college measures that are useful for predicting treatment in higher education and a set of outcome variables that are measured after respondents have entered adulthood. Both surveys are nationally representative longitudinal surveys which began with samples of roughly 9,000

adolescent and young adult respondents. Both crucially contain measures of demographic and socioeconomic background and both administered the Armed Services Vocational Aptitude Battery (ASVAB) to their samples, which provides a measure of cognitive ability. While some of variables used in the propensity score estimation in each chapter vary, cognitive ability is perhaps the most important potential confounder to attempt to control for (Brand 2010; Brand and Xie 2010; Carneiro et al. 2011; Hout 2012; Kaymak 2009). I measure cognitive ability by creating a composite scale of the twelve individual subject tests administered in the ASVAB after residualizing scores by age and gender with a mean of zero and variance of one (Cawley et al. 1996). The scores from the subject tests were weighted equally. Other propensity score variables that remained constant across all of the analyses were race, parental income, parental education, region of residence, family structure, and sibship size. Men and women were analyzed separately.

The outcomes I measure include logged annual income, employment, measured by both weeks employed and hours employed, logged hourly wages, and occupational status measured using the Hauser-Warren socioeconomic index (SEI), a measure of the average level of education and income associated with a given occupation. In the subsequent chapters, I provide additional details on the data and methods specific to those chapters

ORGANIZATION OF THE DISSERTATION

In Chapter 2, I use the NLSY-97 and the NLSY-79 to assess the effects of college completion on labor market outcomes for both early- and late-career workers during the height of the Great Recession in 2009. Chapters 3 and 4 focus on early-career workers

and rely solely on the NLSY-97. Chapter 3 investigates how the effects of college changed for early-career workers across economic context, comparing individuals at age 26 in expansionary contexts to 26-year-olds in recessionary contexts. Chapter 4 investigates elite college effects during the Great Recession for early career workers. Chapter 5 summarizes the main arguments of my dissertation, addresses limitations, and offers suggestions for future work in this area.

CHAPTER 2: COLLEGE EFFECTS DURING THE GREAT RECESSION FOR EARLY AND LATE CAREER MEN AND WOMEN

The relationship between higher education and socioeconomic outcomes has been and continues to be studied by an array of social scientists (see review in Hout 2012). This relationship took on increased interest during the Great Recession, as falling employment and wages seemed to decrease particularly sharply among those without college degrees (Hoynes et al. 2012). The effects of college on socioeconomic outcomes may also be of particular importance during recessions as the individual costs of college, or at least its sticker price, continue to increase. Furthermore, the last two recessions in the U.S., the 2001 recession and the 2007-09 Great Recession, have both given way to slow, protracted recoveries(Carnevale, Jayasundera, and Cheah 2012; Goodman and Mance 2011; Hoynes, Miller, and Schaller 2012). It took longer to gain back the jobs lost by the last two recessions than most previous recessions (Hoynes et al. 2012). For many workers, the distinction between being in a recession or expansion, which denotes the direction and pace of growth, is less important than the overall health of the labor market, more readily measured using the unemployment rate. If these trends continue, future recessions may be accompanied by longer periods of high unemployment.

While comparisons between college and non-college educated workers showed larger differences during the Great Recession (e.g., Carnevale et al. 2011; Elsby et al. 2010; Hout 2012), these analyses do not estimate the effects of college net of selection into college. In this chapter, I analyze two longitudinal data sets to estimate the effects of college on labor market outcomes during 2009, at the height of the Great Recession. This

analysis has several goals. First, by controlling for observable pre-college characteristics, I compare college graduates' labor market outcomes to those of otherwise similar non-college graduates, reducing selection bias. This allows me to estimate college effects during the Great Recession without relying only on zero-order comparisons across levels of educational attainment. Second, this work seeks to replicate and expand on previous research on the heterogeneity of college effects for those who were likely and unlikely to complete college (e.g., Brand and Xie 2010), and to see whether these patterns hold during a recession. Third, by analyzing two distinct age cohorts, I compare the role that college plays during recessions at different points in the career.

I chose to measure labor market outcomes in 2009 for three reasons. First, the timing of the NLSY-79 and NLSY-97 cohorts means that both samples will be comprised of individuals whose age should dictate high labor market participation. Second, as noted in Chapter 1, 2009 was the last official year of the Great Recession, and unemployment rates were high after going through a sharp increase beginning in late 2008. Third, because the NLSY-79 cohort has only been surveyed every other year and respondents are asked retrospective questions, earnings data do not exist for even numbered years for the late career sample. Therefore, 2008 and 2010 data could not be analyzed.

At the start of 2009, the seasonally-adjusted unemployment rate was 7.8 percent and in the middle of a climb. By April, it had reached 9 percent, and would continue to rise gradually until eventually peaking at 10 percent in October. Although the recession ended officially in June, 2009 according to the NBER, the poor economic context continued throughout 2009, and would continue for several years after. Through 2009, the sectors that lost the most jobs included construction, manufacturing, and

transportation, all sectors with relatively few college graduates (Carnevale et al. 2012; Elsby, Hobijn, and Sahin 2010; Hoynes et al. 2012). On the other hand, education, healthcare, and public administration—sectors with higher numbers of college graduates—all gained small numbers of workers. These associations suggest increasing returns to college during the Great Recession. Therefore, I should expect to find strong estimated treatment effects of college across gender, cohort, and the likelihood of completing college. These associations, however, do not control for selection into college. Therefore, predicting the effects of college after controlling for preexisting differences between college and non-college graduates will not necessarily be consistent with correlations between educational attainment and labor market outcomes (Hout 2012).

HYPOTHESES

I derive several hypotheses for the analyses presented below in Chapter 2 from the literature on college effects and on studies of recessions. First, I broadly expect to find patterns of negative selection, with greater effects of college accruing to those who are relatively less likely to complete it. This would be evidenced by both larger TUT's than TT's, meaning that non-college graduates stood to gain more from college on average than college graduates did, and by negative slopes in the HLM's, which would suggest that the average treatment effects of college decrease as the propensity to complete college increases. This hypothesis comes from recent work on the heterogeneity of college effects (Brand and Xie 2010; Hout 2012), but also some work on recessions. For example, Oreopolous et al. (2012) found that graduates from more prestigious

universities suffered fewer short- and long-term consequences of recessions in Canada. These results suggest heterogeneous effects of recessions. Those who are most likely to attend high ranking colleges, and are also likely to attend and complete college in general, may suffer fewer negative consequences of economic downturns regardless of their eventual actual educational attainment. In this scenario, a college degree may be more valuable to those who do not have other resources to help them stay afloat during recessions. Second, consistent with Devereux's (2003) work on labor queues and occupational downgrading during recessions, I expect that estimated treatment effects of college will be relatively strong for job quality measures (wages and occupational status) for those with a high propensity for college, but not for measures of employment. Those relatively advantaged individuals who had high predicted propensities to complete college based on their socioeconomic and demographic backgrounds and cognitive ability occupy relatively secure positions in the labor queue. During a recession, then, I expect them to potentially experience losses in job quality. However, as these relatively advantaged people are forced to perhaps take worse jobs, they may displace those below them on the labor queue into even lower-status jobs, or from employment altogether (Devereux 2004). For this reason, I expect stronger effects for those with a lower propensity for college on measures of overall earnings and employment.

Between cohorts, I expect two countervailing forces to yield relatively similar estimates. On one hand, the cumulative advantage afforded to late career college graduates over their careers should increase effects of college for this group. Similarly, the relative advantage that early career non-college graduates may have in experience over college graduates is at its greatest at young ages. This may decrease effects of

college for the early career cohort. On the other hand, I expect the recession to most strongly affect early career workers who may be entering the labor market for the first time or lack seniority and be employed in low status jobs that are more precarious than those held by older, longer tenured workers. This could work to increase the effects of college at early career stages during recessions, particularly since the labor queue and job competition theories are mostly concerned with how job openings are filled and how wages are assigned (Devereux 2003; Thurow 1975). Finally, given the greater cyclical nature of men's employment compared to women's (Elsby et al. 2010; Hoynes 1999; Hoynes et al. 2012), I expect in general larger effects of college for men than women.

DATA AND METHODS

In this chapter, I use data from both the NLSY-79 and the NLSY-97. I refer to the NLSY-97 sample as the early career sample. In 2009, this group was aged between 25 and 29. The late career sample comes from the NLSY-79, with participants ranging in age from 45 to 49 in 2009. I analyze both cohorts using the same methodology, though some differences in the variables collected by each survey do change the measures used to predict the propensity of completing college.

First, I use logistic regression to predict the propensity of each individual to complete college by 2008, before labor market outcomes were measured. The covariates used to predict college completion are all measured during adolescence, before college enrollment (Brand and Xie 2010). After assuring that the balancing property of the propensity score estimation is met and restricting the analysis to the region of common support (Morgan and Winship 2007; Rosenbaum and Rubin 1983), I conduct nearest

neighbor matching. I compare labor market outcomes for each treated case to the two nearest untreated cases provided their propensity scores are within +/- .05 of one another, resulting in the TT. This process is replicated for the untreated group, matching the nearest treated cases, resulting in the average treatment effect on the untreated, or the TUT. Comparing the TT to the TUT gives some idea of the potential heterogeneity of effects (Brand and Halaby 2006). I also conduct a hierarchical linear model (HLM) by propensity score stratum (Brand and Xie 2010). In this process, the propensity score distribution is broken into a number of blocks, or strata, where the values of the covariates between treated and untreated cases are not significantly different. Then, the average treatment effect is estimated within each propensity score stratum linear regression (Brand and Xie 2010). I then fit a line through these stratum-specific average treatment effects using variance weighted least squares regression (Brand and Xie 2010). If the resulting level-2 slope is positive, it suggests that college provides a stronger positive effect for those who had high estimated propensities of completing college. A negative level-2 slope would indicate that college is more beneficial to those who were relatively unlikely to obtain a college degree.

I restricted both the early and late career samples to include only respondents who were in the civilian population, had completed high school, and had values for all of the precollege covariates used to predict college completion. I further restricted the sample to those that did not have missing values for 2009 logged earnings, weeks worked, and hours worked. For those who reported working in 2009, those missing on either wages or occupation were also dropped from the analysis. This resulted in sample sizes of 2,119 for the early career sample and 2,177 for the late career sample.

Covariates used to predict college in both samples include race, mother's and father's education measured in years, number of siblings, family structure, region of residence, logged parental income, enrollment in a college preparatory high school curriculum, peers' college plans, and cognitive ability. Race was measured using dummy variables for black and Hispanic respondents, with all others being the reference category. Family structure was a dichotomous measure of whether or not respondents lived with both of their biological parents during Wave I of the survey. Region of residence was measured using the four Census regions: Northeast, North Central, South, and West. The peers' college plans question differed across sample. The early career sample was asked to estimate the percentage of their peers at school who planned to attend college. The late career sample was asked the highest grade their closest friend planned to complete. I created a dichotomous measure of whether respondent's friends planned to complete college or not. Cognitive ability was measured using ASVAB scores, which were residualized by age and gender, as described in Chapter 1.

The early career sample also includes high school grade point average and perceptions of teacher's interest in students. Hallinan (2008) found that student perceptions of teacher interest increased students' attachment to school, which in turn increases academic performance. Since academic performance in high school is one of the key criteria for college entry and it predicts performance in college, high school grades were important to include for the NLSY-97 sample, where they were available for a fairly large subset of the sample (Hoffman and Lowitzki 2005). Additionally, high school grades are associated with both cognitive and non-cognitive skills (see review in Farkas 2003). This is important especially for the NLSY-97 sample, which did not

include measures of non-cognitive skills such as the Rotter scale for locus of control, which has been used in previous studies of non-cognitive skills (Heckman, Stixrud, and Urzua 2006).

The late career sample included respondents' college aspirations and the Rotter locus of control scale and its square, used to measure non-cognitive skills, as additional covariates. The Rotter scale is a series of four questions that ask respondents about the degree to which they control their life circumstances and outcomes. This scale has been shown in previous work to be predictive of future labor market outcomes (Heckman et al. 2006). It was administered in 1979 during the first wave of the NLSY-79, before respondents entered tertiary education.

For purposes of satisfying the balancing property in the propensity score estimation (Brand and Xie 2010), I also included interaction terms between mother's education and father's education for the early career sample. For men in the late career sample, I added a squared terms for mother's education. Greater detail on the propensity score estimation and the common covariates between cohorts is available in Chapter 1 since I use broadly similar measures in Chapters 2, 3, and 4.

In both samples following the propensity score estimation, I restricted the samples used for matching to the region of common support, where the maximum propensity score was set to the highest estimated propensity score of a control group member, and the minimum propensity score was set to the lowest estimated propensity score of a treatment group member. Additionally, I dropped early career sample respondents who were still enrolled in school during 2009, when labor market outcomes were measured.

This resulted in samples sizes of 1,558 respondents in the early career sample and 2,093 respondents in the late career sample.

The treatment variable for both samples was college completion by 2008. Outcome variables included respondents' logged income in 2009, the number of weeks they reported working in 2009, and the number of hours they reported working in 2009. For those who worked at least one week in 2009, I also used their overall average logged hourly wages (earnings divided by hours worked) and the occupational status of their modal primary jobs in 2009. Respondents with multiple jobs reported one as their primary job while constructing employment histories. For respondents who changed primary jobs during 2009, I measure occupational status of the primary job they held for the largest number of weeks during 2009. One limitation particular to the wage data is that it relies on self-reports of two separate variables: earnings and hours worked. Thus, any measurement error due to errors in self-reporting may be exacerbated for wages. Occupational status was measured using the Hauser-Warren socioeconomic index, which measures the average education and earnings of occupations.

PREDICTING COLLEGE COMPLETION

Early Career Sample

Logistic regression results predicting college completion for the early career sample are shown in Table 2-1 for men. Living in an intact household with both biological parents increased the odds of early career men completing college by 134 percent, net of controls. Residents of the Northeast were more likely to complete college than those from the South, net of controls; those residing in the North Central region were

also more likely to complete college than those from the South, though this was only significant at the p<.10 level. There was not a significant difference between Western residents and Southern residents net of controls. An F-test for the measures of mother's years of education, father's years of education, and an interaction between the two suggested that they were jointly significant ($\chi^2 = 28.74$; $p < .001$). As parental education increased, so did the propensity to complete college. For example, when both a respondent's mother and father had completed eight years of education, the average male from the NLSY-97 sample had a predicted probability of completing college of .191; if both parents completed 16 years of education, this predicted probability increased to .458. High school grade point average was perhaps the most important predictor of college completion. Increasing high school GPA by a full letter grade was associated with an eleven-fold increase in the odds of completing college. Cognitive ability also increased the predicted propensity to complete college net of controls. A one-standard deviation increase in a male respondent's residualized ASVAB score was associated with a 72 percent increase in the odds of completing college. Being enrolled in a college preparatory curriculum also increased the odds of completing college by 128 percent, net of controls. Finally, a ten percent increase in the number of peers who planned to attend college increased the odds of the respondent completing college by 12 percent net of controls.

[INSERT TABLE 2-1 HERE]

For the female early career sample, being black as opposed to non-Hispanic and non-black, coming from an intact family, living in a region other than the South, parental education, being enrolled in a college preparatory curriculum during high school, high

school grades, and peers' college plans predicted college completion. Both living in an urban area and cognitive ability were positively associated with college completion, but only significant at the $p<.10$ level. Like the male subsample, high school grades appear to be the most important predictor of college completion. A full letter grade increase in high school GPA was associated with more than an eight-fold increase in the odds of completing college. Compared to non-blacks and non-Hispanics, black women had 151 percent higher odds of completing college net of controls. Living with both biological parents increased the odds of completing college by 58 percent net of controls. Relative to women who lived in the South, living in the Northeast was associated with an 88 percent increase in the odds of completing college, living in the North Central region was associated with a 130 percent increase in the odds of completing college, and living in the West was associated with a 71 percent increase in the odds of completing college. The relationship between parental education and children's predicted probabilities of college completion was positive over the most of the distribution of parents' education. The predicted probability of completing college for women with parents who both had eight years of education was .38; for women whose parents both completed 16 years of education, the predicted probability of completing college increased to .57. Being enrolled in a college preparatory curriculum was associated with a 214 percent increase in the odds of completing college net of controls. Finally, a ten percent increase in the number of peers planning on attending college was associated with a 15 percent increase in the odds of completing college.

Late Career Sample

The propensity score estimation results for late career men and women are reported in Table 2-2. Net of controls, black men had 163 percent higher odds of completing college than non-black, non-Hispanic men; there was not a significant difference in the odds of Hispanic men completing college net of the included covariates relative to the reference category. Mother's education and its square were jointly significant in predicting college completion according to the results of an F-test ($\chi^2 = 5.8$; $p = .05$). An increase in mother's years of education from eight to 16 years increased the predicted probability of completing college from .33 to .41 for an individual set to the mean for the remaining covariates. Aspiring to complete college during high school had a very large effect on completion, increasing the odds nearly ten times. Peers' aspirations were also important for men in the NLSY-79 sample. Having a best friend who planned to complete at least 16 years of education increased the odds of completing college by 94 percent, net of controls. Being enrolled in a college preparatory curriculum increased the odds of college completion by over three hundred percent net of controls. Lastly, cognitive ability was positively associated with college completion. A one-standard deviation of the residualized ASVAB score was associated with a 356 percent increase in the odds of completing college, net of controls.

[INSERT TABLE 2-2 HERE]

For women, the propensity score estimation is based on a sample of 1,261 individuals, and the restriction to the region of common support reduces the sample to 1,248. Being black as opposed to neither Hispanic nor black, father's education, aspirations, peer aspirations, being enrolled in a college preparatory curriculum, and cognitive ability were all positively associated with college completion net of controls.

Black women had 72 percent higher odds of completing college relative to non-black, non-Hispanic women net of controls. Each additional year of father's education increased the odds of completing college by 7 percent net of the other variables in the logit model. Women's college aspirations were associated with more than a tripling of the odds of completing college. Having a best friend who aspired to complete college was associated with a 75 percent increase in the odds of completing college, net of controls. Being enrolled in a college preparatory curriculum increased the odds of completing college by 99 percent net of controls. Finally, cognitive ability was strongly predictive of women's college completion in the NLSY-79 sample, with a one-standard deviation increase in cognitive ability associated with a 255 percent increase in the odds of completing college.

THE SAMPLES USED FOR MATCHING

In both cohorts, the samples used for matching were restricted to the region of common support, between the lowest propensity score in the treated group and the highest propensity score in the control group. In the early career sample, those enrolled in college or graduate school during 2009, when labor market outcomes were measured at the height of the Great Recession, were also excluded from the propensity score matching and HLM analyses. This resulted in samples of 753 men and 805 women in the early career sample drawn from the NLSY-97. Descriptive statistics of the samples used in the matching analysis are available in Table 2-3. Further tables showing descriptive statistics of those who were omitted from the sample because they were enrolled in college or graduate school are also available in Table 2-7 in the appendix.

[INSERT TABLE 2-3 HERE]

[INSERT TABLE 2-4 HERE]

For early career men, the average predicted propensity of completing college among the control group was .200, and the average propensity score for the treated group was .669. In the female early career sample, the average propensity scores were .262 for the control group and .696 for the treated group. The late career sample drawn from the NLSY-79 also had large gaps in the estimated propensity scores of control and treatment group members. For late career men, the average propensity scores were .222 and .661 for non-college and college graduates, respectively. For women, non-college graduates averaged propensity scores of .230 and college graduates averaged .608. These large disparities in the average predicted propensities of completing college between the treatment and control group suggest that zero-order comparisons between college graduates and non-college graduates (Carnevale et al. 2012), while offering an important description of differences between educational groups, do not offer much evidence one way or the other regarding college effects.

The HLM uses propensity score strata where the propensity scores and the values of the covariates are not significantly different between treated and untreated cases within each block. In the early career sample, this resulted in the creation of 6 blocks for men and 8 blocks for women. In the late career sample, there were 6 blocks for men and 10 blocks for women.

TREATMENT EFFECTS OF COLLEGE DURING THE GREAT RECESSION

Early Career Workers

[INSERT TABLE 2-5 HERE]

Men

Men in the early career sample experienced uneven effects of college during the Great Recession. The results of the propensity score matching analysis (shown in Table 2-5) suggest that college completion did provide an earnings premium to early career male college graduates on average, noted by the positive estimate for the TT on logged earnings. Similarly, the TUT for earnings suggests that non-college graduates would have earned significantly more than they did during the Great Recession on average had they completed college. Thus, during the Great Recession, college provided significant benefits in terms of earnings for early career men after controlling for the propensity to complete college. While the point estimates for the TT and TUT were relatively close, the HLM results (Figure 2-1) showed a negative level-2 slope over the distribution of propensity scores. This means that college provided larger earnings premiums to early career men with low propensity scores. Brand and Xie (2010) call this a pattern of negative selection.

[INSERT FIGURE 2-1 HERE]

[INSERT FIGURE 2-2 HERE]

The TT for weeks worked was not distinguishable from zero, suggesting that college graduates did not work more weeks during 2009 than they would have had they not completed college on average. The TUT, on the other hand, was positive. It suggested that on average, non-college graduates worked 6.3 fewer weeks in 2009 than they would have had they completed college. Thus, college did not seem to provide a premium in terms of weeks worked to early career men in 2009 for the average college graduate, but it would have provided non-college graduates with a greater number of weeks worked.

The level-2 slope in the HLM (Figure 2-2) again confirms this apparent pattern of negative selection. The HLM suggests that the largest college employment premium exists for those with low estimated propensity scores.

[INSERT FIGURE 2-3 HERE]

The matching analysis for hours worked suggested that college did not provide a benefit in hours worked in 2009 for college graduates nor non-college graduates on average. While both point estimates for the TT and the TUT were positive, neither was statistically significant. The level-2 slope in the HLM (Figure 2-3) is only slightly negative, but essentially flat. This suggests that there was not strong evidence of heterogeneous effects of college on hours worked across propensity score during 2009.

In 2009, in contrast to the analyses for earnings and weeks worked, college seemed to provide a positive effect on wages for college graduates on average, but not for non-college graduates. The TT is positive and significant at the $p<.10$ level, while the point estimate of the TUT is positive, but not statistically significant. This suggests a pattern of positive selection on wages during the Great Recession, though the matching analysis does not strictly test this. The HLM, however, provides a negative level-2 slope, though this slope is not as large relative to its standard error. Overall, there appeared to be a pattern of negative selection with respect to college effects on young men's employment during the Great Recession.

[INSERT FIGURE 2-4 HERE]

[INSERT FIGURE 2-5 HERE]

The results for the two measures of job quality, logged hourly wages and occupational status, differed from the patterns found for employment. The average male

college graduate in the early career sample saw significantly increased wages than his matched control cases, conditional on employment. For non-college graduates, the TUT of college on wages was also positive and significant at the $p<.10$ level. The relatively large TT in comparison to the TUT suggests a pattern of positive selection, with higher wage premiums accruing to likely college graduates. The HLM in Figure 2-4 seems to confirm this, with a relatively steep positive level-2 slope. Thus, for early career men who were employed during the Great Recession, college increased the wages of likely college graduates most.

College effects on young men's occupational status also showed some evidence of positive selection during the Great Recession. The TT (9.384) was slightly larger than the TUT (7.160), though both were significantly greater than zero. There was also a modest positive slope in the HLM (Figure 2-5), again suggesting that average treatment effects of college on occupational status was greater for those with high predicted propensities of completing college based on precollege observable characteristics. It is important to note when comparing results for wages with those for occupational status that wages are across all jobs for the entire year, and occupational status was reported for the job that the respondent reported as his primary job for the modal number of weeks in 2009.

Women

[INSERT FIGURE 2-6 HERE]

For early career women, college seemed to provide greater overall benefits in 2009 relative to men. The matching results, shown in Table 2-5, the average early career

female college graduate increased her logged income by 1.117 units by completing college. The TUT was also significantly greater than zero, and even larger than the TT. The average non-college graduate's logged income would have been 1.645 units higher on the logarithmic scale had she completed college. Thus, the propensity score matching analysis suggests a TUT that is larger than the TT, which supports the hypothesis of negative selection. This conclusion is bolstered by the HLM results for early career women's income shown in Figure 2-6, which show a negative linear slope across the propensity score distribution. Both the propensity score matching and HLM provide support for a negative selection hypothesis, where college provides the greatest earnings benefit for early career women who were least likely to receive the treatment.

[INSERT FIGURE 2-7 HERE]

[INSERT FIGURE 2-8 HERE]

The estimated treatment effects of college on the number of weeks worked for early career women in 2009 also seem to suggest a strong pattern of negative selection. Both the TT and the TUT are positive and significantly greater than zero, though the magnitude of the TUT is larger. The TT suggests that the average college graduate worked 5.6 more weeks on average than similar female non-college graduates. The TUT suggests that the average non-college graduate would have worked 10.3 more weeks in 2009 if she had completed college. The level-2 slope in the HLM, shown in Table 2-7, provides further evidence for the negative selection hypothesis for weeks worked during the Great Recession. Thus, at the height of the Great Recession, college provided the largest employment gain to women who were least likely to complete college.

The analysis of hours worked for early career women in 2009 suggests positive effects of college for both college graduates and non-college graduates. The TT suggests the average early career female college graduate worked over 500 more hours in 2009 than she would have had she not completed college, which is roughly 10 hours per week. The TUT suggests that the average non-college graduate would have worked an additional 619 hours in 2009 if she had completed college. For hours worked, the estimated TT is slightly smaller than the TUT, again suggesting a pattern of negative selection. However, the flat level-2 slope in Figure 2-8 does not provide evidence for a strong pattern of heterogeneous effects of college across propensity score for early career women's hours worked. The matching analysis and the HLM together suggest that college had a positive effect on early career women's hours worked in 2009 after controlling for pre-college characteristics. These effects also appear to be quite similar in magnitude across the propensity score distribution, and do not follow a clear monotonic pattern either increasing or decreasing across the propensity score distribution.

College completion also provided positive effects on women's hourly wages if they were employed in 2009. While the TUT of college on wages was slightly larger than the TT, both were positive and statistically significant. Like the analysis of hours worked, the level-2 slope for logged hourly wages in the HLM was essentially flat (Figure 2-9). This suggests a lack of evidence for heterogeneous effects of college on early career women's wages during the Great Recession conditional on employment.

[INSERT FIGURE 2-9 HERE]

[INSERT FIGURE 2-10 HERE]

Finally, both early career women in the treated and untreated groups appeared to benefit significantly from college in terms of occupational status. Employed early career college graduates had primary jobs in 2009 that were 6 points higher than their matched control cases on average. The TUT was also positive and statistically significant with non-college graduates who were employed in 2009 losing roughly 10 points on the occupational status scale compared to their matched treated counterparts. Therefore, the average employed female non-college graduate in 2009 was working in a substantially lower status occupation than she could have expected if she had completed college. The level-2 slope in the HLM for occupational status reinforces these findings, and suggests a modest pattern of negative selection (Figure 2-10). Again, because occupational status was measured for the respondent's self-reported modal primary job in 2009, it may not take into account any additional jobs that contributed to their average level of hourly wages.

For early career men, there seemed to be patterns of negative selection for earnings and employment, but patterns of positive selection for job quality. For women, the positive effects of college on labor market outcomes seemed more universal during the Great Recession. While there were, similar to men, patterns of negative selection for earnings and employment, there was not evidence for a pattern of positive selection for women's job quality.

Late Career Workers

[INSERT TABLE 2-6 HERE]

Late Career Men

Propensity score matching results for the NLSY-79 sample are provided in Table 2-6. The TT of college on late career men's logged earnings in 2009 was positive in a one-tailed test according to the propensity score matching analysis. The point estimate for the TUT on earnings, though positive, was not significantly greater than zero. The relatively similar magnitudes of the TT and the TUT do not suggest a strong pattern of heterogeneous effects of college on late career men's earnings during 2009. The HLM shown in Figure 2-11, on the other hand, suggests a pattern of negative selection illustrated by a negative level-2 slope for the average treatment effects across the propensity score strata.

[INSERT FIGURE 2-11 HERE]

On average, college provided neither college graduates nor non-college graduates with significantly more weeks worked in 2009 after matching based on the estimated propensity score. However, there was a significant pattern of negative selection according to the HLM. Looking at the graph in figure 2-12, the estimated average treatment effects for weeks worked are actually slightly negative for the highest propensity strata, while being slightly positive for the lower propensity score strata. This leads to a negative slope, which is significantly less than zero according to the variance weighted least squares in the HLM. Thus, the average treatment effects of college on weeks worked appear to decrease as the propensity of completing college increases. For hours worked in 2009, again, neither the TT nor the TUT are statistically significant in the propensity score matching analysis. Again, there is a negative level-2 slope in the HLM (Figure 2-13). However, in this case, the variance around the level-2 regression line is greater than it was for weeks worked. This results in a lack of statistical significance for the level-2

slope. Overall, however, there seems to be some evidence for a pattern of negative selection for the effects of college completion on late career men's employment during the Great Recession.

[INSERT FIGURE 2-12 HERE]

[INSERT FIGURE 2-13 HERE]

For the late career male sample, both the treated and the untreated groups experienced positive estimated treatment effects of college on wages. However, while the TT was significant at the $p<.001$ level, the effect of college for the untreated was only significant in a one-tailed test. This, combined with the larger magnitude of the TT relative to the TUT, suggests that a pattern of negative selection on wages does not exist. The modest yet positive level-2 slope in Figure 2-14 reinforces this conclusion. Therefore, among late career men who were employed during the height of the Great Recession, college may have increased the wages of likely college graduates more than it did for unlikely college graduates.

[INSERT FIGURE 2-14 HERE]

[INSERT FIGURE 2-15 HERE]

Results for the other measure of job quality, occupational status, were not consistent with this conclusion. Similar to the matching results for log wages, both the TT and the TUT of college on occupational status were positive. On average, late career male college graduates who were employed during 2009 had jobs that scored 7.8 points higher on the Hauser-Warren SEI than their matched control cases. Non-college graduates benefited even more on average, with a TUT of 9.3. Figure 2-15, showing the HLM results for occupational status, also suggest a slightly negative level-2 slope, which would

suggest a pattern of negative selection. The relatively small magnitudes of the level-2 slopes for both measures of job quality, as well as their conflicting signs, suggest that there was not a strong monotonic pattern of heterogeneous effects of college on job quality for late career men in 2009.

Late Career Women

According to the propensity score matching results for late career women (Table 2-6), college completion did not provide college graduates with greater logged earnings in 2009, evidenced by a TT that was not significantly different from zero. On the other hand, the TUT was positive and significant at the 99.9 percent confidence level. The matching results, therefore, suggest a pattern of negative selection. While the HLM in Figure 2-16 does produce a negative level-2 slope, seemingly corroborating the matching results, I note that it is not all that strong.

[INSERT FIGURE 2-16 HERE]

In terms of weeks worked, college did not provide college graduates with an employment premium; similarly, non-college graduates worked similar numbers of weeks in 2009 as otherwise similar college graduates. Thus, according to the propensity score matching analysis, college did not provide significant increases in weeks worked for late career women during the Great Recession because neither the TT nor the TUT was significantly different from zero. The HLM for weeks worked (Figure 2-17) also suggests a lack of heterogeneity in effects. It seems that across the propensity score distribution, there were few effects of college on weeks worked or changes in those effects.

[INSERT FIGURE 2-17 HERE]

[INSERT FIGURE 2-18 HERE]

For hours worked in 2009, there were slightly different results than the analyses for weeks worked. College graduates were on average no different from their matched control cases in terms of the number of hours they worked during 2009. Non-college graduates, on the other hand, could have expected to work roughly 260 more hours per year had they completed college. This is equivalent to roughly five hours per week. There was a modest negative level-2 slope for hours worked in Figure 2-18. Thus, college completion may have benefited low-propensity women in terms of employment more than their high-propensity counterparts, though the evidence is not as strong for late career women as it was for men.

[INSERT FIGURE 2-19 HERE]

In contrast to the prior outcomes, college seemed to have strong positive effects on both the treated group and the control group's logged hourly wages. For late career female college graduates, the average treatment effect of college on logged wages was .207; the TUT, applicable to non-college graduates on average, was .295. The slightly larger TUT suggests a modest pattern of negative selection, with college providing a larger average expected wage premium to women who did not complete it. These results were mirrored with a negative, though relatively weak, level-2 slope in the HLM for the effect of college on late career women's logged hourly wages (Figure 2-19). Therefore, conditional on employment in 2009, college may have provided a slightly larger wage premium for those with low predicted propensities to complete college.

[INSERT FIGURE 2-20 HERE]

I found similar results to the logged hourly wages analyses for the effects of college completion on late career women's occupational status in 2009. Both college graduates and non-college graduates on average stood to benefit from completing college in terms of occupational status, provided they were employed in 2009. During the height of the Great Recession, employed college graduates were employed in occupations with roughly 8 points higher occupational status on average than similar employed non-college graduates. The penalty applied to non-college graduates in terms of occupational status was slightly larger in magnitude, just as it had been for hourly wages. Employed non-college graduates, on average, would have expected to occupy occupations with 11 additional points on the Hauser-Warren socioeconomic index, conditional on remaining employed through the recession. Although both the TT and the TUT for occupational status were positive and significant, the larger magnitude of the TUT would lead to a prediction of a slight pattern of negative selection in the HLM (Figure 2-20). The multilevel analysis produces a level-2 slope of -6.7 for the trend in average treatment effects across the propensity score distribution. This suggests a very weak pattern of negative selection, with slightly greater effects of college on occupational status at lower propensity score levels. In contrast to the late career male results, each of the outcomes studied for late career women seems to produce similar patterns of college effects. In each, estimated TUT's were slightly larger than the corresponding TT's. Similarly, the level-2 slope in each HLM was modest, yet negative.

DISCUSSION OF RESULTS

For early career men and women, the estimated treatment effects of college completion on labor market outcomes during the height of the Great Recession were relatively widespread across the five labor market outcomes analyzed in 2009. College effects in the early career seemed more consistent for women than for men. Significant treatment effects existed for both college and non-college graduate women on average on all of the outcomes. Thus, college provided substantial benefits for women in terms of income, employment, and job quality during the Great Recession. For non-college graduate men, on the other hand, the TT for weeks worked and the TUT for hours worked were positive, but were not significantly greater than zero. Thus, the effects of college on early career men seemed slightly more variable than for women. This conclusion is reinforced by the stronger level-2 slopes HLM's for early career men compared with early career women. For men, the level-2 slopes for earnings and employment were at least moderately negative, and the level-2 slopes for job quality were positive. On the other hand, early career women had relatively strong level-2 slopes for earnings, weeks worked, and occupational status, but essentially flat level-2 slopes for hours worked and hourly wages.

For young men during the Great Recession, the negative level-2 slopes for the effects of college on earnings and employment seem consistent with prior findings of negative selection (Brand and Xie 2010). However, conditional on being employed, college seemed to provide them with higher quality jobs as measured by both wages and especially occupational status. This discrepancy could be due to several factors. First, there may be differences in the pattern of heterogeneous effects of college on wages by cohort. Because Brand and Xie (2010) studied the WLS and the NLSY-79, it is possible

that subsequent generations experience a different pattern of college effects because of changes in the intervening years in college access or changes in the labor market.

Second, instead of a cohort effect, this could be an age effect. The early career sample here is between the ages of 25 and 30 when labor market outcomes are measured. In Brand and Xie (2010) the youngest age at which the NLSY-79 sample is analyzed is between the ages of 29 and 32. The wage distribution, and in particular the wage difference between college graduates and non-college graduates, may be particularly narrow at young ages because non-college graduates will have a greater relative advantage in job tenure and labor market experience that will dissipate over time. This could lead to a distinct pattern of college effects on wages at this point in the career.

Third, the results may differ because the propensity score estimation is different. Exact replication of propensity score estimation and analyses of treatment effects is difficult because data sets rarely have identical information about respondents and satisfying the balancing property may be fickle. For instance, the NLSY-79, which Brand and Xie (2010) used, does not contain information regarding respondents' high school grades. However, the NLSY-97, which I use here for the early career cohort, does include transcript information for a large subset of the sample. Given the importance of academic performance during high school on college acceptance and its predictive power for college completion, I felt it necessary to include in the propensity score estimation. Doing so may have changed the propensity score estimation, and therefore changed the distribution of propensity scores, altering the average treatment effect estimates in turn. Fourth, the results for early career men's job quality may differ from previous findings of negative selection due to the special circumstances of the Great Recession. It is possible

that changes in the economic context brought on by the Great Recession affected the relationship between education and labor market outcomes such as wages and occupational status. I test this hypothesis in a later chapter of this dissertation. However, given the relatively small body of literature on heterogeneous patterns of effects and the lack of replication across different data sets, it is hard to say which of these scenarios is responsible for the discrepancies for the effects of college on young men's wages and occupational status.

Early career women, on the other hand, tended to benefit more uniformly from college completion across the range of labor market outcomes included here. College provided significant benefits to women's earnings, employment, and job quality for both the average college graduate and the average non-college graduate. There seemed to be larger effects for those who were unlikely to complete college for earnings, weeks worked, and occupational status. However, the effects of college on both early career women's hours worked and hourly wages conditional on employment were largely homogenous across the propensity score distribution. Although I conclude that there are roughly homogenous effects of college on the average log wages for young women across propensity score strata, the magnitudes of the slope I find (-.03 from a propensity score of 0 to 1) is not much smaller than the slope reported for the youngest age group of women in Brand and Xie's (2010) NLSY-79 analysis (roughly -.04 from a propensity score strata of 0-.1 to .8-1).

The divergence here between the early career male and female results particularly for wages could be due to gender differences in returns to college (Gerber and Cheung 2008), gender differences in the effects of recessions (Hoynes et al. 2012), or both.

Although a gender wage gap exists where men earn higher wages than women of the same education level and that ratio seems consistent across educational levels (Jacobs 1996), the pattern of those effects across the distribution of individuals may differ by gender. Alternatively, labor economists (Elsby et al. 2010; Hoynes et al. 2012) have noted that men's employment responds more strongly to changes in the business cycle. For example, male-dominated sectors such as construction and manufacturing have traditionally been the most adversely affected by recessions. If these observations remain after controlling for precollege characteristics, then recessions may cause greater changes in the effects of college (and their patterns of heterogeneous effects) for men.

The results from early career workers suggest that the positive association between college completion and individual labor market outcomes observed during the Great Recession (Elsby et al. 2010; Hout 2012; Hout, Levanon, and Burak 2011; Hoynes et al. 2012) were not due simply to differences in precollege observable factors, such as high school grades, socioeconomic and demographic background, and cognitive ability. Despite real concerns over recent college graduates' declining wages and employment during the recession, completing college provided significant benefits. These results also suggest that the effects of college on early career workers during the Great Recession tended to follow patterns of negative selection more often than not when patterns of heterogeneous effects existed. Of the ten HLM's estimated, only two of the level-2 slopes were positive and only one was statistically significant. On the other hand, eight of the HLM's yielded negative level-2 slopes, and three were statistically significant, suggesting that college completion provided greater benefits to those least likely to undergo the treatment (Brand and Xie 2010).

These early career college effects are also important given the relative advantage that non-college graduates may have at this stage of the career. Advantages in job tenure and labor market experiences that non-college graduates may have because they chose to enter the labor market instead of attend school are greatest as individuals are still young. Furthermore, the wage distribution is narrowest early in the career, before employees are promoted and reach their peak wages later in adulthood. As the NLSY-97 cohort ages, we would expect the differences in work experience to shrink and the distribution of wages to widen. This could be one reason that the estimated effects of college on logged wages in 2009 among early career workers were not statistically significant. Occupational status may provide a better gauge at this stage of job quality than wages. If workers employed in higher status occupations can expect greater future increases in wages, the occupational status premium provided to early career college graduates may translate into higher wages and income later in their careers.

Among late career men, college seemed to provide greater increases in earnings during the Great Recession to those who were less likely to have completed college. There was also a strong pattern of negative selection for employment, which primarily drove the corresponding pattern for earnings. By contrast, there was a slight pattern of positive selection for wages, though both college graduates and non-college graduates stood to benefit from college completion. For late career women, there were negative patterns of heterogeneous effects of college across all of the labor market outcomes, though none were particularly strong relative to their standard errors.

The gender differences among the late career cohort suggest that during the Great Recession, college effects showed a much stronger pattern of negative selection for

men's employment than women's. That is, women who were unlikely to complete college may have benefitted slightly more than others from completing college in terms of employment; however, men with low propensity scores who completed college benefitted tremendously relative to their higher propensity counterparts. Thus, for late career workers during the recession, college provided the largest employment benefit to men who were unlikely to complete college based on precollege observable characteristics.

The strong pattern of negative selection for late career men may contribute to the slightly positive pattern observed for wages. The job quality analyses were conditional on employment. If low-propensity college graduates, who remained employed at relatively high rates compared to their non-college counterparts during the recession, took lower paying jobs, their college wage premium would decrease relative to high-propensity college graduates. This could explain the positive pattern of selection on wages for the men in both cohorts, similar to a process of occupational downgrading, where more qualified workers take lower quality jobs during recessionary contexts (Devereux 2003). If women's jobs are less cyclical than men's, this might explain the similar patterns across outcomes for women, where it seems that low-propensity women benefit slightly more from college than high-propensity women.

There are several limitations in this chapter that future analyses might address. First, the sample sizes available are relatively small, which could have negatively impacted the accuracy of my results. Ideally, larger samples would provide more precise estimates, though data sources that measure the precollege variables required to adequately control for selection into college are relatively rare. Second, because labor

market outcomes were self-reported unlike analyses that rely on administrative data (Oreopoulos et al. 2012) there may be measurement error. For example, a few individuals who were dropped from the analysis provided estimates of hours worked that seemed physically impossible, such as working 20 hours per day for seven days per week. Of greater concern, however, was the data on wages. The wage data relied on self-reports of both the number of hours worked and the individual's earnings. Thus, wages had two potential sources of measurement error. Following Kahn (2010), I dropped some self-reported wages that were implausible, (e.g., wages under $1 per hour), which underscores the existence of measurement error. The potential measurement error of the wage data was a primary reason I also include analyses of occupational status, which is more reliable given that it does not change unless a respondent changed his or her job. However, the limitation of the occupational status variable was that it only corresponded to the respondent's primary job held for the most weeks during 2009. Therefore, respondents with two jobs only had the occupational status of whichever job they reported as their primary occupation analyzed. Furthermore, it is unclear how accurate of a measure of job quality occupational status is, as it is based only on the average earnings and education level of workers in a given occupation, and says nothing about the job itself. Better data sources in the future may alleviate some of these concerns, though previous analyses using different data sources, such as the Wisconsin Longitudinal Survey (Brand and Xie 2010), are consistent with the general patterns of negative selection observed in this chapter.

Taken together, these analyses strongly suggest that college provided a net benefit to those who completed it during the Great Recession. Even after controlling for

precollege observable characteristics, both early and late career college graduates were better off than their less educated counterparts on a number of labor market outcomes. Even at the height of the Great Recession, college did seem to help individuals "weather the storm" (Carnevale et al. 2012) by providing significant income, employment, and job quality premiums. The existence and strengths of these premiums, however, differed across cohort, gender, the likelihood of completing college, and the type of labor market outcome specified.

Table 2-1. Odds ratios predicting college completion by 2008, early career men and women: NLSY-97.

	Men (N = 1,016)	Women (N = 1,103)
Demographic background		
Black	2.025*	2.511***
	(.73)	(.71)
Hispanic	1.006	.796
	(.32)	(.26)
Live in MSA	1.394	1.489†
	(.33)	(.33)
Northeast	3.244***	1.876*
	(.99)	(.53)
North Central	1.573†	2.295***
	(.41)	(.56)
West	1.398	1.707*
	(.46)	(.44)
Family variables		
Sibship	.973	.897
	(.08)	(.06)
Intact family	2.346***	1.583*
	(.54)	(.31)
Mother's educ.	1.168	.723*
	(.19)	(.10)
Father's educ.	1.174	.755*
	(.20)	(.10)
Mother's ed*Father's ed	.998	1.032***
	(.01)	(.01)
Log parental income	1.249	1.111
	(.21)	(.12)
Ability		
Cognitive abil.	1.719**	1.386†
	(.33)	(.25)
High school variables		
Peer college plans	1.011*	1.014**
	(.00)	(.00)
College prep	2.275***	3.149***
	(.48)	(.60)
High school GPA	12.068***	9.885***
	-3.21	-2.54
Teacher interest	0.838	0.722
	-0.29	-0.18

*† p<.10; *p<.05; **p<.01; ***p<.001*

Table 2-2. Odds ratios predicting college completion by 2008, late career men and women: NLSY-79.

	Men (N = 916)	Women (N = 1261)
Demographic background		
Black	2.625**	1.721*
	(-.97)	(.48)
Hispanic	0.743	1.165
	(-.35)	(.39)
Rural	.954	1.116
	(.30)	(.23)
Northeast	1.234	1.149
	(.45)	(.36)
North Central	1.310	.906
	(.44)	(.26)
South	.970	1.009
	(.33)	(.29)
Family variables		
Sibship	.961	1.038
	(.06)	(.05)
Intact family	1.492	1.313
	(.46)	(.32)
Mother's educ.	.752	1.034
	(.17)	(.05)
Mother's educ.[2#]	1.016†	
	(.01)	
Father's educ.	.992	1.072*
	(.04)	(.03)
Log parental income	.961	.981
	(.13)	(.09)
Ability		
Cognitive abil.	4.565***	3.546***
	(1.07)	(.69)
Rotter scale	1.055	1.189
	(.26)	(.26)
Rotter[2]	.998	.988
	(.01)	(.01)
High school variables		
Peer college plans	1.944*	1.746**
	(.52)	(.33)
College prep	4.049***	1.992***
	(1.04)	(.38)
College aspirations	9.261***	4.782***
	-3.37	-0.98

*† p<.10; *p<.05; **p<.01; ***p<.001*

Squared term for mother's education included in male logit to satisfy the balancing property.

Table 2-3. Descriptive statistics for early career men and women, NLSY-97.

	Male Means (N = 753)		Female Means (N = 805)	
	Non-college Graduate	College Graduate	Non-College Graduate	College Graduate
Propensity score	.20	.67	.26	.70
Logit covariates				
Black	.10	.03	.10	.07
Hispanic	.11	.06	.11	.05
Intact family	.57	.80	.49	.74
Northeast	.14	.20	.18	.15
North Central	.31	.33	.29	.36
West	.23	.17	.20	.18
Live in MSA	.76	.78	.72	.83
Sibship	2.90	2.57	2.90	2.42
Mother's educ.	12.76	14.54	12.66	14.08
Father's educ.	12.65	14.79	12.27	14.37
Log parental income	3.72	4.11	3.58	4.03
College prep	.43	.77	.42	.80
Cognitive abil.	.15	.73	.12	.62
High school GPA	2.71	3.26	2.86	3.40
Peer college plans	61.69	69.30	64.54	73.45
Teacher interest	.88	.93	.83	.92
2009 Outcomes				
Log earnings	10.32	10.66	9.90	10.45
Weeks worked	48.71	50.08	47.15	48.93
Hours worked	2146.58	2254.42	1781.37	2067.71
Log wages	2.72	2.99	2.54	2.90
Occupational status	27.61	40.95	28.46	39.19

Table 2-4. Descriptive statistics for late career men and women, NLSY-79.

	Male Means (N = 801)		Female Means (N = 1248)	
	Non-college Graduate	College Graduate	Non-College Graduate	College Graduate
Propensity score	.22	.66	.23	.61
Logit covariates				
Black	.07	.06	.10	.08
Hispanic	.04	.03	.05	.04
Rural	.24	.16	.23	.21
Northeast	.20	.25	.20	.21
North Central	.39	.36	.37	.30
South	.26	.26	.28	.34
Sibship	2.93	2.49	3.23	2.77
Intact family	.84	.88	.81	.88
Mother's educ.	11.94	13.32	11.38	12.83
Father's educ.	12.08	13.97	11.28	13.37
Log parental income	9.82	9.91	9.66	9.81
Cognitive abil.	.47	.90	.27	.81
Peer college plans	.48	.87	.41	.72
College prep	.26	.76	.22	.60
College aspirations	.52	.95	.34	.86
Rotter scale	8.05	7.41	8.41	7.69
2009 Outcomes				
Log earnings	10.76	11.29	10.13	10.67
Weeks worked	49.08	49.92	48.26	48.59
Hours worked	2275.13	2362.18	1879.97	1948.66
Log wages	3.10	3.60	2.74	3.21
Occupational status	36.48	49.47	34.97	48.30

Table 2-5. Matching and HLM Results for Early Career Men and Women, 2009: NLSY-97.

	Men			Women		
	TT	TUT	HLM Level-2 Slope	TT	TUT	HLM Level-2 Slope
Log Earnings	.850**	.696**	-1.103**	1.117***	1.645***	-1.569***
	(.28)	(.26)	(.32)	(.32)	(.31)	(.45)
Weeks Worked	3.171	6.304**	-6.176	5.583*	10.333***	-15.953***
	(2.27)	(2.33)	(4.33)	(2.72)	(2.75)	(3.41)
Hours Worked	256.35†	93.41	-138.20	510.69***	618.58***	-1.327
	(154.4)	(156.6)	(340.7)	(144.1)	(139.0)	(335.0)
Log Wages	.440***	.192†	.779***	.192*	.232**	-.030
	(.11)	(.10)	(.18)	(.08)	(.07)	(.18)
Occupational Status	9.348**	7.160***	3.858	6.648**	9.784***	-9.210
	(2.96)	(1.98)	(5.55)	(2.50)	(2.18)	(6.65)

† *p<.10; *p<.05; **p<.01; ***p<.001*

Table 2-6. Matching and HLM Results for Late Career Men and Women, 2009: NLSY-79.

	Men			Women		
	TT	TUT	HLM Level-2 Slope	TT	TUT	HLM Level-2 Slope
Log Earnings	.387†	.282	-.788*	.323	1.089***	-1.098
	(.23)	(.35)	(.36)	(.34)	(.33)	(.71)
Weeks Worked	-.120	-.875	-9.907***	.605	2.022	-.940
	(1.67)	(2.82)	(1.98)	(2.49)	(2.53)	(6.55)
Hours Worked	52.25	-1.66	-362.86	156.55	260.50*	-158.96
	(119.5)	(170.9)	(229.8)	(120.2)	(121.9)	(309.2)
Log Wages	.362***	.221†	.180	.207**	.295***	-.130
	(.11)	(.13)	(.26)	(.07)	(.07)	(.18)
Occupational Status	7.761***	9.327***	-2.137	8.071***	11.234***	-6.708
	(1.92)	(2.21)	(4.13)	(1.76)	(1.73)	(4.11)

† *p<.10; *p<.05; **p<.01; ***p<.001*

Table 2-7. Means for College and Graduate School Enrollees, 2009: NLSY-97.

	Men		Women	
	Undergraduate (N=83)	Graduate (N=71)	Undergraduate (N=132)	Graduate (N=114)
Propensity score	.339	.694	.315	.666
Black	.099	.058	.183	.142
Hispanic	.156	.072	.090	.055
Intact family	.681	.838	.417	.645
Northeast	.117	.144	.173	.170
North Central	.304	.486	.277	.285
West	.271	.195	.213	.163
Live in MSA	.786	.895	.769	.762
Sibship	2.742	2.584	3.038	2.770
Mother's educ.	13.524	14.538	13.131	13.907
Father's educ	13.793	15.088	12.992	14.017
Log parental income	3.735	4.148	3.505	3.730
College prep	.560	.835	.552	.880
Cognitiv abil.	.288	.709	.263	.588
High school GPA	2.852	3.242	2.886	3.354
Peer college plans	65.157	70.600	65.584	71.422
Teacher interest	.905	.908	.839	.876

Figure 2-1. College Effects on Early Career Men's Logged Earnings, 2009: NLSY-97

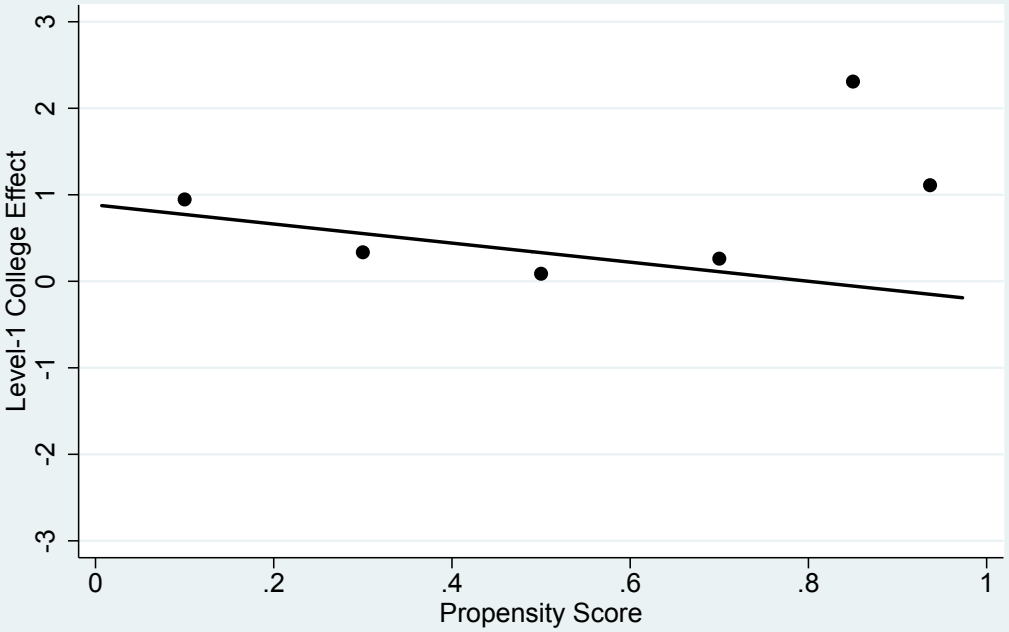


Figure 2-2. College Effects on Early Career Men's Weeks Worked, 2009: NLSY-97

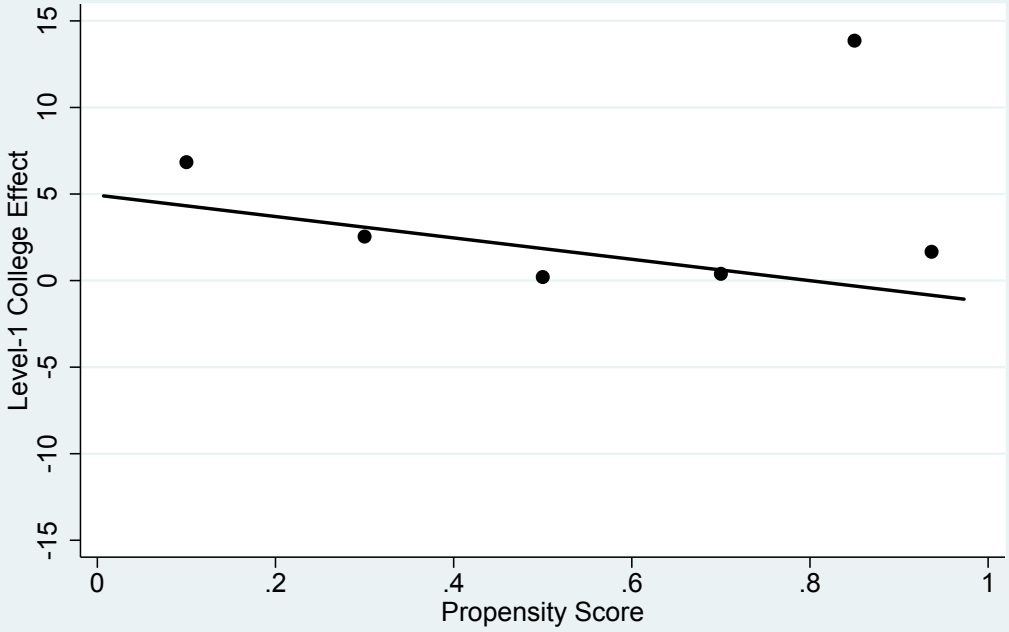


Figure 2-3. College Effects on Early Career Men's Hours Worked, 2009: NLSY-97

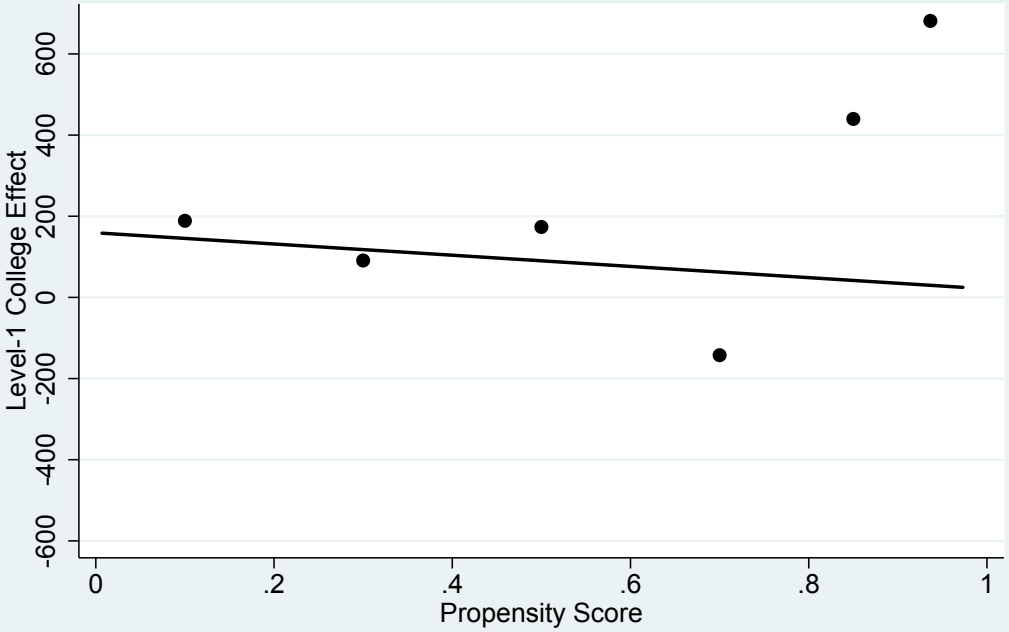


Figure 2-4. College Effects on Early Career Men's Logged Hourly Wages, 2009: NLSY-97

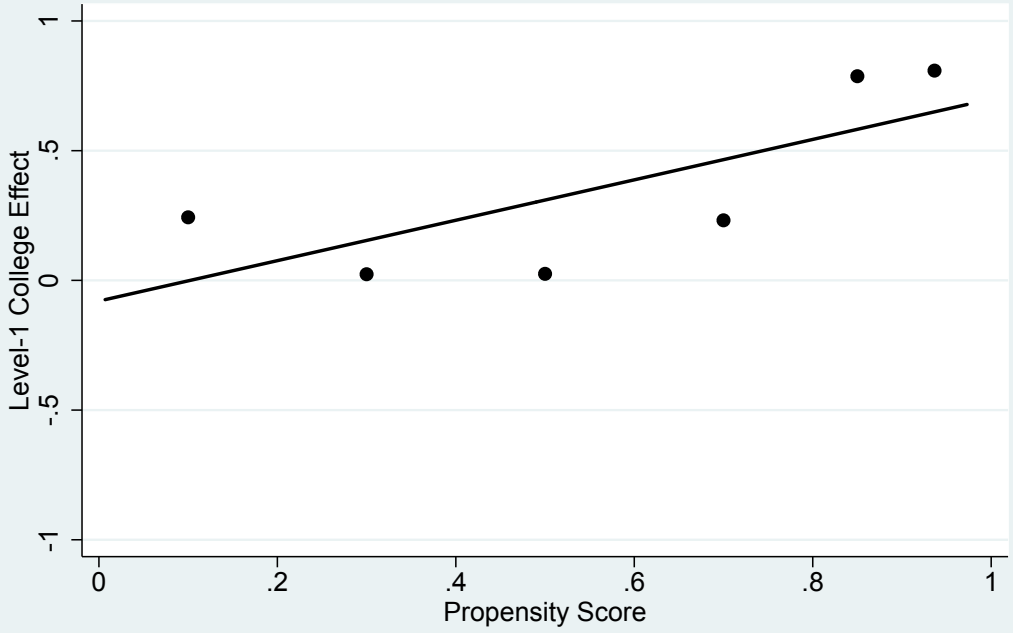


Figure 2-5. College Effects on Early Career Men's Occupational Status, 2009: NLSY-97

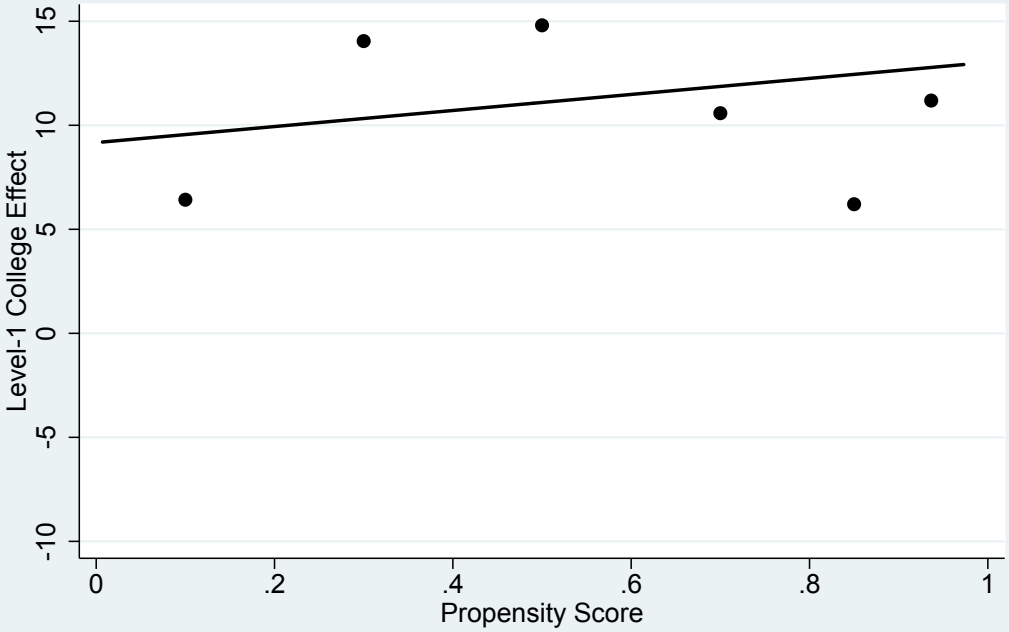


Figure 2-6. College Effects on Early Career Women's Logged Earnings, 2009: NLSY-97

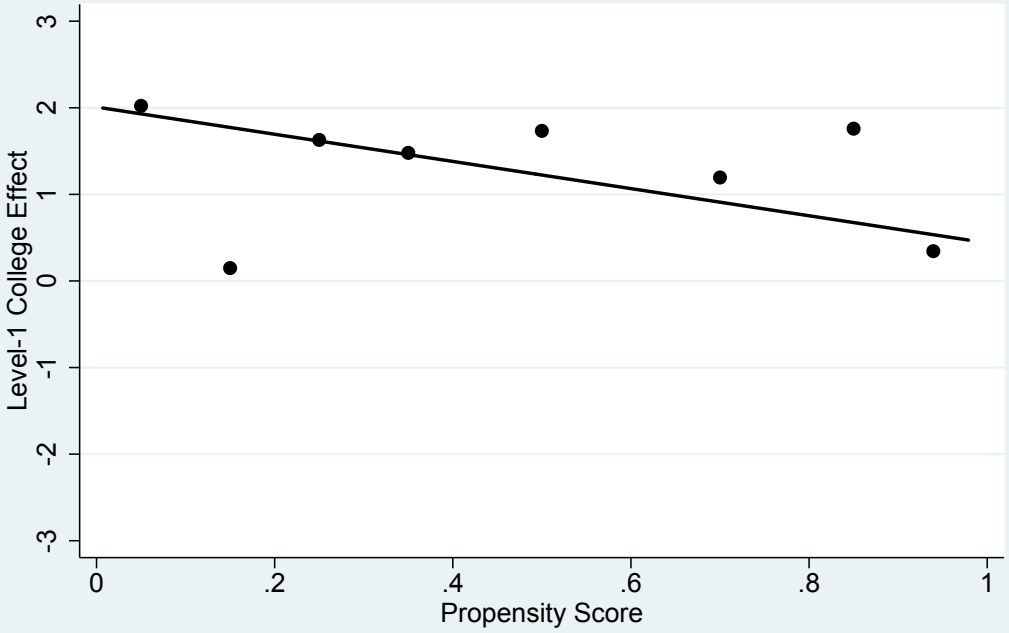


Figure 2-7. College Effects on Early Career Women's Weeks Worked, 2009: NLSY-97

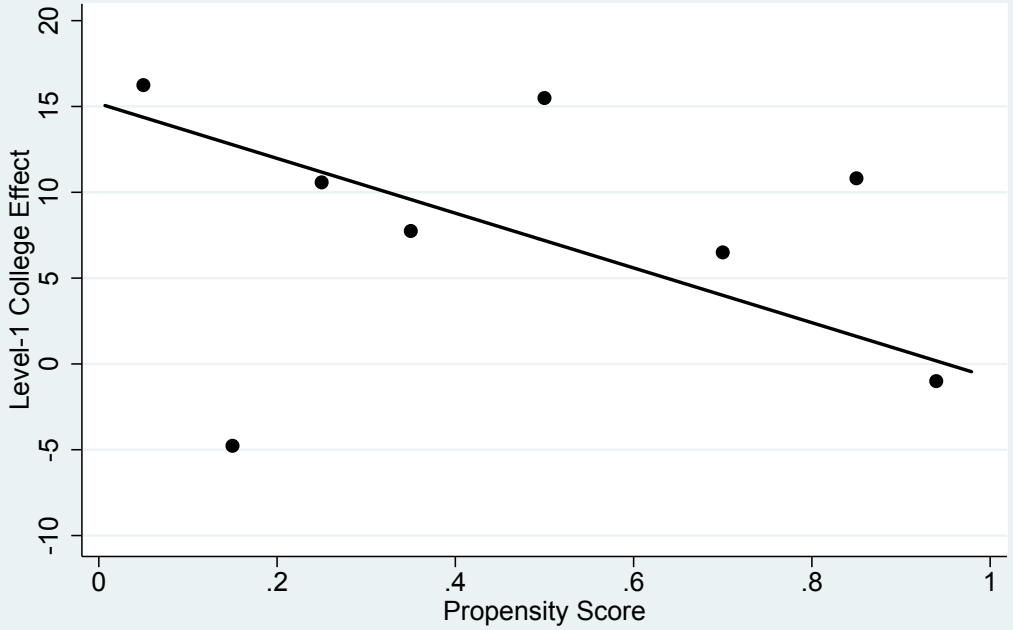


Figure 2-8. College Effects on Early Career Women's Hours Worked, 2009: NLSY-97

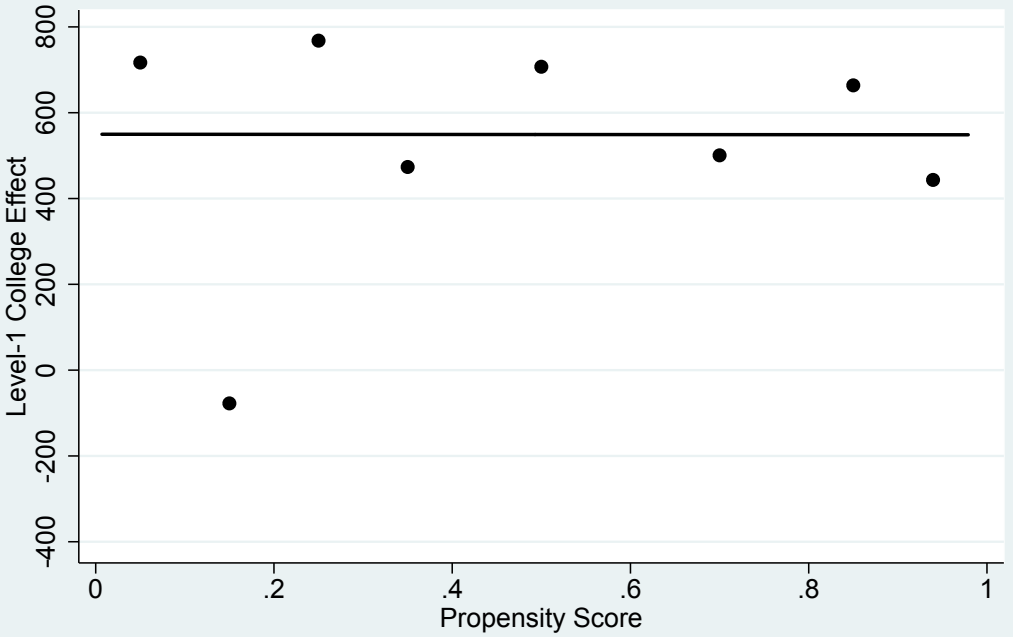


Figure 2-9. College Effects on Early Career Women's Logged Hourly Wages, 2009: NLSY-97

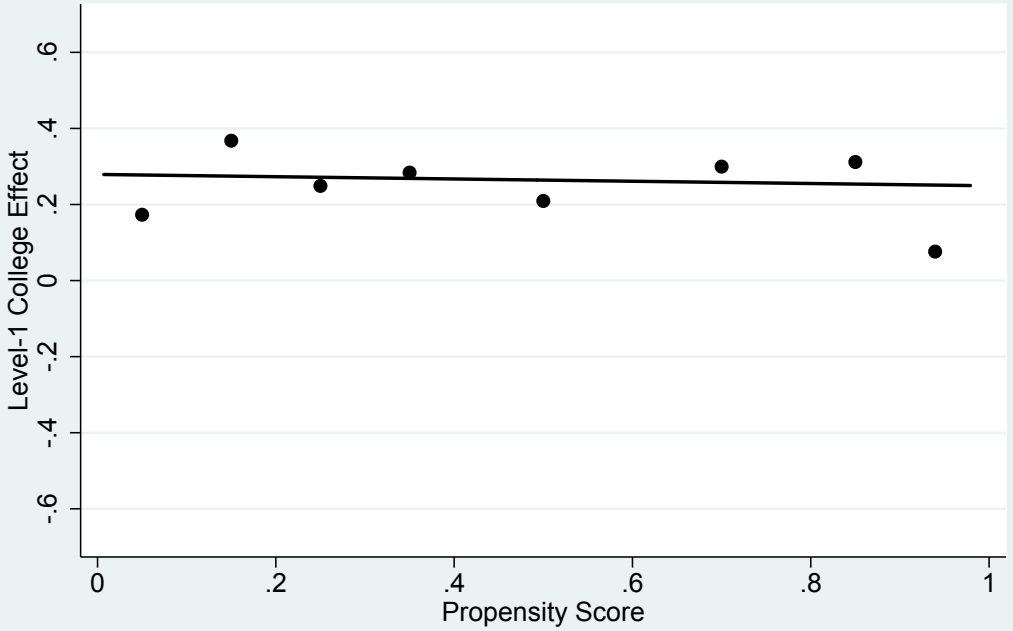


Figure 2-10. College Effects on Early Career Women's Occupational Status, 2009: NLSY-97

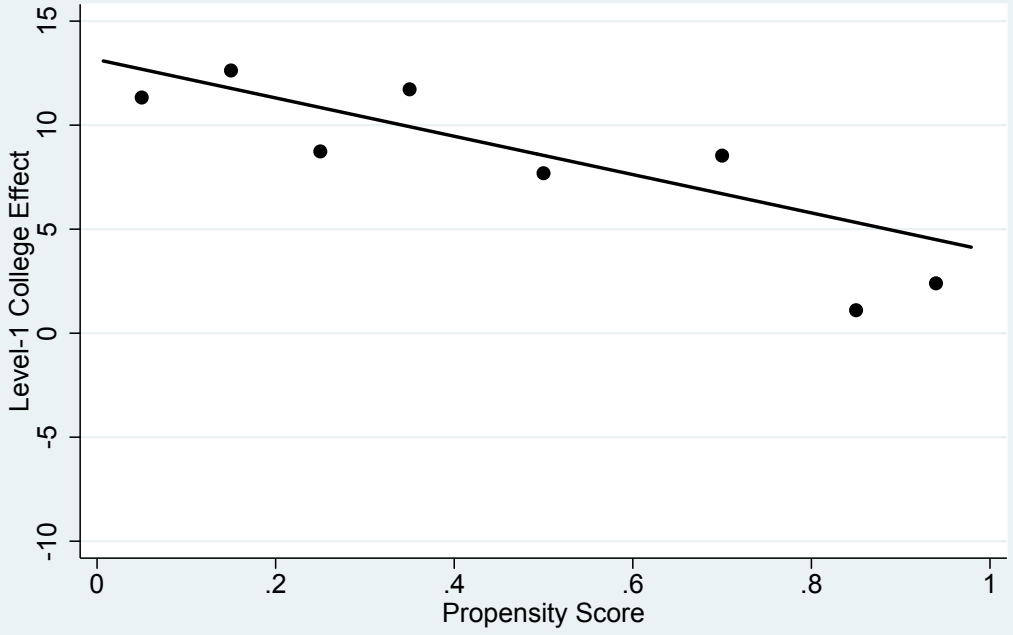


Figure 2-11. College Effects on Late Career Men's Logged Earnings, 2009: NLSY-79

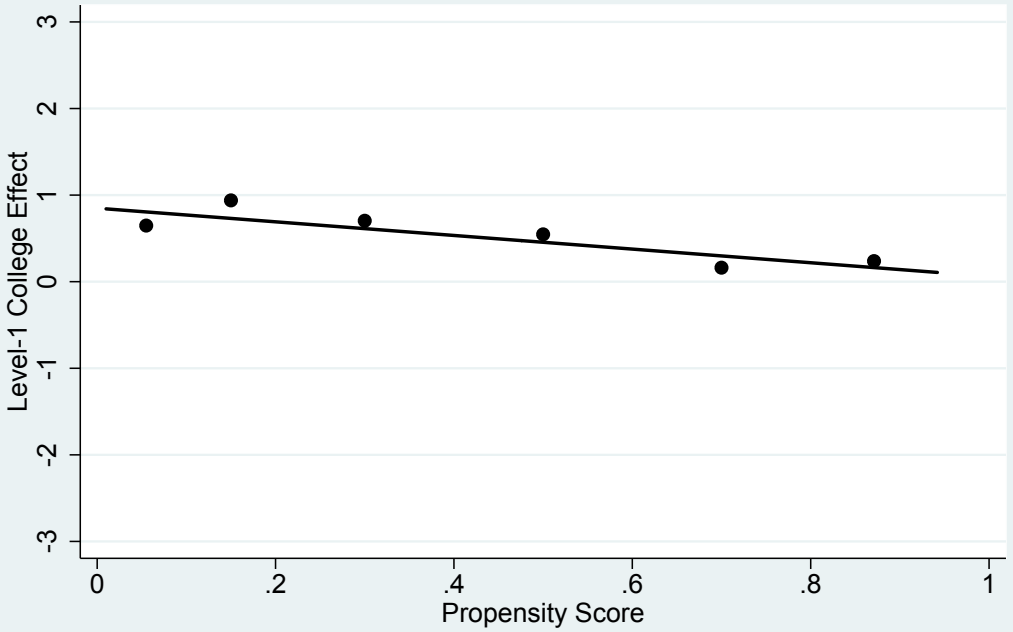


Figure 2-12. College Effects on Late Career Men's Weeks Worked, 2009: NLSY-79

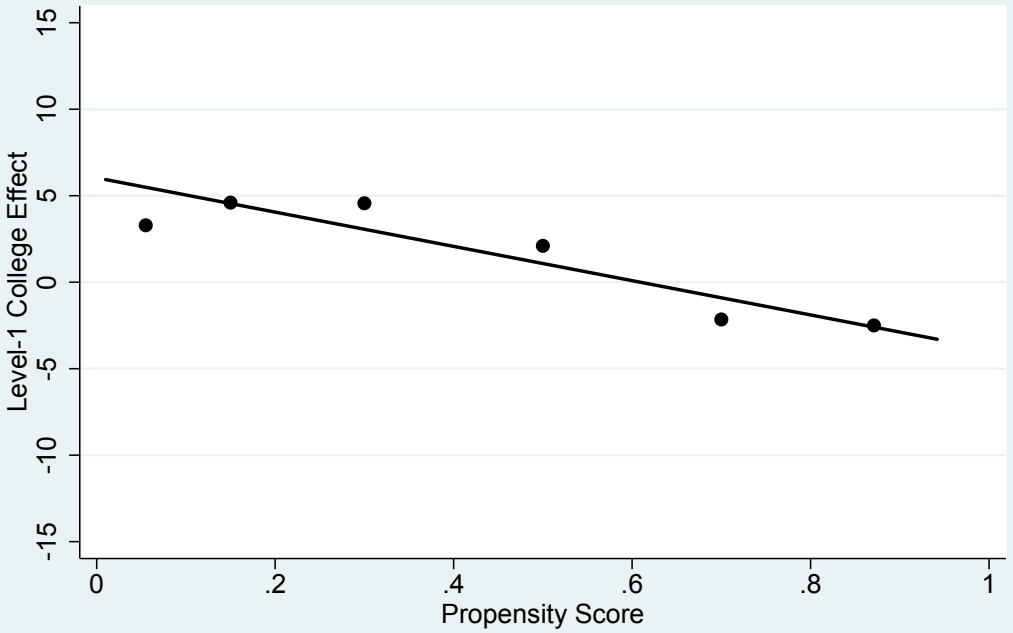


Figure 2-13. College Effects on Late Career Men's Hours Worked, 2009: NLSY-79

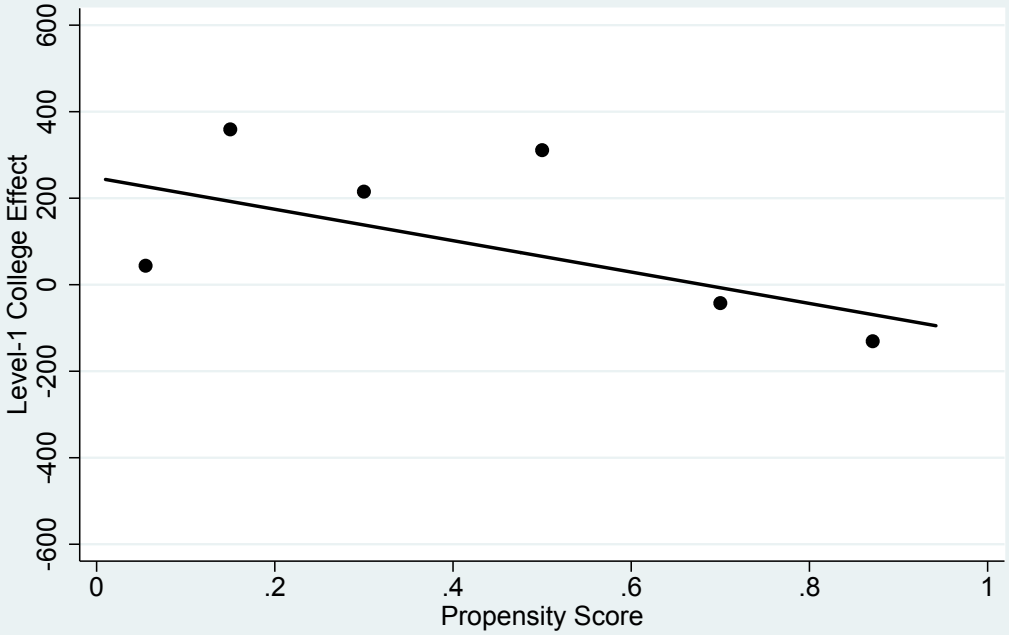


Figure 2-14. College Effects on Late Career Men's Logged Hourly Wages, 2009: NLSY-79

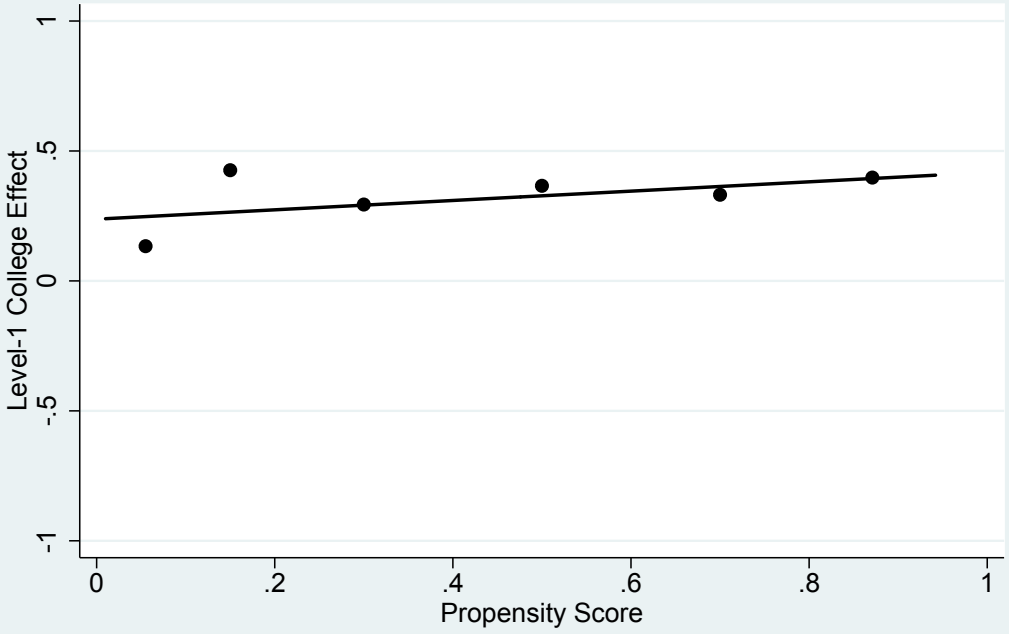


Figure 2-15. College Effects on Late Career Men's Occupational Status, 2009: NLSY-79

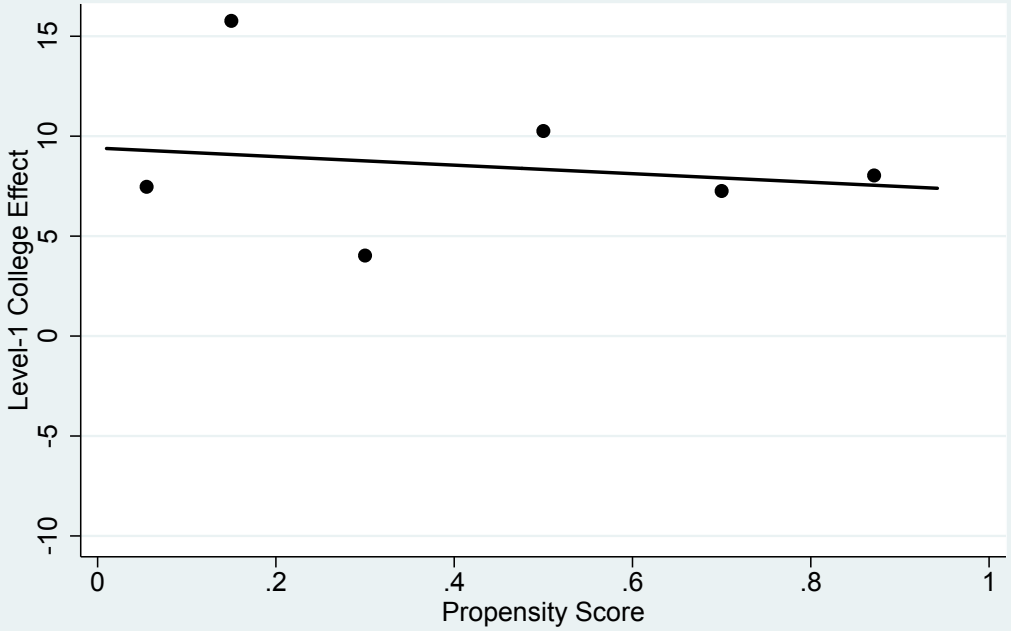


Figure 2-16. College Effects on Late Career Women's Logged Earnings, 2009: NLSY-79

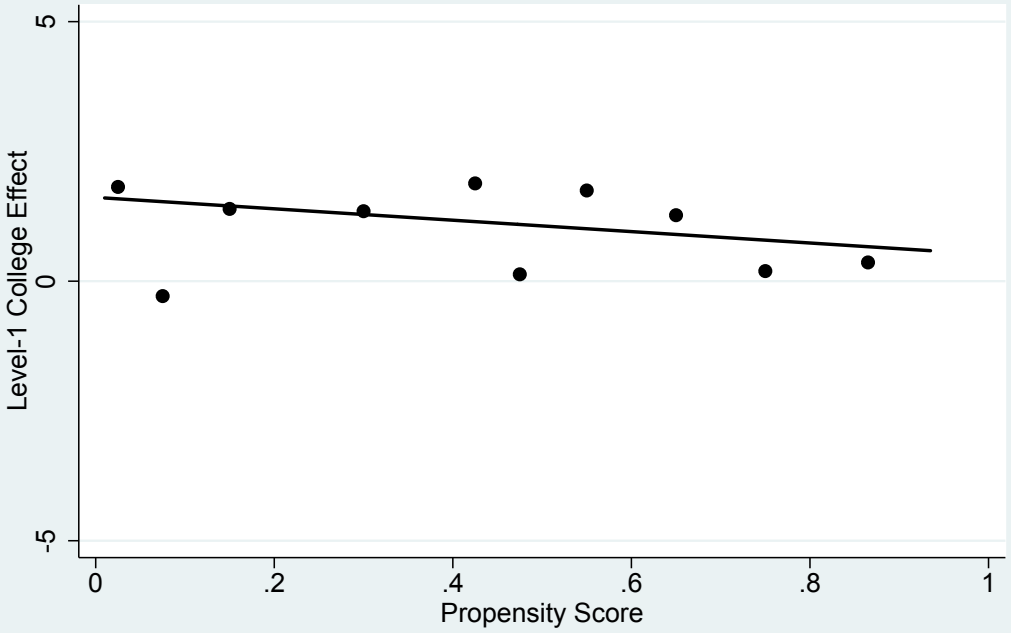


Figure 2-17. College Effects on Late Career Women's Weeks Worked, 2009: NLSY-79

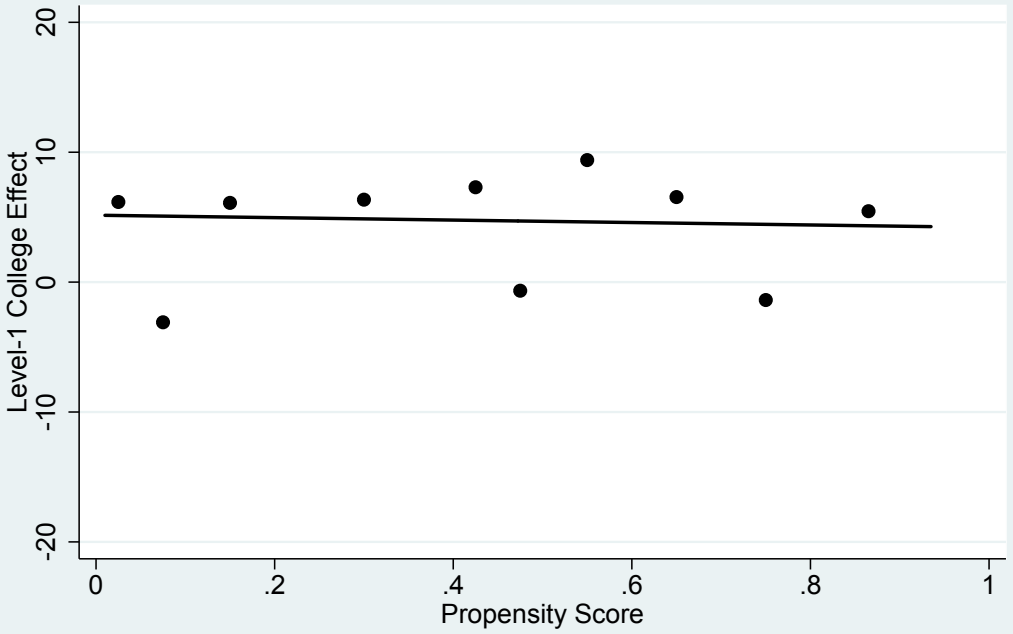


Figure 2-18. College Effects on Late Career Women's Hours Worked, 2009: NLSY-79

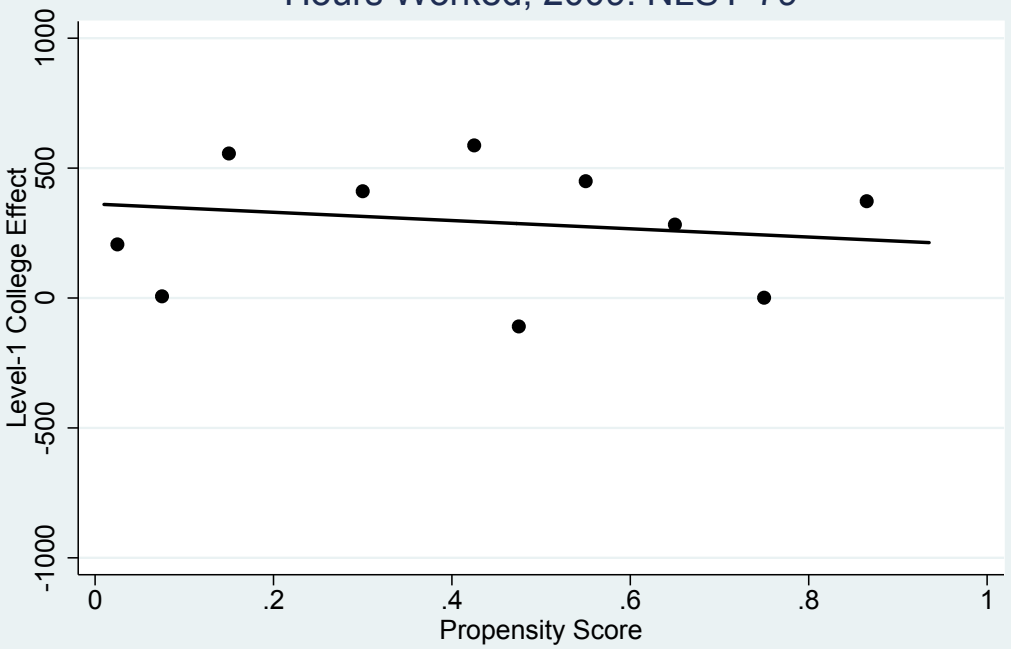


Figure 2-19. College Effects on Late Career Women's Logged Hourly Wages, 2009: NLSY-79

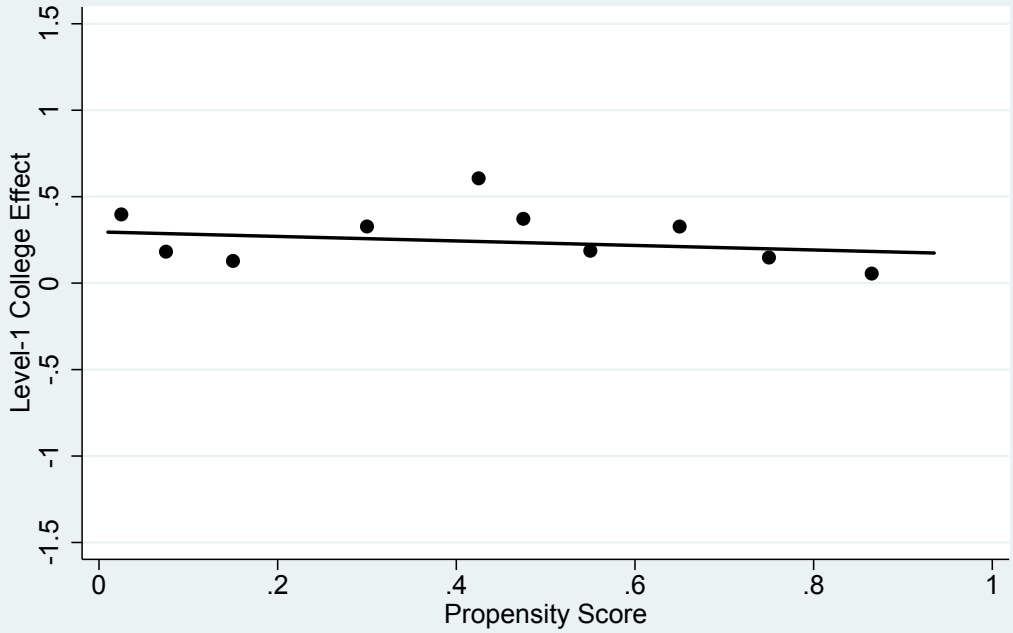
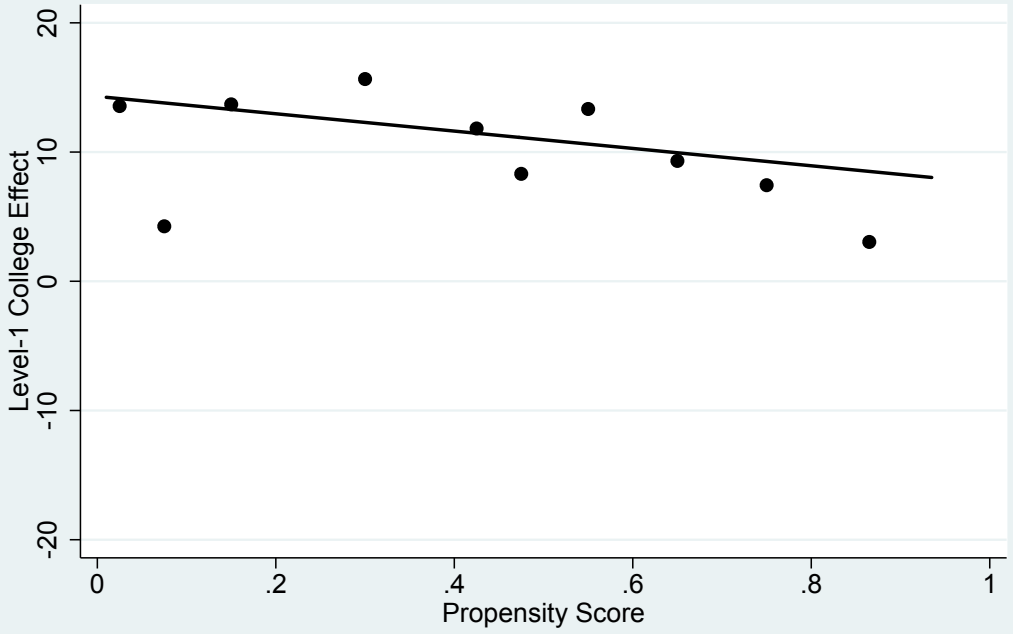


Figure 2-20. College Effects on Late Career Women's Occupational Status, 2009: NLSY-79



CHAPTER 3: COLLEGE EFFECTS ON EARLY LABOR MARKET OUTCOMES ACROSS ECONOMIC CONTEXTS

Results from Chapter 2 showed that early career workers during the Great Recession experienced heterogeneous effects of college on labor market outcomes. These results provide additional data points to existing studies of college effects in general (e.g., Brand and Xie 2010). However, these results should not be extrapolated outside the context of the Great Recession given that social scientists have called the Great Recession an extreme event and perhaps the "defining event" of the early 21st century (Grusky, Wimmer, and Western 2011; Redbird and Grusky 2016). Instead, many observers have hypothesized that average effects of higher education on labor market outcomes—or at least the strength of the positive correlation between education and labor market outcomes—may have changed precisely because of the economic shock caused by the Great Recession (Carnevale, Jayasundera, and Cheah 2012; Hout, Levanon, and Burak 2011; Hoynes, Miller, and Schaller 2012). There is currently a void in the sociological literature on college effects with respect to this question, as no studies have attempted to simultaneously control both for selection into college and for changes in the economic context. Thus, it is unclear if any of the results presented earlier in Chapter 2 are due to changes in economic context brought on by the recession or if those results remain unchanged from previous, stronger labor markets.

Without controlling for factors that affect selection into college, empirical evidence from the Great Recession suggests that college graduates escaped less harmed than those with less education (Carnevale et al. 2012; Elsby, Hobijn, and Sahin 2010;

Hoynes et al. 2012). Even during the Great Recession, from 2007-09, college graduates had an unemployment rate of just 2.8 percent, and actually gained a small number of jobs during the recession (Carnevale et al. 2012; Hout 2012). By contrast, those with some college but without a bachelor's degree lost nearly two million jobs during the recession, and only gained back those two million jobs after more than two years of recovery (Carnevale et al. 2012). Those with a high school diploma or less fared even worse, losing 5.6 million jobs during the recession, and continuing net losses in employment throughout the first two full years of the recovery (Carnevale et al. 2012). From 2007-09, high school graduates experienced an unemployment rate over twice that of college graduates (Hout 2012). These statistics suggests a widening gap in the fortunes of the highly educated and the less educated through the Great Recession and its recovery. However, as Hout (2012) notes, moving beyond the descriptive statistics described above into assertions of the effects of college require controlling for selection into college, as the correlation between academic abilities and both educational and labor market outcomes introduce the possibility of a spurious relationship between education and labor market outcomes.

Another question raised by the findings in Chapter 2 are whether increases in the causal effects of college due to the recession, if they exist, exist homogenously across the population. That is, does the college premium rise or fall during recessions in a uniform way, or do certain individuals stand to gain or lose more than others? Previous findings with respect to the effect of college on wages suggest negative selection, where the benefits of college accrue to most strongly to those least likely to complete college

(Brand 2010). If economic shocks change college effects on labor market outcomes, it is unclear whether this pattern will remain intact, be exacerbated, or disappear.

While they do not explicitly compare high school and college graduates, Oreopolous et al.'s (Oreopoulos, Wachter, and Heisz 2012) analysis of Canadian college graduates suggest some heterogeneity in both the immediate and scarring effects of recessions on college graduate by ability level. To act as a proxy for ability, they compared the short- and long-term effects of recessionary contexts on graduates from highly-selective and less-selective Canadian universities, finding that recessions had larger negative effects in both the short- and long-term on those from less selective universities. This suggests that more advantaged college graduates may face fewer negative consequences of recessions than their more advantaged counterparts (Oreopoulos et al. 2012). This in a vacuum would suggest that patterns of selection across the propensity score distribution might become more positive during recessions, as outcomes for low-propensity college graduates decrease while high-propensity college graduates remained relatively unfazed. However, because descriptive evidence suggests high school graduates' labor market outcomes decrease sharply during recessions (Hoynes 1999), the effect of graduating college as opposed to the alternative will not necessarily have a similar pattern of change. Thus, Oreopolous et al.'s (2012) findings, while suggestive of potential heterogeneity based on cognitive ability, do not directly speak to differences in the effects of college completion vs. non-college completion because their analysis focuses on college graduates.

In the following chapter, I test whether the effects of college completion for early career workers changed as the economic context worsened due to the Great Recession.

This requires making comparisons across levels of education and across economic contexts.

HYPOTHESES

Based on associative findings that directly compare college to high school graduates during both expansions and recessions, I expect to find modest increases in the estimated treatment effects of college on labor market outcomes during recessionary contexts after controlling for observable precollege variables. However, I predict the strongest increase in college effects for those who were likely to be non-college graduates based on precollege factors. This hypothesis is derived from previous findings of negative selection in college effects, the theory of the labor queue, and studies of recessions, which suggest low-education job sectors have historically suffered the most severe cutbacks during recessions. Completing college may have a larger effect for those who were relatively disadvantaged than those who were relatively disadvantaged in part because its benefits may be redundant among the advantaged. That is, college might provide skills or social capital increases to low-status students that high-status students already enjoyed. If college is more beneficial to individuals in precarious situations, then large-scale economic shocks, which tend to negatively effect those who were already struggling the most, should increase the potential benefit of college for this population vis-à-vis a more traditionally advantaged group. In terms of a labor queue, I predict the recession shrinks the number of open jobs, raising the requirements for employment in any given job, but also for employability in general (Devereux 2003). Thus, during recessions, the least able college graduates may be forced to jobs they would normally be

overqualified for based on their educational credentials. As a consequence, the bar for even the lowest status jobs might be raised above those at the very bottom of the labor queue as employers have a larger and larger supply of available workers to choose from for any open positions. Disadvantaged non-college graduates, then, might experience the largest losses in earnings and employment, thereby increasing the potential benefit of college most for this group.

ANALYTIC STRATEGY

I use propensity score matching methods to estimate the effects of college completion on a set of socioeconomic outcomes among young workers. I then compare these effects across expansionary and recessionary periods to determine whether college effects on these outcomes respond to changes in economic context. This methodology relies on a counterfactual framework, where each individual has both an observed outcome associated with her treatment status, and an unobserved counterfactual outcome that would have occurred had she been in the opposite treatment group(Morgan and Winship 2007; Rosenbaum and Rubin 1983). For example, since in this case the treatment of interest is college completion, a college graduate's observed outcome might be her occupational status, and the counterfactual outcome would be her occupational status *had she not completed college*. While this counterfactual outcome is not directly observable, it can be estimated using control cases that are similar to the treated case (and vice versa) on a set of factors that predict the likelihood of undergoing treatment (Rosenbaum and Rubin 1983). The effect of treatment on a given outcome can then be ascertained by taking the difference of similar treated and control cases.

To identify 'similar' treated and control cases, I use logistic regression to predict the propensity of each individual to complete college based on a set of precollege characteristics. After ensuring balancing, where scores on any given covariate are not significantly different across matched cases, and that the analysis is confined to the region of common support (Rosenbaum and Rubin 1983), the propensity score can be used to match similar cases across treatment groups. Thus, I match college graduates to non-college graduates who have similar propensity scores, and then compare their labor market outcomes.

Estimates of treatment effects can correspond to different populations, an important distinction given previous findings of heterogeneous effects of college (Brand 2010; Brand and Xie 2010). I calculate the average treatment effect on the treated (TT) by comparing treated cases to control cases with similar propensity scores, and then averaging the difference in outcomes. Similarly, the average treatment effect on the untreated (TUT) is calculated by comparing control cases to similar treated cases. The primary difference between these two statistics is the population to which they are applicable. Because the estimated propensity to receive the treatment is lower for control group members than treated individuals, the TUT estimates treatment effects mostly for those with lower propensity scores, while the TT is weighted toward those with high propensities of completing college. The TT can be interpreted as the estimated bonus in wages, for example, that college graduates received for having completed college. Conversely, the TUT is the estimated bonus that non-college graduates would have received had they attended college.

I also investigate the heterogeneity of estimated average treatment effects across the propensity score distribution using a hierarchical linear model (HLM) (Brand and Xie 2010). This multi-level process first estimates average treatment effects in each of a set of propensity score strata before regressing a line through the points using variance weighted least squares. The slope of this level-2 line indicates whether the treatment effects are larger for those at the bottom or the top of the propensity score distribution.

I estimate the TT, TUT, and HLM for a variety of socioeconomic outcomes for young workers in expansionary and recessionary contexts, then compare the effects across changes in economic context, which I measure using state unemployment rates (Kahn 2010; Oreopoulos and Salvanes 2009). This methodology estimates changes in the effects of higher education on young adults' labor market outcomes. Increases in estimated treatment effects of college in recessions would suggest that college becomes more important as a buffer in bad economies net of pre-college characteristics. Shifts in the level-2 slopes in the HLM across economic context would suggest that the relative importance of college completion changes for different segments of the population.

DATA AND MEASURES

This analysis uses data on 26-year old respondents from the National Longitudinal Survey of Youth 1997 (NLSY-97), which has followed a nationally representative cohort born from 1980-84 annually since 1997. In 2010, the last year for which data currently exists, the youngest members of the study were 26 years old. The sample was constricted to non-military members (n=8455), high school graduates (n=7073), those who were not enrolled in school during the year in which they turned 26 (n=5755), which is when labor

market outcomes were measured, and those who were not missing on the characteristics that predicted college completion (n=3317). The data set is particularly useful for this analysis because of its timing, longitudinal nature, and high quality measures of pre-college variables such as cognitive ability and high school grades. The timing of the cohort is such that roughly 60 percent of the respondents turned 26 years old before the onset of high unemployment caused by the Great Recession (2006-08), and roughly 40 percent turn 26 as the economic context worsened (2009-10). To test whether these effects differ across economic context, I compare estimates of treatment effects from an expansionary period to those in a recessionary period. I operationalize this by comparing those that experienced the bottom 40 percent of state unemployment rates compared to the top 40 percent. The expansionary states were defined as having state unemployment rates below 5.1 percent, and the recessionary states had unemployment rates of 6.66 percent or higher. Each "recessionary context" occurred in 2009 or 2010, when the worst effects of the recession began to impact most workers.

[INSERT TABLE 3-1 HERE]

[INSERT TABLE 3-2 HERE]

The propensity of completing college by age 25 is calculating using a set of predictors which have been previously included in studies of educational attainment, for which descriptive statistics are available in Table 3-1 and Table 3-2. Since respondents were interviewed starting in 1997 (ages 12-17), the NLSY-97 provides good measures of background characteristics before they could be 'contaminated' by treatment, i.e., before they enroll in college. I include measures of socio-demographic background, social psychological variables, cognitive ability, academic achievement, and pre-collegiate

school experiences in the propensity score estimation. One of the most important theoretically important covariate included is measured cognitive ability. This score comes from the Armed Services Vocational Aptitude Battery (ASVAB). Respondents are tested on 12 subjects, which are combined into a single score averaging the standardized subject scores with equal weights. I then residualize this composite score by age and gender with a mean of zero and a standard deviation of one (Cawley et al. 1996). In terms of net strength of association, the most important predictor of college completion was high school grade point average, which may capture both cognitive and non-cognitive skills. I include a squared term for high school grade point average because the relationship appears curvilinear in the male logistic regression (p-value for the squared term <.001). Other covariates included race, region of residence, parental education, urban residence, logged parental income, family structure, sibship size, peers' college plans, perceived teacher interest, and type of high school curriculum.

The labor market outcomes I measured included logged earnings, the number of weeks worked, the number of hours worked, logged hourly wages, and occupational status. Each outcome variable was measured when respondents were aged 26. The nature of the NLSY-97 cohort means these measurements took place across a variety of economic contexts. Wages and occupational status refer to the respondents' primary job at age 26. Occupational status was measured using the Hauser-Warren socioeconomic index, which characterizes the average earnings and education of occupations, and provides an estimated measure of long-term earnings. This provides a second measure of job quality in addition to earnings. Having multiple measures of job quality is especially

important for early labor market outcomes, since wage distributions may be more compressed early in the career.

In these analyses, I do not control for job tenure or labor market experience. This is because conditioning on a collider variable will bias estimates of the effects of an independent variable (Morgan and Winship 2007). Attending college reduces labor market participation for many students. Thus, one of the effects of college attendance is decreased labor market experience and shorter job tenure. Therefore, to "control" for work experience or job tenure could incorrectly bias estimated treatment effects of college. Put another way, time in the labor market is endogenous to college enrollment.

PREDICTING COLLEGE COMPLETION

[INSERT TABLE 3-3 HERE]

Men

Logistic regression results used to predict the propensity of individuals to complete college by age 25 are shown in Table 3-3 for men and women. For men, region of residence, family structure, parental education, high school curriculum, cognitive ability, and high school grades were significant net predictors of college completion. High school grade point average was a very strong predictor of college completion, which is consistent with previous studies of college completion and academic performance (Light and Strayer 2000; Zwick and Sklar 2005). For example, increasing high school grade point average by a full letter grade from a 2.5 to a 3.5 resulted in increasing the predicted probability of college completion from .206 to .615 for men, net of other covariates. This positive relationship is more muted at the lower end of the grade

point average distribution since those with grade point averages in the "C" range (roughly 2.0) and below have low predicted probabilities of completing college.

Cognitive ability was, as expected, positively correlated with college completion even after including controls for high school academic performance. A one-standard deviation increase in cognitive ability was associated with a 50 percent increase in the odds of completing college by age 25. Parental education was also a positive predictor of college completion. An additional year of father's education was associated with a 13 percent increase in the odds of completing college net of controls. A similar increase in mother's education was associated with a 14 percent increase in the odds of college completion.

Being enrolled in a college preparatory curriculum increased the odds of college completion by 130 percent holding constant the other variables included in the propensity model. Family structure was also predictive of college completion net of controls; living with both biological parents as opposed to with one or neither biological parent was associated with a 117 percent increase in the odds of completing college. Finally, living in the Northeast as opposed to the South was associated with a 162 percent increase in the odds of completing college net of controls; there were not significant effects of living in either the North Central or Western regions as opposed to the South. Living with both biological parents was associated with a 117 percent increase in the odds of completing college by age 25.

Women

In the propensity score model for women, I used the same independent variables as in the male propensity score model. Unlike the model for men, high school grade point average did not appear to show a non-linear relationship, as the squared term was not significantly different from zero. An F-test for the joint significance of the two terms for high school grades, however, suggested that together the main effect and squared term for high school grade point average were statistically significant predictors of college completion ($\chi^2 = 71.79$; $p < .001$). Similar to men, a 1-point increase in high school grade point average from 2.5 to 3.5 was associated with an increase in the predicted probability of completing college from .234 to .605 after holding the other covariates in the model constant.

Unlike the results for men, women's cognitive ability was a not significant predictor of college completion after controlling for high school grades, which may capture much of the effect of cognitive ability. To investigate these results, I also ran a logistic regression without including high school grade point average as one of the covariates; in that model, cognitive ability had a strong positive association with college completion, with a one-standard deviation increase in measured cognitive ability increasing women's odds of completing college by 135 percent ($p<.001$) net of the other control variables in the original model (save for high school GPA). The inclusion of high school grades, however, appears to reduce the estimated effect size of cognitive ability. While still positive, the point estimate for the coefficient for cognitive ability's effect on college completion is not significantly different from zero. Therefore, women's cognitive ability scores seem to affect their college completion propensities primarily through increasing their high school academic performance. After taking that performance into

account, however, no significant net effects of either cognitive ability remain. This stands in contrast to the logistic regression results for men, which still showed significant positive effects of cognitive ability even after accounting for high school grades.

In the full model, both mother's and father's education provided positive net effects on college completion. Each additional grade completed by a female respondent's mother increased the odds of completing college by 16 percent. An additional grade completed by a respondent's father increased her odds of completing college by 9 percent, net of controls. Being enrolled in a college preparatory curriculum increased the odds of completing college by 191 percent after controlling for the other pre-college variables. Female students also benefitted from their peers plans to go to college, though this was only significant using a one-tailed test ($p=.09$). A ten percent increase in the chances that her friends would complete college led to a 9 percent increase in the odds of completing college for a female student net of controls. Residing in the Northeast as opposed to the South increased women's odds of completing college by 161 percent net of controls, and living in the North Central region compared to the South increased the odds of completing college by 118 percent. Western residents had 80 percent higher odds than Southern residents of completing college by age 25 net of controls. Those with larger sibships were less likely to complete college; each additional sibling was associated with a 27 percent decline in the odds of completing college net of controls.

THE SAMPLES USED FOR MATCHING

Restricting the samples to those who were not enrolled in college or graduate school at age 26, and to those in the region of common support resulted in 234 men in

expansionary contexts and 243 men in recessionary contexts. Sample sizes for women were 281 in expansionary contexts and 249 during recessionary contexts. The college completion rates in the analytic samples after making these restrictions were 41 percent for men and 38 percent for women. For the multi-level analysis, the sample was split into propensity score strata such that the propensity score and each explanatory variable were not significantly different within each strata (Brand and Xie 2010). Table 3-4 shows the strata used in the multi-level model. This process resulted in 8 strata for men, with cut points where the propensity score equaled 0.2, 0.25, 0.3, 0.4, 0.6, 0.7, and 0.8. In the female sample, there were six strata, with cut points where the propensity score equaled 0.2, 0.4, 0.6, 0.7, and 0.8. I operationalized economic context by using state unemployment rates from the year when each respondent was 26, when individual labor market outcomes were measured. I compare the bottom 40 percent to the top 40 percent in terms of unemployment rate, which resulted in comparing those in state-year combinations with unemployment rates below 5.1 percent to those with unemployment rates above 6.6 percent.

TREATMENT EFFECTS OF COLLEGE FOR YOUNG MEN

After conducting the logistic regression above and dividing the sample by economic context, I matched each treated case to the closest two untreated cases by propensity score, resulting in the average treatment effect on the treated (TT). Similarly, I matched control cases to their closest two neighbors from the treatment group, resulting in the average treatment effect on the untreated (TUT). I also conducted hierarchical linear models by economic context to test whether the estimated effects of college

completion were heterogeneous across propensity score strata (Brand and Xie 2010). Propensity score matching results for men are shown in Table 3-5, and HLM results for men are shown in Table 3-6.

[INSERT TABLE 3-5 HERE]

[INSERT TABLE 3-6 HERE]

Logged Earnings

The first outcome variable I analyzed was logged earnings at age 26. In state-year combinations that experienced expansionary economic contexts (unemployment under 5.1%), the TT was positive. A college degree increased the logged earnings of the average male college graduate by 1.30 points on the log scale in expansionary contexts. In state-year combinations where unemployment was above 6.6 percent, the point estimate of the TT decreased to .73, but was still significantly greater than zero. Thus, in both economic contexts, the average male college graduate received a significant bonus in logged earnings by completing college above what he would have expected to receive had he not completed college. The estimated potential effect of college on logged earnings for the average non-college graduate is given by the TUT. In the expansion, the TUT was not significantly different from zero. Thus, when the economic context is favorable, 26-year-old non-college graduate men are not earning less than otherwise similar college graduates. However, in the high unemployment context, the point estimate for the TUT for logged earnings increases to become positive, and is statistically significant in a one-tailed test. Thus, there is some evidence that during recessions, the average 26-year-old male non-college graduate would have earned more if he had completed college.

[INSERT FIGURE 3-1 HERE]

This pattern of uneven effects across treatment group is also apparent by examining the multilevel hierarchical linear model. Figure 3-1 shows the estimated treatment effect of college on logged earnings by propensity score stratum for both high- and low-unemployment contexts. During the expansion, the slope of the average treatment effect across propensity score is positive (.800; p=.008), suggesting that the effects of college are greatest for 26 year old men with high probabilities of completing college. By contrast, during the recession, the slope is negative (-.922; p=.073), with the largest benefit accruing to college graduates from low-propensity strata. Thus, the value of a college degree in terms of earnings for low-propensity young men seems to grow as the economic context worsens, unlike for high-propensity young men.

Weeks Worked

The estimated treatment effects of college on the number of weeks that 26-year-old men worked followed a pattern similar to that for logged earnings. During the expansion, the TT was positive but non-significant, suggesting that the average college graduate would have been employed at roughly the same level even if had not completed college. The TT of college on weeks worked during the recession was also not significantly different from zero, suggesting that even during a recession, the number of weeks worked for the average college graduate was similar to what he could have expected without a college degree. Thus, after controlling for a set of precollege characteristics, college did not provide a greater employment for the average college graduate. The point estimate for the TUT was negative but only statistically significant

using a one-tailed test during the expansion. When state unemployment rates were low, there is some evidence that the average non-college graduate was employed for fewer weeks than a college graduate conditional on the propensity to complete college. However, as the economic context worsened, the estimated TUT increased, becoming positive, though not statistically significant. In states where unemployment was above 6.6 percent, the propensity score matching results suggest the average non-college graduate worked a similar number of weeks as he would have had he completed college.

[INSERT FIGURE 3-2 HERE]

The weeks worked HLM across economic contexts displayed in Figure 3-2 shows a similar pattern in general to the logged earnings HLM. During the expansion, there is a positive slope (b=3.86; p=.025) in the average treatment effect across propensity score strata. The regression line during low-unemployment contexts suggests that those with higher estimated propensities of completing college benefitted more from a college degree in terms of weeks employed than those who were less likely to complete college. By contrast, the slope of the regression line in the HLM during the recession decreases (b=-1.20; p=.767). During recessionary contexts, the greatest employment benefits due to a college degree accrue to those with low propensities of completing college. Like the estimated effects of college on logged earnings, the effects of college on the number of weeks employed therefore seem to be heterogeneous across both propensity score stratum and economic context.

Hours Worked

Total hours worked at age 26 was, as expected, strongly correlated with the number of weeks worked. However, during the recession, underemployment was seen as a problem rivaling in significance the problem of unemployment. Thus, we might expect to find more widespread effects of college on hours worked than weeks worked, as even individuals who worked throughout the year may have been working fewer hours than desired during the economic downturn. However, the estimated treatment effects of college on hours worked largely mirrored the results for weeks worked. The TT on hours worked at age 26 was positive and statistically significant. During expansionary contexts, college graduates worked 9.7 more hours per week (506.5 hours annually) than their matched control cases. However, in contexts with higher unemployment rates, college graduates, on average, did not work significantly more hours than similar non-college graduates in either economic context. This pattern, with significant positive effects in expansionary contexts being reduced to non-significance in recessionary contexts, is similar to the one found for weeks worked.

The untreated group also followed the pattern established for weeks worked. During the expansion, the point estimate for the TUT is negative and significant using a one-tailed test. The matching results suggest the average non-college graduate actually worked 7.5 more hours per week (391 hours annually) than otherwise similar college graduates. Thus, the extra labor market experience and job tenure that college students may forego to attend school may hurt their employment during expansions for those who are otherwise similar to those in the untreated group. However, this modest negative effect of college for the untreated group disappears during recessionary contexts, with the point estimate becoming positive, though not significantly greater than zero. Taken

together with the matching results for weeks worked, these results suggest that a college employment penalty exists for members of the control group and their matched treated cases during tight labor markets, but that this penalty is reduced during recessions.

[INSERT FIGURE 3-3 HERE]

The HLM for hours worked shows a positive slope during the expansion, similar to the weeks worked graph. During expansionary contexts, college increases the number of hours worked most for those who were very likely to complete a college degree. Conversely, college graduates in the lowest propensity score stratum worked fewer hours than their non-college counterparts. This suggests a pattern of positive selection for young men during expansions. While the economic conditions are favorable, a college degree does not counteract disadvantages in labor market experience and job tenure that may accrue to non-college graduates at the low end of the propensity score distribution. However, those with greater pre-college chances of completing college were unharmed in terms of employment by their decisions to complete college, and may have benefitted at the highest end.

During the recession, however the slope of the HLM flattens, becoming only slightly positive. Thus, there is relatively little difference across propensity score strata in the effects of college on hours worked when looking only at recessionary economic contexts. The net result of these differing patterns is that the average treatment effects of college on hours worked in the low-propensity strata increase during recessions; college is more important during recessions than expansions for low-propensity individuals. However, college does not act as an additional insulating factor against lost hours of

work during recessions for those that were very likely to complete college based on pre-college characteristics.

Logged Hourly Wages

The effects of college on logged wages at age 26 were calculated for those that worked during the year in which they turned 26. On average, college graduates who were 26 years old in expansionary contexts received increased wages compared to their matched non-college graduate cases. This college wage premium for the treated group continued in recessionary contexts. The point estimate for the TT remained essentially unchanged across both economic contexts.

The TUT for wages was also positive during recessionary contexts. Conditional on employment, non-college graduates on average earned significantly lower wages than similar employed college graduates. However, during the recessionary contexts, non-college graduates who were employed were not penalized by their lack of education in terms of wages. Instead, conditional on employment, non-college graduates on average earned similar wages to college graduates in recessionary contexts. Thus, the college wage advantage for the untreated group existed only in expansionary contexts.

[INSERT FIGURE 3-4 HERE]

In the HLM for logged wages (Figure 3-4), the second level slope during the expansion is negative but essentially zero ($b = -.040$; $p=.838$); there is very little difference in the effects of college on wages throughout the propensity score distribution. However, during the recession, a pattern of positive selection emerges ($b = 1.226$; $p<.001$). During recessionary economic contexts, college seems to benefit those in the

highest propensity score stratum most, while not providing a benefit in wages for low-propensity individuals. This pattern of positive selection on wages suggests that during times of economic stress, the highest propensity college graduates experience less severe wage losses compared to high-propensity non-college graduates. On the other hand, at the lower end of the propensity distribution, both college graduates and non-college graduates see wage changes of similar magnitudes.

Occupational Status

Because the wage distribution is generally compressed at young ages, occupational status may provide a proxy for job quality and long-term earnings not captured purely by wages (Roksa and Levey 2012). Occupational status was measured using the Hauser-Warren Socioeconomic Index (Hauser-Warren SEI), a combination of the occupational earnings and occupational education level of workers in a given Census-classified occupation. Higher occupational statuses are associated with higher education and higher earnings (Hauser and Warren 1997). Because Hauser-Warren SEI is a characteristic of occupations, only individuals that reported occupations are included in the analysis. Using 2000 Census occupation codes, I matched respondents' reported occupations in the NLSY-97 to Hauser-Warren SEI scores for those occupations. During the expansion, the TT was 9.127 ($p=.039$). The average employed college graduate's occupational status was 9.127 points higher than a similar non-college graduate. During the recession, the TT grew to by nearly 6 points to 14.863 ($p<001$). Thus, for the average college graduate, his college degree provided a significant benefit in occupational status

in all economic contexts, but the estimated effect was larger during the recession than the expansion.

The TUT for occupational status was also positive during the expansionary context, but was only significant using a one-tailed test (TUT=6.588; p=.094). During the recession, the TUT grew, although by less that the TT estimate. The estimated TUT increased by 3.1 points to 9.696 (p<.001). Conditional on employment, non-college graduates during the recession worked in significantly lower status jobs than otherwise similar college graduates. The importance of college for job quality as measured by the Hauser-Warren SEI was larger for non-college graduates during the recession than expansion. However, this increase was still less than the increase in college effects for the average college graduate.

[INSERT FIGURE 3-5 HERE]

Examining the pattern of effect heterogeneity in the HLM in Figure 3-5, we see that there is a negative slope during the expansion. This suggests that college provides larger benefits to graduates' occupational status at lower propensity scores, though even at the highest levels of propensity scores, the estimated treatment effects of college completion on occupational status for employed young men was positive. During the recession, however, this pattern shifts strongly, becoming positive (b=20.071; p=.002). As the economy worsened, the occupational status bonus of a college degree was reduced for lower propensity score strata. However, for those at the top, the benefit of a college degree on occupational status increased. Thus, a college degree kept those at the top of the propensity score distribution eligible for high-SEI jobs. Their non-college counterparts, however, experienced lower occupational status on average.

TREATMENT EFFECTS OF COLLEGE FOR YOUNG WOMEN

I present results for labor market and socioeconomic outcomes for women using both propensity score matching and HLM across propensity score strata below in Table 3-7 and Table 3-8, respectively. In general, results for suggest that the interaction between college completion and economic context was less important for women than for men. This finding is largely consistent with previous work on the Great Recession and previous recessions that show men's outcomes to be most strongly associated with labor market cycles (Hoynes et al. 2012).

[INSERT TABLE 3-7 HERE]

[INSERT TABLE 3-8 HERE]

Logged Earnings

During the expansion, the TT for women's earnings was positive, though it was only significant at the $p<.10$ level (TT=.787; p=.070). In recessionary contexts, the TT was not significantly different from zero. For young female college graduates, there is some weak evidence that college may increase earnings over their matched control cases, but only during expansionary contexts. The TUT for women was also statistically insignificant during both the expansion and recession. None of the estimated treatment effects of college on either the treated or untreated groups for young women reached 95 percent significance. Therefore, unlike the results for men, there is a lack of strong evidence that after controlling for the propensity to complete college, college completion had strong effects on annual logged earnings for young women across economic context.

[INSERT FIGURE 3-6 HERE]

The level-2 slopes in Figure 3-6 suggest patterns of negative selection in both the expansionary and recessionary contexts. Again, in contrast to the male results, the level-2 slopes are essentially parallel. This suggests that the weak patterns of negative selection observed in the expansion also exists during recessionary contexts.

Weeks Worked

In the analysis of weeks worked, neither the TT in expansionary contexts nor the TT in recessionary contexts was significantly greater than zero. This suggests that after controlling for the propensity to complete college by age 25, female college graduates did not work significantly more weeks than their non-college graduate counterparts in either good or bad economic contexts. Similarly, this seems to suggest that the onset of the Great Recession did not have a large impact on the effects of college on weeks worked for the treated group.

Similarly, the estimated effects on the untreated were not significant in either the expansionary context or the recessionary context. While all of the point estimates were positive, the lack of statistical significance suggests that college completion would not have increased the number of weeks worked at age 26 for non-college graduate women on average. Thus, I do not find evidence that college provided an increase in the number of weeks worked for women in either the treated or the untreated group after controlling for the propensity to complete college.

[INSERT FIGURE 3-7 HERE]

Given that neither the TT nor the TUT were significant, the HLM results (Figure 3-7), which show the heterogeneity of estimated treatment effects across the propensity score distribution, should be interpreted relatively conservatively. The level-2 slope during the expansion was negative (b = -15.89; p=.070), suggesting that college, on average, provided a greater benefit to those at low-propensity score levels. This negative slope increases slightly in the HLM for recessionary contexts (b = -6.16; p=.265). Both slopes remain negative, and neither reaches significance at the p<.05 level. These results, combined with the insignificant estimates for the TT and the TUT, suggest that the average effects of college completion on young women's weeks worked are not very sensitive to changes in the economic context.

Hours Worked

While hours worked and weeks worked tend to be highly correlated, the analysis of weeks worked showed a different pattern than the one for hours worked. The effect of college on female college graduates' hours worked at age 26 in expansionary contexts was positive and statistically significant. In expansionary contexts, college graduates worked 416.6 (p=.024) more hours than their matched control cases, or roughly 8 more hours per week. During the recession, however, the point estimate of the TT dropped down to 30.2 (p=.877), suggesting that female college graduates did not work more hours at age 26 than they would have had they not completed college. These results, in concert with the weeks worked results, suggest that while college graduate women may have been employed at similar rates to their non-college matched controls during the expansion, they still worked significantly more hours. However, the protective effect of

college against underemployment was reduced for members of the treated group during recessionary contexts, where they worked a similar number of hours as non-college graduates with similar propensity scores.

For non-college graduate women, the point estimates for the treatment effects of college on hours worked were not significantly greater than zero in either the expansionary or recessionary contexts. The estimated TUT's for women's hours worked in both the expansion and recession reflect the positive but statistically insignificant estimated TUT's for women's weeks worked. Together, they suggest that college completion did not have a strong effect on untreated women's employment on average in either economic context.

[INSERT FIGURE 3-8 HERE]

The HLM for hours worked among young women, however, shows (Figure 3-8) different patterns of selection across propensity score strata by economic context. During the expansion, the level-2 slope was positive and relatively strong ($b = 1166.1$; $p = .049$), with college providing basically zero additional hours of work at the lowest propensity score stratum and the largest benefit in hours worked at the highest propensity score. For example, during the expansion, the regression line estimates that a woman with a propensity to complete college of .25 could expect to work an additional 0.3 hours per week by completing college. At the upper end of the propensity score distribution, however, this estimated treatment effect is much larger. At a propensity score of .75, for instance, the HLM predicts that college would provide a 26-year-old woman in an expansionary context with an additional 11.5 hours of work per week.

During recessionary contexts, on the other hand, the direction of the level-2 slope in the HLM flipped, becoming negative ($b = -1843.0$; $p < .001$). Low-propensity college graduates worked more hours than similar non-college graduates during the recession, meaning college seemed to have some protective effect against employment losses for low-propensity college women. However, this benefit decreased as propensity score increased, actually resulting in a college employment penalty at higher propensity score levels. For example, a female college graduate with a precollege propensity score of .25 would expect to work an additional 8.6 hours compared to a similar non-college graduate. However, at higher propensity score ranges, the estimated effect of college was actually negative. For a young woman with a propensity score of .75, a college graduate would expect to work 9 *fewer* hours than a non-college graduate with a similar propensity score.

Thus, during expansions, a college degree most benefits women who were likely to complete college in terms of hours worked. However, during the recession, college actually provided the greatest insurance against lost hours of work for low-propensity women. This pattern, where recessionary contexts decrease the level-2 slopes for measures of employment, mirrors the analysis for men. It suggests that college's role in protecting young workers against unemployment and underemployment is strongest for those who are unlikely based on their precollege characteristics to complete college.

Logged Hourly Wages

During the expansion, the TT of college on logged hourly wages for 26-year-old women was positive but not significant ($TT = .119$; $p = .23$). The average employed female college graduate did not have significantly higher wages than otherwise similar

employed non-college graduates. During the recession, the estimate for the TT stayed relatively stable, and was again not statistically different from zero (TT = .165; p = .17). Consequently, there is a lack of evidence for significant college wage premiums for young employed female college graduates in either expansionary or recessionary periods, conditional on having been employed.

For non-college graduate young women, the TUT was positive during the expansion (TUT = .379; p = .002). Thus, college completion would have provided non-college graduates with additional wages during expansionary periods, conditional on employment. This, along with the non-significant TT, suggests a pattern of negative selection for college effects on young women's wages, with higher benefits accruing to those women less likely to receive the treatment (Brand and Xie 2010). During the recession, however, the TUT is reduced in magnitude to a non-significant number (TUT = .109; p = .38). Therefore, during recessionary contexts, college completion would not have provided young female non-college graduates with a wage premium on average, conditional on employment. The statistically insignificant TT and TUT during recessionary contexts suggests, at the very least, a lack of negative selection to the degree that it may exist in the expansionary contexts, since both the treated and untreated groups experienced null effects of college on wages.

[INSERT FIGURE 3-9 HERE]

The HLM in Figure 3-9 seems to offer additional evidence that bolsters the conclusions drawn from the propensity score matching analyses for logged wages. During the expansion, there is a strong negative level-2 slope (b = -.608; p = .004). This suggests that, conditional on having been employed at age 26 during an expansion,

college increased the wages of young women with lower propensity scores more than it did women with high propensity scores. For an employed woman with an estimated propensity to complete college of .25, a college degree is estimated to increase her hourly wages by 0.38 points on the log scale. By contrast, a woman with an estimated propensity score of .75 would only receive a 0.08 increase in her logged wages.

During recessionary contexts, however, the level-2 slope in the HLM is positive ($b = .202$; $p = .41$), though it is not as steep as the negative expansionary slope. Therefore, the pattern of negative selection observed in the expansion seems to disappear, turning positive. The HLM during recessionary contexts suggests that high-propensity employed female college graduates receive a larger earnings premium than their low-propensity counterparts. For young women who were unlikely to complete college based on observable precollege characteristics such as cognitive ability, socioeconomic and demographic background, and high school academic achievement, college provides larger wage premiums during expansions than recessions. For the members of this population who remain employed, the importance of college in securing high wages may actually decrease during recessions. This stands in contrast to those with high estimated propensities to complete college. For this population of young women, college provides little wage premium in expansionary contexts. However, for those employed in recessionary contexts, college completion was associated with higher wages for this population of women. This pattern of heterogeneous effects of college on wages across economic context, where a pattern of negative selection in expansionary contexts gives way to a pattern of positive selection in recessionary contexts, mirrors the results for men reported above.

Occupational Status

The analyses for college effects on young women's occupational status also were similar to the corresponding analyses for young men. During the expansion, the point estimate for the TT was positive but was not significantly greater than zero (TT = 2.460; p = .44). Therefore, during the expansionary contexts, young female college graduates who were employed were not employed in jobs with significantly higher occupational status scores than their matched control cases. However, during recessionary contexts, the estimated TT for occupational status was significant in a one-tailed test (TT = 6.238; p = .07). Therefore, conditional on employment, college completion offers an occupational status premium for young women during recessionary contexts, but not during expansionary contexts.

For untreated women on average, the average treatment effect of college on occupational status was positive both during expansionary economic contexts (TUT = 5.428; p = .046) and during recessionary economic contexts (TUT = 7.528; p = .005). While the TUT was slightly higher during recessionary contexts, the two estimates are close together, suggesting a lack of evidence that increasing the state unemployment rate has a substantial impact on the TUT of college on occupational status.

[INSERT FIGURE 3-10 HERE]

In Figure 3-10, the HLM shows a slightly negative, but basically flat level-2 slope during expansionary contexts (b = -1.626; p = .82). This suggests that the average treatment effects of college on occupational status were relatively homogenous for young women in expansionary contexts. Women across the propensity score distribution

benefitted relatively evenly from college completion conditional on employment at age 26. During recessionary contexts, on the other hand, a relatively steep positive slope emerged (b = 11.849; p = .09). This suggests, similar to the analysis of occupational status for men, that recessionary contexts are associated with a pattern of positive selection. The HLM suggests that in state-year combinations with high unemployment rates, young women with high propensity scores benefitted most from college completion in terms of occupational status.

The HLM's for the two measures of job quality (logged hourly wages and occupational status) for women show similar patterns across economic context. In each, the slope during recessionary contexts is substantially more positive than during expansionary contexts. Thus, the pattern of heterogeneous effects of college on job quality conditional on employment seems to be associated with economic context; in high-unemployment contexts, college provides a greater job quality premium for young women with high predicted propensities of completing college.

DISCUSSION OF RESULTS

In the following section, I integrate results for the various socioeconomic outcomes reported above to answer how effects of college differ according to the economic context for young men and women. My analyses suggest that this question has a complex set of answers. First, college seems to affect various individual labor market outcomes in different ways. Second, these effects are heterogeneous within the population, differing across characteristics of the individual. Third, they differ according

to the economic context, measured here by state unemployment rates. Finally, the multilevel analyses suggest that the particular outcome, characteristics of the individual, and characteristics of the larger context interact, creating different patterns of heterogeneous effects that shift across economic contexts. Thus, the importance of college on a given early-career labor market outcome varies depending on the characteristics of the individual and of the economic context s/he experiences.

I find that for both young men and young women, the estimated treatment effects of college on various labor market outcomes were sensitive to both individual variations in preexisting factors and variation in the economic context. For some, the effects of college on a given labor market outcome increase during recessions, while for others they remain constant or decline. Similarly, college does not provide universal protection against the negative effects of recessions on young workers as implied by direct comparisons between college and non-college graduates across economic context (Carnevale et al. 2012). Instead, college seems to provide important protections against declines in employment for relatively unlikely college graduates (i.e., those with low propensity scores) during recessionary contexts. Those whose precollege characteristics made them more likely to complete college did not see an increased benefit of college for employment during recessions in large part because they would have remained employable through the recession even if they had not completed college; instead, college provided them with better job quality than they would have otherwise experienced during the downturn.

For men, the effects of college on earnings, labor supply, and job quality were heterogeneous across the population and economic context. While observational studies

have reported increasing inequality between college graduates and non-college graduates during economic downturns (Carnevale et al. 2012; Elsby et al. 2010; Hoynes 1999), controlling for a set of observable precollege characteristics offers a more complex narrative about the estimated effects of college itself, as opposed to simply group differences between the more- and less-educated. Recessionary economic contexts do not seem to universally increase the effects of college on each outcome studied. Instead, a worsening economy was only associated with increased effects of college for some individuals for some outcomes. The result is that blanket statements such as, "college protects workers from the negative effects of recessions," are incomplete. The protective effect of college during economic downturns differs depending on where an individual is in a hierarchy that includes both educational attainment and precollege characteristics as stratifying factors. If these precollege factors are not controlled for, the increase in college effects during recessions may be overstated and overgeneralized.

College, for example, provided greater protection against earnings losses during recessions than expansions, but only for men lower in the propensity score distribution. While the average college graduate earned more than he would have if he had not completed college during both economic expansions and recessions, the college earnings premium was larger during expansionary contexts than recessionary contexts for young men. However, the effect of college increased during the recession for the average non-college graduate and those who were least likely to complete college. Thus, for a specific subset of the population, the effects of college on earnings increase during economic recessions.

Using the variance-weighted least squares regression to find patterns of heterogeneous effects of college across propensity score strata (Brand and Xie 2010) suggests differing patterns of selection for earnings across economic contexts. During expansionary contexts, college provides the largest benefits to young men who were likely to complete college based on their precollege covariates. However, this pattern reverses during expansionary contexts; in contexts with high unemployment rates, college provides the largest earnings premium to lower propensity score strata. These results are consistent with the matching results for earnings. Together, they suggest that recessionary contexts increase the college earnings premium most for young men who were not likely to complete college.

While the earnings analyses provide a clear pattern of effects across economic contexts, decomposing earnings into labor supply and job quality provides a more detailed look at how college effects may shift according to the economic context for young men. Measures of labor supply, including weeks worked and hours worked at age 26, suggest that the potential benefit of college increases for those unlikely to complete college during recessions. These results largely mirror those for earnings. The matching analyses for weeks and hours worked for the average college graduate (TT) suggests little change across economic context, though there is a stronger positive effect of college on hours worked during expansionary contexts. The TUT shows opposite trends, increasing from negative estimates during expansionary contexts to non-significant yet positive estimates during recessions. Together, the matching analyses suggest that the effects of college on labor supply are constant or are reduced during recessions for the average college graduate. For the average non-college graduate, college actually penalizes

employment during expansions, but not during recessions. Thus, the effect of college on weeks and hours worked increases during recessions for non-college graduates on average.

The regression slope in the HLM for weeks worked is positive during expansions, but negative during recessionary contexts. This suggests a pattern of positive selection during expansions, but negative selection during recessions. Therefore, college appears to be most important for low-propensity young men during recessions. Among those who were likely to complete college, recessionary contexts do not bring about an increase in the college employment premium after controlling for the propensity to complete college based on observable precollege characteristics.

The HLM for hours worked follows a similar pattern to weeks worked, with the slope decreasing as the unemployment rate in a state rises. The strong positive slope during expansions, which suggests an employment penalty for low-propensity college graduates but an employment premium for high-propensity college graduates, flattens during recessionary contexts. Therefore, the patterns of selection become more negative for both measures of employment during recessionary contexts. The college effect on labor supply increases most during recessions for those with low propensities to complete college based on precollege observable characteristics such as high school grades, cognitive ability, and parental background. Thus, for those who are relatively disadvantaged, college may act as a protective factor against unemployment or underemployment during recessions. The same, however, does not hold true for those who are advantaged due to precollege characteristics. Although the level-2 slopes in the HLM's for both hours worked and weeks worked move in similar directions across

economic context, it is important to note that these effects seem stronger for hours worked than weeks worked. The level-2 slope decreased by 5.026 weeks when moving from expansionary to recessionary contexts; the corresponding change for hours worked was 2,016. If college effects on employment worked only through employment status (i.e., weeks worked), we would expect the level-2 slope for hours worked to be decreased by roughly 201 hours, assuming a 40 hour work week. The much larger change in the effect of college on hours worked suggests that much of the change in college effects on employment had to do with its effects on the intensity of employment, not whether respondents were employed at all during the week. Thus, economic context interacts most strongly with college effects on young men's employment intensity, as opposed to their joblessness.

The opposite pattern of heterogeneous effects seems to occur for measures of job quality for those who are employed. That is, conditional on employment, the pattern of selection for college effects on job quality appears to grow more positive during recessionary contexts. The level-2 slopes for the analyses of both logged wages and occupational status for young men are both much larger during recessionary contexts than expansionary ones. This suggests that recessionary contexts are associated with growing college effects on job quality for those who had large predicted propensities to complete college. Thus, high-propensity college graduates seem to be protected from losses in job quality—both wages and occupational status—relative to similar non-college graduates during recessions. The same is not true of those at the bottom of the propensity score distribution.

Together, these analyses suggest that college acts as a protective factor against the negative effects of recessions in different ways for different segments of the population. I use Thurow's (1975) labor queue and job competition theory to explain these trends in a cohesive fashion. Those at the top of the labor queue will have high levels of education, but will also be likely to complete college based on precollege characteristics, as several traits that positively predict college completion are also positively associated with employment, wages, and earnings (e.g., cognitive ability) (Brand and Xie 2010; Hout 2012). Those at the bottom of the labor queue posses low levels of education, but also score lower on cognitive ability and other traits that predict college completion.

At the top of the queue, the most able workers, high-propensity college graduates, experience few losses in either employment or job quality relative to other groups during recessions. High-propensity non-college graduates remain employed at relatively high rates during the recession, but experience losses in job quality, as captured by wages and occupational status. Thus, at the high end of the propensity distribution, the average treatment effects of college on measures of labor supply decrease during recessionary contexts, while the average treatment effects on measures of job quality increase. This results in a tilting down of the level-2 slope for employment outcomes, and a tilting up of the level-2 slop for job quality outcomes.

Low-propensity college graduates, also in the middle of the labor queue, again remained employed at relatively high rates through the recession. However, those at the bottom of the labor queue, low-propensity non-college graduates, experienced employment losses during the recession relative to otherwise similar college graduates. This results in a greater average treatment effect of college on employment outcomes at

lower propensity score levels. At the top of the labor queue, higher education seems to act as a buffer against decreases in job quality in a recession. Those in the middle of the labor queue seem to take lower quality jobs, but still remain employed at roughly the same rate as those above them. This may displace those at the bottom of the labor queue. With few lower status jobs to fall to during recessions, this most disadvantaged population suffered employment losses, being displaced from the workforce altogether. Thus, among those who were relatively disadvantaged based on precollege variables, college acts as a strong protective factor against employment losses during recessions, but only a mild buffer against job quality losses compared to the benefit in job quality that high-propensity college graduates receive.

The analysis of earnings young female college graduates showed more muted effects of college both during expansionary and recessionary contexts compared to men. Similarly, there was less volatility in treatment effects on women's earnings than on men's across economic context. This supports previous findings suggesting that men's earnings are more strongly cyclical than women's (Elsby et al. 2010; Hoynes et al. 2012). Furthermore, the HLM shows modestly negative slopes in both expansionary and recessionary contexts. This further suggests that net of the propensity to complete college, changes in economic context did not change the value of college for women differently across the propensity score distribution. Thus, the pattern of heterogeneous effects observed during expansionary contexts held during recessionary contexts.

Consistent with the results for earnings, college completion seemed to have little effect on the number of weeks worked per year for the average college graduate and the average non-college graduate. This null effect from the propensity score matching

analysis held in both expansionary and recessionary contexts. There was a somewhat stronger pattern of negative selection during expansionary contexts compared with recessionary contexts; however, during both contexts, the level-2 slope in the HLM was negative, suggesting relatively similar patterns of heterogeneous effects of college on weeks worked for women aged 26.

There was a slightly different pattern of findings for hours worked at age 26, the other measure of employment. College increased the hours worked for female college graduates during expansionary contexts, but not during recessionary ones. For the average female non-college graduate, on the other hand, a college degree would not have increased hours worked significantly in either context. This resulted in a positive pattern of selection during expansionary contexts, as those with high propensity scores worked more hours than those with lower propensity scores. During recessionary contexts, the direction of the level-2 slope was negative, mirroring the results for men's employment. Thus, for hours worked, recessionary contexts were associated with growing average treatment effects of college for low-propensity young women, but shrinking average treatment effects for high-propensity young women. College seems to provide protection against employment losses during recessions for those who are less likely to complete college based on observable precollege factors. The differing patterns for weeks and hours worked suggest that economic context and college affect women's employment status and the intensity of that employment differently. For young women, college seemed to play a larger role in buffering against underemployment, as opposed to unemployment, at lower propensity scores during recessionary contexts. By contrast, at

the upper end to the propensity score distribution during recessionary contexts, college completion did not have a strong positive effect on either measure of employment.

The propensity score matching results and the HLM results for women's employment across economic context were largely similar to the results for men. College provided an important buffer against unemployment and underemployment during the Great Recession for those with low predicted propensities to complete college. However, among those who were advantaged in terms of observable precollege factors, college did not provide a large buffer against unemployment or underemployment in recessionary contexts. This is evidenced primarily by the sharply decreasing level-2 slopes in the HLM's for hours worked as the economic context worsened, which responded much more strongly to changes in economic context than the slopes for weeks worked. This suggests that college completion plays an important role in protecting relatively disadvantaged graduates from underemployment during recessions, but that this protective factor is more muted for overall employment status (i.e., having a job or not) and for those who scored highly on precollege factors associated with college completion.

The heterogeneous effects of college on job quality, measured by logged hourly wages and occupational status, show the opposite pattern over changes in economic context. For early career women who were employed at age 26, college only provided a significant average wage premium for untreated women during expansions. This positive effect on wages was not present during recessionary contexts. This pattern was reinforced by the HLM results, which showed a strong pattern of negative selection during expansionary contexts, but a flat or slightly positive pattern of selection during

recessionary contexts. The increasing level-2 slope across economic contexts for the average treatment effect of college on wages suggests that college is a more important protective factor against low wages for young women at the bottom of the propensity score distribution during expansions than recessions. On the other hand, for those with high propensity scores, college completion provided a greater wage premium during recessions. This increase in the level-2 slope as the economic context worsened was also present in the results for occupational status, again conditional on employment at age 26. The estimated average treatment effects of college on occupational status increased for nearly the entire propensity score distribution as the economic context worsened; this increase, though, was greatest for those with higher propensities to complete college.

Again, the results for the effects of economic context and college completion on young women's job quality largely echo those for men. Among those who were employed during recessionary contexts, college provided an increased buffer against lowered job quality, measured by wages and occupational status, for those who were likely to complete college. However, those with lower predicted propensity scores did not see increased benefits of college in terms job quality during recessionary contexts. Therefore, the effect of college on job quality increased most during recessionary contexts for those who were the most likely to complete college.

Considering labor supply and job quality together, it seems that, broadly speaking, recessions increase the importance of college for low-propensity women's labor supply, but not for their job quality. Among this relatively disadvantaged population, college graduates and non-college graduates are employed at about the same rates and intensities during good economies. However, as the economy worsens, the employment prospects

for college graduates increase vis-à-vis similar non-college graduates. However, these relative gains in employment for low-propensity college graduates do not translate into gains in job quality. Thus, while low-propensity college graduates enjoy greater employment during recessions, they are not employed in better jobs than similar non-college graduates.

At the higher end of the propensity score distribution, a substantially different pattern of effects takes place. During expansions, college has little effect on employment, and this null effect remains during the recession. Therefore, unlike at the lower end of the propensity distribution, among relatively advantaged young women, the recession did not increase the importance of college for employment. However, among those who were employed, a worsening economic context did seem to increase the importance of college for high-propensity young women. Thus, while even high-propensity non-college graduates remain employed at rates similar to their college graduate counterparts, their job quality is reduced compared to college graduates. For high-propensity college graduates, the recession did not provide a buffer against employment losses, but it did provide a buffer against losses in job quality.

For young women, college provides different benefits depending on both the individual and the larger economic context. These complementary patterns are consistent with a queuing model where potential workers are ranked by both educational attainment and precollege characteristics. As the number of available positions shrinks during recessions, those at the top of the queue, high-propensity college graduates, experience few negative effects on employment or job quality. High-propensity non-college graduates may remain employed at high rates, but have to take lower quality jobs to

remain in the workforce. This leads to no change in college effects on employment during recessions for high propensity women, but increases in college effects on job quality. At the lower end of the propensity score distribution, the recession brings about job losses for non-college graduates, but not for college graduates. However, these lower propensity college graduates do not enjoy the same levels of job quality as their high-propensity counterparts, and experience losses in job quality of similar magnitude as low-propensity non-college graduates. Therefore, among this population, the recession may cause modest losses in job quality among low-propensity college graduates, but can cause similar non-college graduates to be displaced from employment altogether. Thus, at the top of the queue, an economic context of rising unemployment has little negative effect. In the middle, where young women are either less educated or disadvantaged based on their precollege characteristics, the recession might cause decreases in job quality, but not in employment itself. At the bottom of the queue, where workers are both disadvantaged and less educated, recessions bring about losses in employment, but not in job quality for those that manage to remain employed since those workers already occupied low-status jobs even during better economic contexts. Overall, then, more advantaged workers tend to displace workers below them in the labor queue. Once this process reaches the bottom of the labor queue, those most disadvantaged workers are likely to be pushed out of the workforce completely, as there are few low-status jobs for them to fall to as employment opportunities in the jobs they would have occupied become scarcer (Devereux 2003).

CONCLUSIONS

Results from propensity score matching at hierarchical linear models suggest that some, but not all of the observed increase in inequality between non-college and college graduates (Elsby et al. 2010; Hout et al. 2011; Hoynes et al. 2012) during recessions can be attributed to observed precollege factors. However, substantial increases in college effects became apparent for different segments of the population as the labor market contracted during the Great Recession. These results extend previous scholarship on business cycle effects (Kahn 2010; Oreopoulos et al. 2012) by comparing across both education level and economic context. The concept of the labor queue (Thurow 1975) helps to integrate the various results provided above. I argue that as employment opportunities decreased for young workers during the Great Recession, the most advantaged and desirable workers, college graduates who had high predicted probabilities of completing college, displaced those directly below them in the labor queue from the shrinking supply of high status jobs. This intermediate group, consisting of low-propensity college graduates and high-propensity non-college graduates, was able to remain employed, but suffered losses in job quality during the recession due to pressure from those above them in the labor queue. This resulted in the growing positive effect of college on job quality at high propensity score levels. This is an example of occupational upgrading during recessions, where the employees in a given occupation increase in quality as more employees flood the labor market relative to the number of jobs available (Devereux 2003). As lower status jobs were increasingly being 'upgraded' and taken by these workers who were positioned in the middle of the labor queue, the least desirable group of employees who had populated these occupations during better contexts, low-propensity non-college graduates, suffered losses in employment. These workers were

displaced not just from the types of jobs they normally would have occupied, but in many cases, from full time work, steady employment, or employment altogether. This occurred despite the advantages that non-college graduates had in labor market experience, which are greatest in the early career. With the previous occupants of low-status occupations being employed less frequently and less intensely during recessionary contexts, the effect of college on low-propensity young workers' labor supply increased.

There were several limitations of this analysis that previous research could address to strengthen the findings presented above. First, data limitations resulted in small sub samples for the analysis. Ideally, the samples used to compute treatment effects during expansionary and recessionary contexts would be larger; however, the relatively small cohort, sample attrition, missing covariates, and the need to analyze men and women's labor market outcomes separately all reduce the analysis sample sizes. Further replication of these results with other data sources is necessary to increase their reliability.

Another limitation is that studying the labor market outcomes of early career workers means that some people have yet to finish their education. In this analysis, those who were enrolled in college or graduate programs at age 26 were not included in the propensity score matching or the HLM analyses. Therefore, these findings do not generalize to all young people, as those enrolled in school might differ from those who remained in the labor market at age 26. Furthermore, there is evidence that college enrollment increases during recessions (Dellas and Koubi 2003). It is possible that during recessions those that return to college or graduate programs in their mid-twenties, or delay graduation to avoid a poor labor market, may differ from those who are not

enrolled in school. This may also limit the findings presented above as the decision to enroll or re-enroll in school during recessionary periods may be correlated with expected employment or wages. I ran logistic regression models to determine whether economic context interacted with the effects of precollege observable characteristics, changing the types of students who were enrolled in college or graduate programs at age 26. I used the propensity score, a dummy for economic context, and an interaction term between the two to predict college enrollment at age 26 separately for non-college and college graduates. The logit coefficients for these models are presented below in Table 3-9. None of the interaction terms, which may have indicated that economic context changed the average propensity scores of enrollees at age 26, were statistically significant. This provides at least some evidence against the hypothesis that the types of students enrolled in graduate programs during expansionary periods were fundamentally different from the types of students enrolled in graduate programs during recessionary contexts. Since economic context did not seem to change the effect of the propensity score on college enrollment at age 26, there is a lack of evidence that increasing unemployment rates were driving advantaged college graduates into graduate programs at differential rates to less advantaged college graduates. However, the lack of evidence here is not necessarily evidence of null effects. Follow-up analyses or analyses on older samples of workers should be performed to ensure that the effects of economic context on returns to college completion are not due only to changing populations of workers in the labor market.

[INSERT TABLE 3-9 HERE]

Another potential limitation is that workers could leave states experiencing recessions in favor of areas experiencing less unemployment. To address this limitation, I

also analyzed the sample using year at age 26 instead of state unemployment rates at age 26 to capture economic context. Since the national unemployment rate in 2009 and 2010 was higher than it was in 2006 and 2007, this provided variation in economic context. Respondents could no longer "move" out of recessionary contexts, unless, as stated above, they entered school, which would have removed them from the analysis sample. The results for these auxiliary analyses largely mirrored the state unemployment rate findings, with college generally becoming more important for young men's and women's labor supply at low propensity scores during recessions, though the effects of economic context were smaller, as expected, with a worse measure of economic context. Similarly, the effects of college for high-propensity individuals' job quality increased during 2009 and 2010 compared to earlier when the economy was stronger. These results are provided in Tables 3-10 and 3-11 in the appendix. These results are also consistent with emerging results from Yagan (2016), who suggested that effects of relocation during the Great Recession were modest.

In the early career, educational stratification in the labor market seems to be contingent on micro-level factors, such as individual cognitive ability and family background, but also on the larger economic context. By increasing the effects of college, economic recessions may exacerbate existing inequalities between the educated and less educated, and between the advantaged and disadvantaged. Given the scarring effects of recessions which can negatively impact wages for a decade or longer (Kahn 2010; Oreopoulos et al. 2012), this increase in inequality observed for young workers during recessionary contexts may persist into later stages of the career. The negative effects of recessions seem harshest for those at the bottom of both the predicted college probability

distribution and the educational attainment distribution. The combination of these two axes of stratification is what leads to the worst consequences of recessions in terms of earnings and employment. By contrast, those with high predicted probabilities of completing college experienced growing effects of college on job quality during recessionary contexts. Therefore, while increasing college completion among those already relatively likely to graduate might help those individuals obtain better jobs during recessions, most of the increase in inequality of earnings and employment between educational levels comes from those who were unlikely to complete college based on precollege factors. College, it seems, does help young workers "weather the economic storm" (Carnevale et al. 2012), though its role as a buffer against the negative impacts of recessions is heterogeneous across the population, and differs according to the outcome of interest.

APPENDIX

Table 3-1. Means by economic context and college completion, men: NLSY-97.

	Expansion		Recession	
	Non-college	**College**	**Non-college**	**College**
Propensity score covariates				
Black	.080	.048	.121	.016
Hispanic	.082	.053	.101	.046
Northeast	.181	.277	.115	.168
North Central	.352	.278	.247	.348
West	.221	.197	.289	.175
Live in MSA	.696	.779	.775	.817
Intact family	.599	.784	.619	.839
Sibship	2.813	2.328	2.938	2.652
Mother's educ.	12.836	14.496	12.811	15.123
Father's educ.	12.735	14.911	12.718	15.049
Log parental income	3.808	4.167	3.680	4.246
College prep	.322	.807	.542	.820
Cognitive ability	.222	.826	.241	.740
HS GPA	2.714	3.295	2.798	3.341
Peer college plans	62.062	69.588	62.525	72.120
Teacher interest	.906	.927	.901	.979
Propensity score	.202	.688	.247	.712
Log earnings	10.327	10.729	10.208	10.482
Weeks Worked	50.135	50.815	49.683	50.694
Hours Worked	2252.478	2362.641	2158.548	2186.551
Log Hourly Wages	2.635	2.965	2.574	2.799
Occupational Status	28.212	39.677	26.107	44.540

Table 3-2. Means by economic context and college completion, women: NLSY-97.

	Expansion		Recession	
	Non-college	**College**	**Non-college**	**College**
Propensity score covariates				
Black	.095	.070	.122	.050
Hispanic	.101	.038	.130	.061
Northeast	.192	.271	.160	.176
North Central	.251	.289	.245	.343
West	.223	.148	.255	.198
Live in MSA	.698	.807	.796	.845
Intact family	.490	.712	.521	.742
Sibship	2.954	2.432	2.996	2.494
Mother's educ.	12.801	13.353	12.516	14.338
Father's educ.	12.250	13.917	12.265	14.291
Log parental income	3.622	3.809	3.523	4.062
College prep	.441	.703	.465	.887
Cognitive ability	.147	.615	.069	.517
HS GPA	2.821	3.306	2.752	3.354
Peer college plans	62.615	69.222	64.712	72.746
Teacher interest	.797	.911	.873	.922
Propensity score	.255	.603	.242	.683
Log earnings	9.867	10.393	9.815	10.315
Weeks Worked	48.553	51.345	49.059	50.072
Hours Worked	1905.408	2155.941	1882.723	2022.039
Log Hourly Wages	2.391	2.785	2.343	2.768
Occupational Status	31.072	37.913	28.607	36.173

Table 3-3. Odds ratios and standard errors predicting college completion by age 25, NLSY-97.

	Men (n=869)		Women (n=957)	
	OR	**s.e.**	**OR**	**s.e.**
Race[1]				
Black	1.710	.65	1.700†	.50
Hispanic	.938	.33	.762	.27
Region[2]				
Northeast	2.623**	.80	2.614***	.71
North Central	1.284	.35	2.184**	.55
West	1.078	.35	1.805*	.52
Live in MSA	1.388	.33	1.575*	.36
Intact family	2.170***	.52	1.455†	.30
Sibship	1.005	.08	.831**	.06
Mother's educ.	1.145**	.06	1.157**	.06
Father's educ.	1.133**	.05	1.091*	.05
Log parental income	1.311	.22	1.152	.14
College prep	2.301***	.52	2.914***	.59
Cognitive ability	1.495*	.28	1.162	.22
HS GPA	.063*	.07	.477	.87
HS GPA^2	2.381***	.51	1.600	.48
Peer college plans	1.007	.00	1.008	.00
Teacher interest	1.210	.40	.969	.27

*†p<.10; *p<.05; **p<.01; ***p<.001*

[1] Reference group for race is non-black, non-Hispanic

[2] Reference group for region is South

Note: An F-test suggested that high school GPA and its square were jointly significant for women (χ^2=71.8; p<.001)

Table 3-4. Sample size within region of common support by propensity score stratum, men and women age 26: NLSY-97.

	Expansion	Recession
Men		
[0 - .2]	99	106
[.2 - .25]	17	8
[.25 - .3]	17	19
[.3 - .4]	13	21
[.4 - .6]	27	24
[.6 - .7]	16	18
[.7 - .8]	15	17
[.8 - 1]	30	30
Total	234	243
Women		
[0 - .2]	115	104
[.2 - .4]	43	40
[.4 - .6]	52	38
[.6 - .7]	24	20
[.7 - .8]	28	28
[.8 - 1]	19	19
Total	281	249

Table 3-5. Estimated treatment effects of college on the treated (TT) and untreated (TUT) by economic context, men age 26: NLSY-97.

	TT		TUT	
	Expansion	**Recession**	**Expansion**	**Recession**
Log Earnings	1.300**	.728*	-.668	.635†
	(.47)	(.35)	(.59)	(.36)
Weeks Worked	4.561	3.269	-8.558†	4.758
	(3.66)	(2.87)	(4.49)	(3.63)
Hours Worked	506.51**	206.08	-391.39†	87.76
	(194.1)	(221.3)	(234.7)	(200.3)
Log Wages	.477**	.432*	.343*	-.079
	(.18)	(.19)	(.17)	(.12)
Occupational Status	9.127*	14.863***	6.588†	9.696***
	(4.41)	(3.67)	(3.93)	(2.53)

**p<.05; **p<.01; ***p<.001*

Table 3-6. Hierarchical Linear Model Level-2 Slopes, Men aged 26: NLSY-97.

	Expansion	**Recession**
Log Earnings	.800**	-.923†
	(.30)	(.52)
Weeks Worked	3.858*	-1.204
	(1.72)	(4.07)
Hours Worked	2234.80***	218.59
	(274.4)	(408.4)
Log Wages	-.040	1.226***
	(.20)	(.22)
Occupational Status	-21.772**	20.071***
	(7.14)	(6.46)

**p<.05; **p<.01; ***p<.001*

Table 3-7. Estimated treatment effects of college on the treated (TT) and untreated (TUT) by economic context, women age 26: NLSY-97.

	TT		TUT	
	Expansion	**Recession**	**Expansion**	**Recession**
Log Earnings	.787†	.263	.558	.742
	(.43)	(.38)	(.38)	(.52)
Weeks Worked	4.296	1.825	4.614	4.500
	(3.40)	(3.02)	(3.19)	(4.19)
Hours Worked	416.63*	30.24	182.91	254.00
	(185.0)	(195.9)	(184.0)	(211.0)
Log Wages	.119	.165	.379**	.109
	(.10)	(.12)	(.12)	(.12)
Occupational Status	2.460	6.238†	5.428*	7.528**
	(3.16)	(3.40)	(2.72)	(2.69)

*†p<.10; *p<.05; **p<.01; ***p<.001*

Table 3-8. Hierarchical Linear Model Level-2 Slopes, Women aged 26: NLSY-97.

	Expansion	**Recession**
Log Earnings	-1.023	-1.059
	(1.14)	(.78)
Weeks Worked	-15.892†	-6.160
	(8.77)	(5.53)
Hours Worked	1166.07*	-1843.04***
	(592.4)	(420.0)
Log Wages	-.608**	.202
	(.21)	(.25)
Occupational Status	-1.626	11.849†
	(7.10)	(7.09)

**p<.05; **p<.01; ***p<.001*

Table 3-9. Odds ratios predicting college enrollment for non-college graduates and college graduates at age 26, NLSY-97.

	Men		Women	
	Non-college	**College**	**Non-college**	**College**
Recession	.430	-.133	.190	.240
	(.47)	(.87)	(.43)	(.82)
Propensity score	2.457**	-1.109	1.374†	-1.107
	(.93)	(.29)	(.75)	(1.00)
Rec. * pscore	-.564	.910	-.024	.363
	(1.24)	(.63)	(1.12)	(1.35)

*†p<.10; *p<.05; **p<.01; ***p<.001*

Table 3-10. Estimated treatment effects of college on the treated (TT) and untreated (TUT) and HLM level-2 slopes using year at age 26 as proxy for economic context, men age 26: NLSY-97.

	Expansion			Recession		
	TT	**TUT**	**HLM**	**TT**	**TUT**	**HLM**
Log Earnings	1.138†	-.888	.614	.523*	.565	-.514
	(.58)	(.58)	(.67)	(.27)	(.35)	(.43)
Weeks Worked	3.026	-10.535*	.050	1.794	3.817	1.680
	(4.22)	(4.46)	(1.26)	(2.25)	(3.64)	(3.12)
Hours Worked	334.34	-405.17†	1012.67†	118.89	87.95	557.69
	(238.2)	(238.2)	(546.7)	(200.2)	(195.7)	(425.4)
Log Wages	.550*	.326†	.596**	.408*	-.107	1.073***
	(.24)	(.18)	(.19)	(.17)	(.12)	(.22)
Occupational Status	13.048*	3.301	20.200**	14.878***	9.503***	18.399**
	(5.63)	(3.22)	(6.83)	(3.53)	(2.51)	(6.31)

*†p<.10; *p<.05; **p<.01; ***p<.001*

Table 3-11. Estimated treatment effects of college on the treated (TT) and untreated (TUT) and HLM level-2 slopes using year at age 26 as proxy for economic context, women age 26: NLSY-97.

	Expansion			Recession		
	TT	**TUT**	**HLM**	**TT**	**TUT**	**HLM**
Log Earnings	.164 (.32)	.248 (.66)	-1.649 (1.27)	.418 (.41)	.872 (.54)	-1.313 (.81)
Weeks Worked	.167 (2.44)	2.506 (5.42)	-21.286* (10.02)	2.991 (3.30)	5.990 (4.32)	-7.922 (5.92)
Hours Worked	186.20 (145.3)	140.89 (274.9)	857.46 (656.7)	92.02 (201.8)	331.46 (213.2)	-2006.84*** (418.8)
Log Wages	.061 (.09)	.269† (.16)	-.949*** (.27)	.155 (.12)	.118 (.13)	.127 (.25)
Occupational Status	1.074 (2.79)	3.001 (2.97)	-10.954 (9.40)	6.272† (3.34)	7.418** (2.63)	10.746 (7.12)

*†p<.10; *p<.05; **p<.01; ***p<.001*

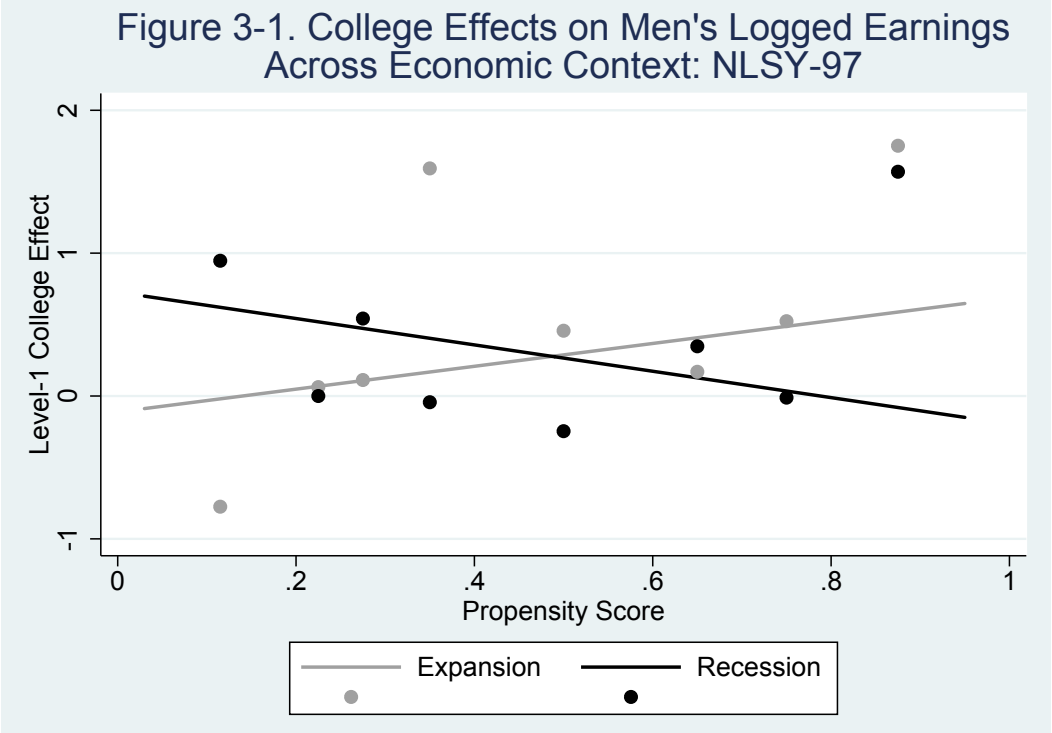


Figure 3-2. College Effects on Men's Weeks Worked Across Economic Context: NLSY-97

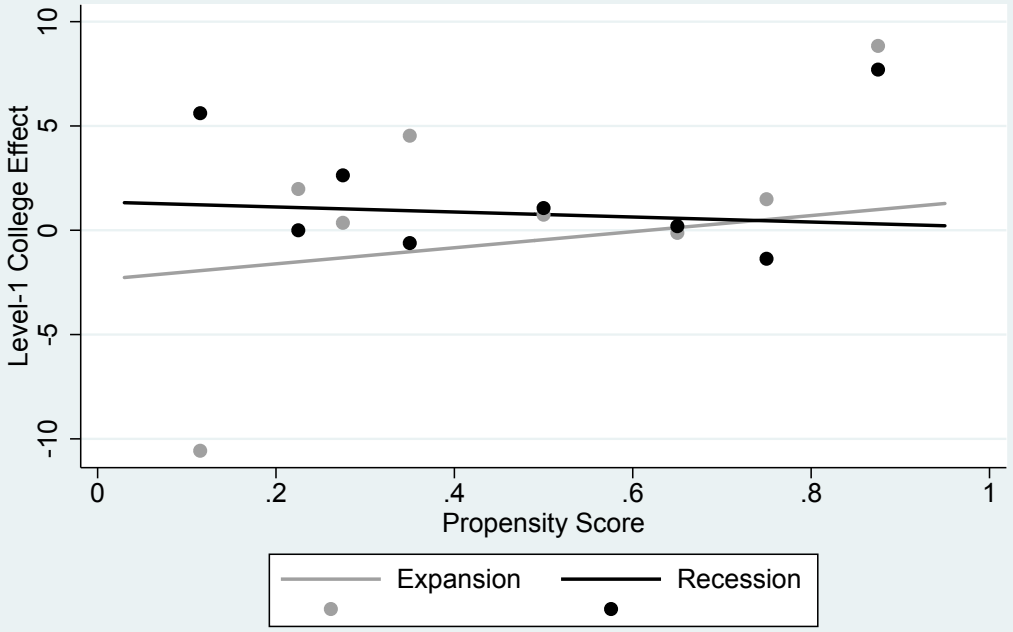


Figure 3-3. College Effects on Men's Hours Worked Across Economic Context: NLSY-97

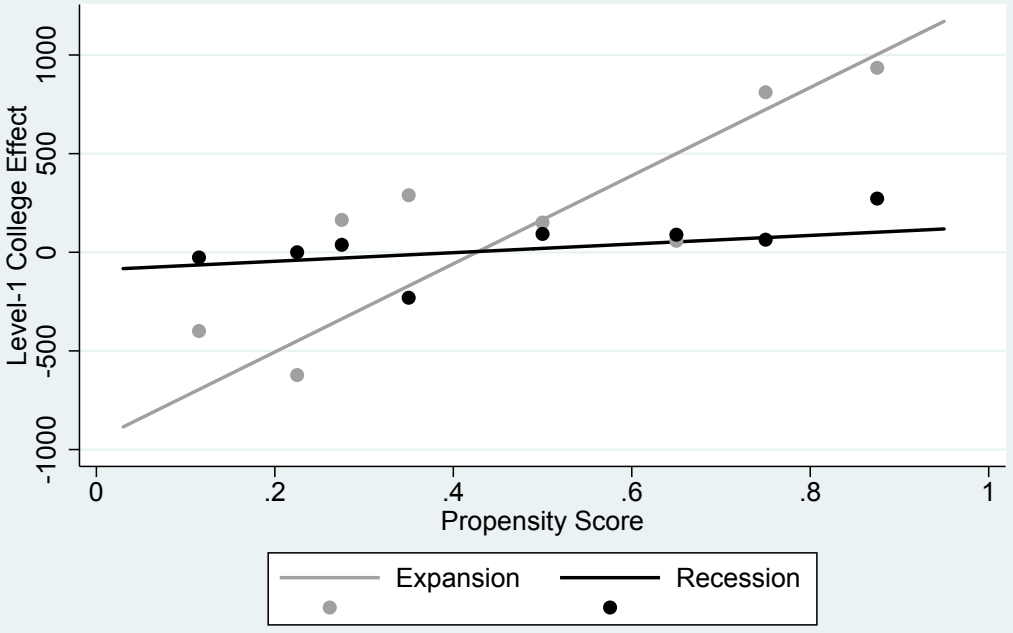


Figure 3-4. College Effects on Men's Logged Hourly Wages Across Economic Context: NLSY-97

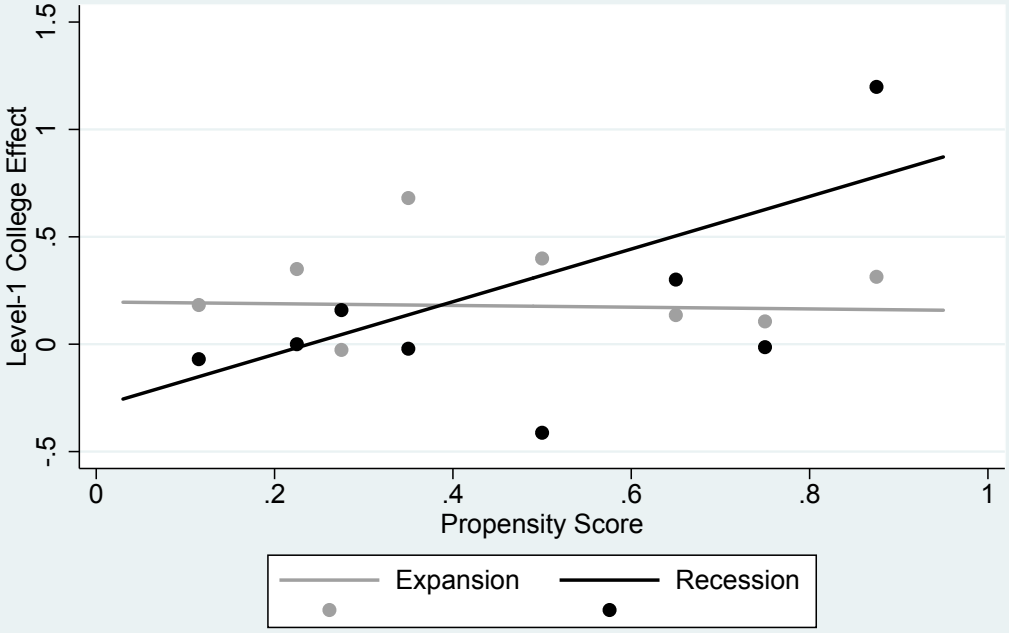


Figure 3-5. College Effects on Men's Occupational Status Across Economic Context: NLSY-97

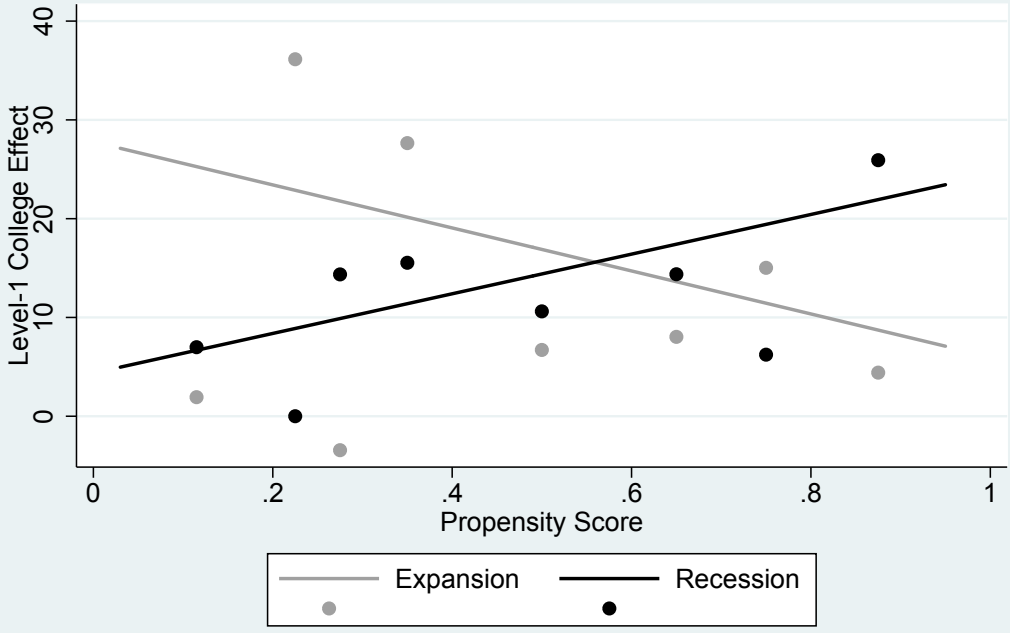


Figure 3-6. College Effects on Women's Logged Earnings Across Economic Contex: NLSY-97

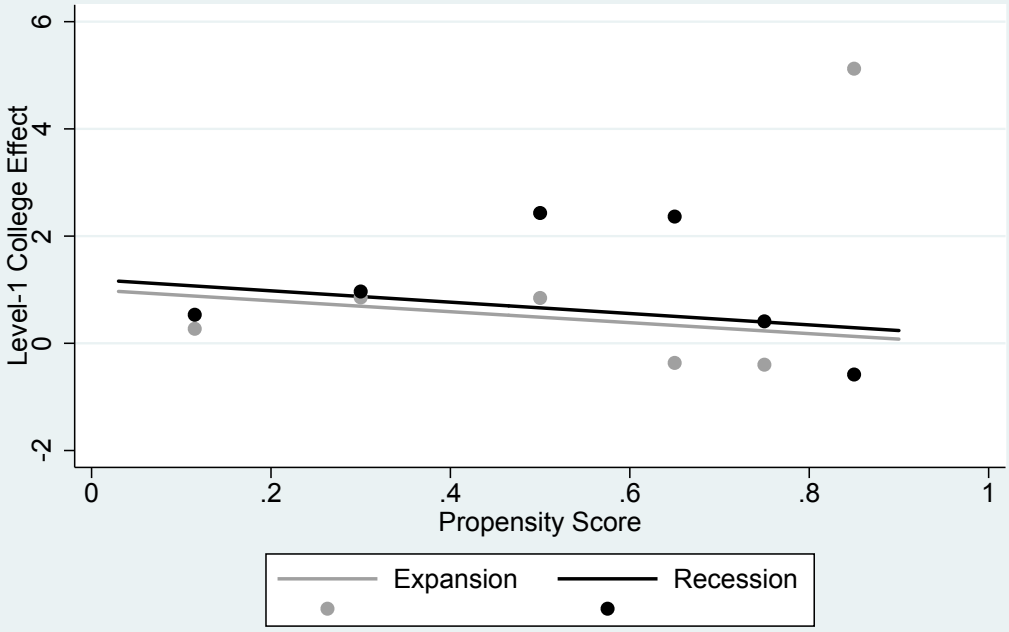


Figure 3-7. College Effects on Women's Weeks Worked Across Economic Context: NLSY-97

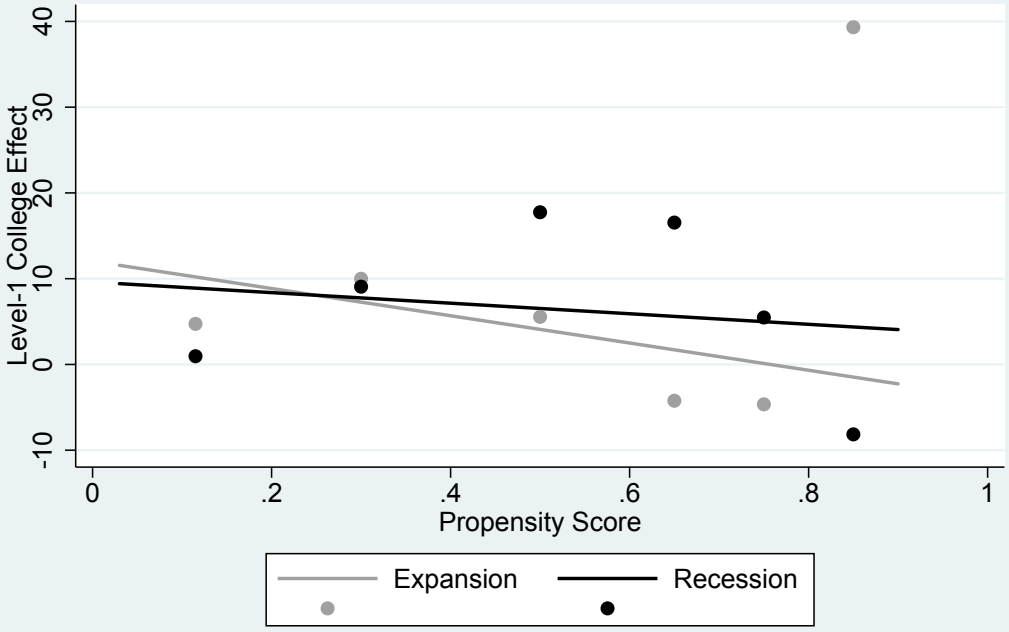


Figure 3-8. College Effects on Women's Hours Worked Across Economic Context: NLSY-97

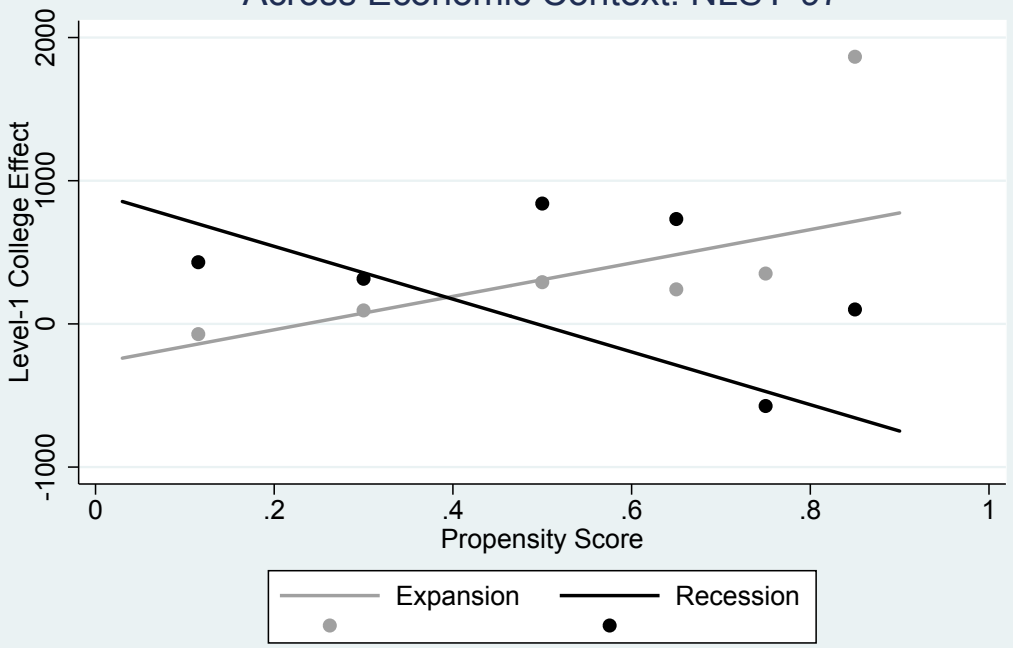


Figure 3-9. College Effects on Women's Logged Hourly Wages Across Economic Context:NLSY-97

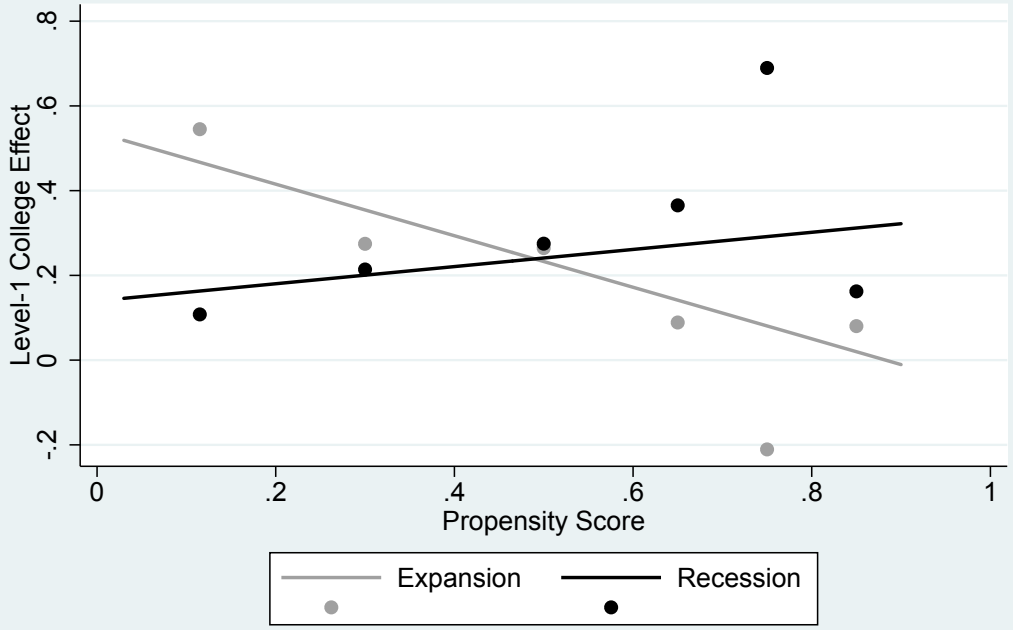
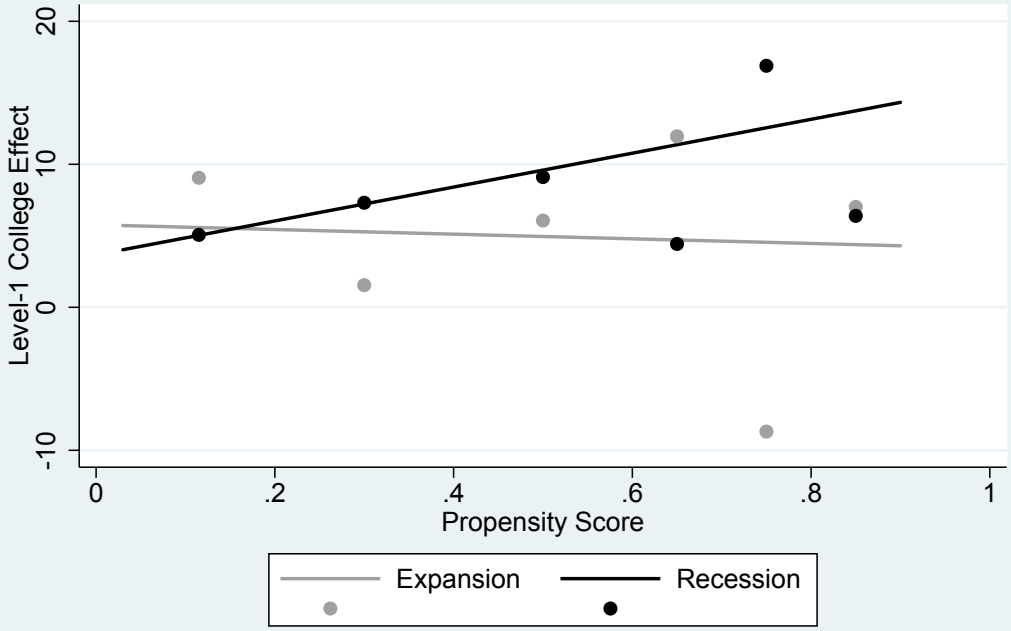


Figure 3-10. College Effects on Women's Occupational Status Across Economic Context: NLSY-97



CHAPTER 4: ELITE COLLEGE EFFECTS ON EARLY CAREER WORKERS DURING THE GREAT RECESSION

In the previous two empirical chapters, I focused on how differences in educational attainment—having completed college versus not having completed college—impacted individual labor market outcomes during the Great Recession and across economic contexts. The analyses of heterogeneity in these chapters suggest that individuals may experience different returns to college depending on their propensity to complete it. In addition to differing across individuals, the effects of college may also differ according to horizontal differences in education. Contemporary research has focused mainly on two such axes: college quality and field of study. While there seem to be strong effects of field of study on returns to education (see review in Gerber & Cheung, 2008, Solmon 1975, Wise 1975, Morgan & Duncan 1979, Brewer & Ehrenberg 1996, Ishida et al. 1997) that may interact with economic context (Elsby, Hobijn, and Sahin 2010; Hoynes, Miller, and Schaller 2012), data limitations preclude their analysis in this project. Here, I focus on the effects of college quality on labor market outcomes. Elite college attendees may see increased returns to college for several different reasons (see review in Gerber and Cheung 2008). First, elite colleges may be more effective at increasing students' human capital by more effectively teaching students the skills, both cognitive and non-cognitive, that increase their productive capacities. Second, attending an elite college might signal high ability to potential employers (Spence 1973; Stiglitz 1975). Third, students at elite colleges might form high-value social networks with their classmates, who are likely to come from advantaged backgrounds and be destined for

high-status occupations (Gerber and Cheung 2008). Fourth, elite college students may share cultural capital with those that make hiring decisions for high-paying jobs (Rivera 2012). However, the observed positive correlation between elite college attendance and labor market outcomes could also be confounded by selection bias, much like the effects of college attendance in general. In this case, elite college attendance does not increase earnings or employment; instead, high ability individuals or those from advantaged backgrounds are likely to both do well in the labor market and to attend elite colleges, though the connection between the two may be spurious (Gerber and Cheung 2008). If selection bias accounts for the apparent elite college effect, then elite college attendance is not actually beneficial for any given individual. On the other hand, if one or more of the three hypotheses regarding elite college effects is correct, then the estimated effects of elite colleges should remain positive after controlling for selection bias.

Recent empirical findings regarding the average effects of elite college attendance on labor market outcomes have been mixed (Black and J. A. Smith 2006; Brand and Halaby 2006; Brewer, Eide, and Ehrenberg 1999; Dale and Krueger 2011; 2002; Gaddis 2015). Most of the elite college research since the 1990s has been able to control for selection bias better than the first generation of elite college effects research (e.g., Weisbrod & Karpoff 1968, Solmon 1975, Solmon & Wachtel 1975, Wise 1975, Griffin & Alexander 1978; see (Brewer et al. 1999) for review), which found positive effects on labor market outcomes. These early analyses usually were only able to include a few controls in their multivariate models, including years of education and work experience. Subsequent research, which has incorporated more controls for measures of ability and utilized innovative methods to control for selection bias, finds mixed results. Monks

(2000), for example, found that college selectivity positively affected earnings after including an ability control. Dale and Krueger (2011; 2002), on the other hand, compared across students who attended elite and non-elite colleges from a sample that had all been admitted to elite colleges. They reasoned that variables that might be unobservable to researchers but observable for admissions committees could have been causing earnings differences between elite and non-elite college attendees. By only comparing students who have been admitted to the same colleges, Dale and Krueger (2002) eliminate this source of bias. They did not find support for positive average elite college effects on earnings. However, mirroring findings of heterogeneous effects discussed above, they did find that students from low income backgrounds benefitted significantly by attending elite colleges (Dale and Krueger 2002). In a subsequent study that used similar methodology, they also found that average effects were not significantly greater than zero, but that black and Hispanic students and those from low-income families experienced positive effects of attending an elite college (Dale and Krueger 2011).

Using an audit methodology, Gaddis (2015) found positive results in callbacks from employers for résumés where the applicant had graduated from an elite college as opposed to a less selective one. His fictional applicants to entry level jobs that listed a college degree as a requirement showed that applicants with black-sounding names from elite colleges did as well as applicants with white-sounding names from less selective colleges. “Black” applicants from non-elite colleges were penalized further, receiving the fewer callbacks. Furthermore, the callbacks they did receive were for positions with lower starting salaries (Gaddis 2015). Gaddis (2015) also matched names to average education levels of mothers from birth records to act as a proxy for socioeconomic

background. For instance, the black male names were Jalen (high SES), Lamar (mid SES), and DaQuan (low SES). The white male names were Caleb (high SES), Charlie (mid SES), and Ronny (low SES). Socioeconomic background also had a positive effect on callbacks. Having a low SES name reduced the odds of getting a callback by 39 percent net of race, college selectivity, college major, gender, and region. These findings suggest that socioeconomic background and race are both important factors for employers, but they do not directly speak to their interaction with elite college attendance. A final piece of very interesting, though limited, evidence, came by mistake. Gaddis (2015) reports that in 13 cases, potential employers accidentally included internal messages amongst themselves when they responded to the mock applicants. In several cases, employers explicitly mentioned elite colleges in applicants' résumés, suggesting a strong signaling effect for elite college graduates. For example, employers communicated among themselves statements such as, "Kids coming out of Duke are by far the most capable," and "Forget the others: HARVARD GRAD" (Gaddis 2015 1471). The audit results suggest that elite college graduates have advantages over graduates from non-selective colleges in the job market, and that these advantages are at least in part due to signaling.

Black and Smith (2004) compared OLS estimates of elite college effects to propensity score matching results. They showed that OLS estimates tended to overestimate average effects because elite and non-elite college students tended not to overlap on all of the relevant control variables. Their matching results tended to fall short of statistical significance, with smaller magnitudes and had larger standard errors than the OLS results. Brand and Halaby (2006) used propensity score matching and similarly did

not find strong support for overall effects of elite college attendance on wages. However, they did find that elite college attendance increases total years of education and occupational status, particularly for those who were unlikely to attend elite colleges (Brand and Halaby 2006). These findings also suggest a pattern of negative selection, where students who were unlikely to attend elite colleges were the ones that stood the most to gain if they did so.

The inconsistent results found among quantitative studies of elite college effects imply that elite college effects, if they exist, are not large or widespread. However, elite college effects do seem stronger for those who are unlikely to attend elite colleges based on observable precollege factors. For example, Dale and Krueger (2002; 2011) found positive effects of elite college attendance for students from low-income families. Similarly, Brand and Halaby (2006) found stronger effects for the control group (non-elite college attendees) than the treated group. These analyses suggest that elite college attendance and graduation may be able to offset some of the disadvantages that racial and ethnic minorities and those from low socioeconomic backgrounds face in the labor market (Gaddis 2015).

Elite college effects also seem stronger at the very top end of the distribution of elite colleges. Bowen and Bok (1998) found positive income effects for the highest selectivity colleges. Monks (2000) also found that after controlling for family background, selectivity effects are reduced to insignificance except for only the most selective colleges. Rivera's (2012) qualitative investigation of hiring practices at a management consulting firm may also suggest that selectivity effects are important among very elite colleges, such as the Ivy League colleges and a few select others. Hiring

managers at these firms used Ivy League degrees as signals of cultural capital they thought was necessary to achieve a "fit" between applicants and their firms (Rivera 2012).

Gerber and Cheung (2008) argue that the recent mixed findings on this topic should cast doubt on claims of strong positive effects for elite colleges. The current analyses suggest that claims of average effects of elite colleges may be dubious, but that effects may exist for smaller groups—either existing only for some students or only for a small number of very elite colleges. Another special case in which elite college attendance might have higher returns that non-elite college attendance could be during economic recessions. As the supply of available jobs decreases, employers might use horizontal axes of education, such as perceived college quality, to differentiate and rank otherwise similar applicants. In the following chapter, I use propensity score matching to estimate returns to elite college attendance during the Great Recession for a sample of early career men and women from the NLSY-97.

HYPOTHESES

At the height of the Great Recession, employment losses meant competition for jobs was high. In Chapter 3, I showed evidence suggesting that college effects for young workers increased in areas with high unemployment rates. Given the increased supply of workers, I hypothesize that college quality in addition to college completion will have a significant effect on individual early career workers' outcomes in 2009. I also predict that elite college effects will be strongest for measures of job quality (i.e., wages and occupational status) as opposed to employment. This hypothesis is based on work by

Devereux (2003) showing that occupational upgrading causes college graduates to take lower status jobs on average during recessions. If potential workers are ranked by the prestige or quality of their colleges in addition to their overall level of educational attainment, I would expect to see any gaps in job quality between elite vs. non-elite college attendees increase. This hypothesis is also informed by results in Chapter 3, which suggest that the benefits of college completion on job quality were greatest for those who had high estimated propensities to complete college. Those with high propensities of completing college are more likely to be represented in the population that was likely to attend an elite college following high school.

As in previous chapters, I estimate the treatment effects on both the treated and the untreated groups. Following Brand and Halaby (2006), I hypothesize effect sizes to be larger among the control group than the treated group. This would provide some evidence for negative selection of elite college effects. Because those who attend elite colleges are likely to come from advantaged backgrounds and score highly on measures of ability such as the ASVAB and high school grades, I do not expect to find large effects of elite college attendance on employment. In both Chapters 2 and 3 of this dissertation, I found that even high-propensity non-college graduates were employed at relatively similar rates to high-propensity college graduates during the Great Recession. There were much larger differences in employment for those at the low end of the propensity score distribution, where individuals were relatively disadvantaged in terms of background and ability. By contrast, I expect the differences in employment between those who attend elite and non-elite colleges to be relatively small because on average both of these groups are relatively advantaged. If they do exist, however, I expect these effects to be strongest

for the untreated group who were on average less likely to attend elite colleges following high school.

DATA AND METHODS

The analysis in this chapter relies on the NLSY-97 to estimate average treatment effects of elite college attendance on young workers' labor market outcomes during the Great Recession. Similar to Chapter 2, I use propensity score matching to estimate the average treatment effect on the treated (TT) and the average treatment effect on the untreated (TUT) on a series of five labor market outcomes in 2009: (1) logged annual income; (2) weeks worked; (3) hours worked; (4) logged hourly wages; and (5) occupational status, measured using the Hauser-Warren socioeconomic index. In this chapter, however, the treatment is elite college attendance before 2008. The control group is composed of those who were enrolled in college prior to 2008, but did not enroll in an elite college. I also conducted a hierarchical linear model to assess the linear trend in average treatment effects of elite college across the propensity score distribution.

I separated elite colleges from non-elite colleges using tier rankings from *Barron's Profiles of American Colleges* from 2008. I considered the top three tiers—Most Competitive, Highly Competitive Plus, and Highly Competitive—"elite colleges," similar to Brand and Halaby (2006). The remaining categories—Very Competitive Plus, Very Competitive, Competitive Plus, Competitive, Less Competitive, and Non-Competitive—comprised the control group. The top category, Most Competitive, included 89 colleges and universities, including many top national universities such as Harvard, Yale, and MIT, top liberal arts colleges such as Williams College and Amherst

College, and a few of the top public universities, such as UC Berkeley, UCLA, and the University of Virginia. The next most competitive group, "Highly Competitive Plus," was composed of 37 colleges and universities. Examples in this group include the University of Wisconsin—Madison, Georgia Tech, and Boston University. Finally, the "Highly Competitive" group included 70 institutions, with UC Irvine, the University of Minnesota, and Providence College being examples. The elite colleges accounted for 13.9 percent of the colleges and universities listed in *Barron's Profiles of American Colleges*. After the sample restrictions were put in place, 15.9 percent of women (82 out of 517) and 16.5 percent of men (64 out of 389) were assigned to the treatment group. Examples of colleges from the categories in the control group in this analysis include less competitive public universities, including many schools in the California State University system, as well as private institutions (e.g., Temple University) and, at the lower end, even for-profit colleges, such as Kaplan University. Those who only attended two-year colleges were also assigned to the control group.

This analysis, similar to the previous chapters, was restricted to those in the non-institutionalized civilian population, those who were not enrolled in college when labor market outcomes were measured in 2009, and those who did not have missing values on any of the covariates used to predict treatment assignment. Men and women were analyzed separately. The sample was also restricted to those who were not missing on the outcome variables in 2009, which included college completion, logged income, weeks worked, hours worked, logged hourly wages, and occupational status. Respondents were allowed to have missing values for wages and occupational status if they were not employed during 2009. In these cases, they were included in the analyses of earnings and

employment, but excluded from the wages and occupational status portion. The matching analysis was restricted to the region of common support, defined by the lowest-propensity treated case and highest-propensity control case.

I use logistic regression to estimate early career men's and women's propensities to attend an elite college as opposed to a non-elite college. A set of covariates measuring socioeconomic and demographic background, cognitive ability, and prior school experiences were included in the logistic regression, similar to the propensity score estimation used in Chapters 2 and 3. Following the propensity score estimation, I used propensity score matching to match treated and control cases to the nearest two neighbors of the opposite treatment group. This process is used to calculate both the TT and the TUT for educational attainment and for the five labor market outcomes. Similar to the previous empirical chapters, I also conducted an HLM to assess the pattern of effect heterogeneity over the propensity score distribution. However, unlike the analyses of college completion, data limitations make interpreting these models difficult. For example, for men there were only two individuals with predicted propensities of attending an elite college in the highest propensity score block, which was .80 to 1.00. As such, I could not conduct an OLS regression within this propensity score stratum. In both the male and female samples, I still ran HLM's on a subset of the sample that provided enough treated and control cases in the region of common support. In most cases, the lower sample sizes within each propensity score stratum yielded higher variances. Therefore, I caution restraint while interpreting these findings, though I do include the models in part to keep the analyses consistent with prior chapters. Because very few individuals had high propensity scores given the inherently rare occurrence of attending

an elite college, estimates in the higher propensity score strata may be unreliable, particularly above about 0.6.

PREDICTING ELITE COLLEGE ATTENDANCE

The odds ratios from the logistic regression used to predict the propensity of attending an elite college are displayed in Table 4-1. Many of the covariates that were important predictors of elite college attendance were also predictive of college completion in Chapters 2 and 3.

[INSERT TABLE 4-1 HERE]

For men, logged parental income, cognitive ability, high school grades, and region of residence were all associated with elite college attendance. Similar to the propensity score models for college completion, both high school grades and cognitive ability were important positive correlates of elite college attendance. A full letter grade increase in high school GPA was associated with more than a four-fold increase in the odds of attending an elite college as opposed to a non-elite college, net of the other covariates in the model. A one-standard deviation increase in cognitive ability score increased the odds of elite college attendance by 193 percent net of controls. Residents in the North Central region had 80 percent lower odds of attending an elite college relative to Northeastern residents; Western residents 88 percent lower odds than those that resided in the Northeast, net of controls. A one-unit increase in logged parental income increased the odds of elite college attendance by 105 percent. The point estimate for father's years of education net of controls was positively associated with elite college attendance, but was only significant at the $p<.10$ level ($p=.066$).

I predicted elite college attendance for women in the NLSY-97 cohort using the same set of covariates as for men. Similar to men, cognitive ability and high school grade point average were positively associated with elite college attendance. A one-standard deviation in cognitive ability was associated with more than a 400 percent increase in the odds of attending an elite college, and a one-point increase in high school GPA was associated with a 99 percent increase in the odds of attending an elite college, net of the other covariates in the propensity score estimation. By contrast, the effects of high school grades were stronger than cognitive ability for men. Race, region of residence, father's education, and being enrolled in a college preparatory curriculum were also statistically significant predictors of women's elite college attendance. Net of controls, both black and Hispanic women were more likely than non-black, non-Hispanic women to enroll in elite colleges. Being black as opposed to the reference category increased the odds of elite college attendance by 117 percent; being Hispanic increased the odds by 158 percent. Being enrolled in a college preparatory curriculum during high school also had a large positive effect on women's elite college attendance, increasing the odds by almost three times net of controls. Each additional year of father's education was associated with a 26 percent increase in the odds of elite college attendance. Finally, residents of the Northeast, the reference category in the logistic regression results, were more likely than North Central, Southern, and Western residents to attend elite colleges.

After restricting the sample to the region of common support, there were 354 men and 479 women. Of these, 60 men and 72 women attended an elite college, and were thus assigned to the treatment group. Descriptive statistics for the samples used for matching are displayed in Table 4-2.

[INSERT TABLE 4-2 HERE]

EFFECTS OF ELITE COLLEGE ATTENDANCE DURING THE GREAT RECESSION

Men

The first outcome for which I estimated treatment effects of elite college attendance was bachelor's degree completion. For the following analyses, it is important to remember the restrictions on the sample. First, the sample was restricted to those who were not in school during 2009. While most of the sample will have completed their education by the time they are in their late 20s, those likely to attend elite colleges may also be more likely to attend graduate programs that continue into this age range. Second, the region of common support did not extend to the full distribution of propensity scores. Therefore, these matching results exclude those propensity scores above .74, meaning that those very high achieving students from very high socioeconomic backgrounds, what might be thought of as the typical elite college student, may not included because there were not suitable matches in the control group.

[INSERT TABLE 4-3 HERE]

Table 4-3 shows propensity score matching results for the male sample. Among men who were between 25 and 29 during 2009, the final year of the Great Recession, elite college attendance did not provide significant increases in baccalaureate completion after controlling for observable precollege factors. Thus, those who attended elite colleges and were in the region of common support were not more likely than otherwise similar non-elite college students to complete college.

Similar null results exist for men on logged earnings, weeks worked, hours worked, and logged hourly wages, also shown in Table 4-3 above. None of the point estimates for the TT or the TUT for these outcomes approached statistical significance. This suggests a lack of evidence for elite college effects among men in their late 20s during the height of the Great Recession. The single exception to these null results seems to be occupational status. The TT suggests that conditional on working in 2009, male elite college attendees were employed in higher status occupations than their matched control cases. The TUT was, similar to the other outcomes, positive but not significantly different than zero. Therefore, on average, treated men in the analysis sample who were employed experienced positive effects on job quality due to attending an elite college. However, on average, control group members would not have experienced a similar benefit in occupational status if they had completed college.

The results from the HLM's on the set of six outcomes mirrored the largely null results from the propensity score matching. Figures 4-1 through 4-6 in the appendix show graphs of the level-2 slopes for the average treatment effects of elite college attendance over the distribution of propensity scores. None of the level-2 slopes is significantly different from zero. Furthermore, the ranges of the HLM's are limited because the overlap assumption is violated at the high end of the propensity score distribution. Therefore, results are not provided for propensity scores above .74 in the male sample. Taken together, the propensity score matching and HLM results for men do not provide strong evidence for elite college effects during the Great Recession for young male workers after controlling for the propensity to attend an elite college.

Women

[INSERT TABLE 4-4 HERE]

The outcomes of the propensity score matching analyses are displayed in Table 4-4 for women aged 25-29 in 2009 during the Great Recession. Women who attended an elite college were more likely than similar women who did not attend elite colleges to complete a bachelor's degree. The point estimate for the TT (TT = .188; p=.001) suggests that on average, if a female elite college goer had instead chose to attend a non-elite college, she would have a reduced her probability of completing a bachelor's degree by .188. Similarly, women in the control group, who did not attend elite colleges, completed bachelor's degrees at lower rates than they would have had they attended a more elite college (TUT = .360; p<.001). Therefore, on average, elite college attendance provided both female treated and control group members with significant increases in educational attainment. This stands in contrast to the insignificant treatment effects of elite college attendance on bachelor's degree attainment for men. One thing to note is that almost all of the women in the treatment group completed college (94.6 percent). The rate of college completion among elite college attendees in the sample may be higher than the corresponding rate in the population. One of the drawbacks of only having access to a small number of elite college attendees (n=72) is that random sampling error may be of greater concern than it would be with a larger sample. However, it should be noted that the bachelor's degree completion rate in the male treated group was also very high (90 percent) and that elite colleges tend to have very high graduation rates since it is one factor used to stratify colleges and universities by ranking institutions and by students and their parents. For example, Harvard University, in the "Most Competitive" tier of

Barron's rankings, had a six-year graduation rate of 97 percent. Even those colleges and universities in the "Highly Competitive" category, which was the lowest tier to be considered part of the treatment group, generally had high graduation rates. Providence College, a private "Highly Competitive" school, had a six-year graduation rate of 87 percent. UC Irvine and the University of Minnesota, both large public universities in the "Highly Competitive" category, had six-year graduation rates of 86 percent and 73 percent, respectively. Bachelor's degree attainment was also measured between 7 and 11 years out of high school, meaning that the six-year graduation rate reported by most colleges is the lower bound of the expected graduation rate for the NLSY-97 sample.

The larger magnitude of the TUT for bachelor's degree attainment relative to the TT suggests that elite college attendance could be more valuable for low-propensity women than high-propensity women's college completion. The negative level-2 slope of the HLM, shown in Figure 4-6 (and also reported in Table 4-4), provides further evidence for a pattern of negative selection within the region of common support. Again, it is important to note that the region of common support does not extend into the highest propensity score levels. Therefore, this finding of negative selection is limited, and may not apply to those students who are very likely to attend an elite college based on their precollege observable characteristics.

Moving on to early career labor market outcomes, women who attended elite colleges on average did not receive a significant premium in logged annual earnings compared to their matched control cases. Similarly, the average female non-elite college attendee did not have significantly lower earnings than elite college attendees with similar propensity scores. Elite college attendance was not associated with an increase in

logged annual earnings for either the treated or control groups after matching on propensity scores.

The TT for women's weeks worked in 2009 was not significantly different from zero. Thus, young women who attended elite colleges were not employed more frequently than otherwise similar women who attended non-elite colleges. However, the TUT for weeks worked was significantly greater than zero, suggesting that on average, women who attended non-elite colleges would have worked 6 additional weeks in 2009 if they had attended an elite college instead. Similar to the results for bachelor's degree attainment, the propensity score matching for weeks worked seems to suggest that elite college attendance provides a greater return to the control group than the treated group. The negative level-2 slope in Figure 4-8 provides additional evidence for a pattern of negative selection.

In contrast to weeks worked, neither the TT nor the TUT of elite college on hours worked in 2009 were significantly different from zero. Thus, elite college attendance did not result in early career women working more hours during the Great Recession than women who attended non-elite colleges, net of observable precollege characteristics. Similarly, the HLM did not show a strong positive or negative slope, suggesting a lack of heterogeneous effects of elite college attendance on hours worked for early career women during the Great Recession. The positive TUT for weeks worked reported above is somewhat at odds with the null TUT for hours worked. Together, these results suggest that control group members were more likely to experience spells of joblessness than their matched treated cases during the Great Recession, but they did not on average work significantly fewer hours over the course of the entire year.

Neither the TT nor the TUT of elite college attendance on logged wages was significant. This suggests that, conditional on having been employed in 2009, young women who attended elite colleges did not receive higher wages than those who attended non-elite colleges after controlling for the propensity to attend an elite college. The HLM shown in Figure 4-9 provides a similar picture, with the estimated average treatment effects of elite college attendance on wages not changing significantly over the propensity score distribution within the region of common support.

Finally, the bottom row of Table 4-5 shows the propensity score matching results for occupational status. In contrast to both the educational attainment and weeks worked results, the TT for occupational status is positive and statistically significant, but the TUT is not significantly different from zero. On average, women who attended elite colleges and were employed in 2009 held jobs that scored 6.6 points higher on the Hauser-Warren socioeconomic index. To provide an example, this difference is similar to the difference between a truck driver (Hauser-Warren SEI = 25.27) and a heating and air conditioner mechanic (Hauser-Warren SEI = 31.85), or a math teacher (Hauser-Warren SEI = 66.53) and a sociologist (Hauser-Warren SEI = 73.23) (Hauser and Warren 1996).

The point estimate for the TUT, though not statistically significant, is positive and relatively similar in magnitude to the TT. Although the average effects are greater for the treated group than the control group, the close point estimates do not provide strong evidence of heterogeneous effects. However, the level-2 slope in the HLM displayed in Figure 4-10 is positive and statistically significant. This suggests that over the entire region of support, there are greater returns to elite college attendance in terms of occupational status at higher propensity scores. The HLM results are somewhat more

extreme than the matching results in terms of heterogeneous effects because the matching results reflect the averages of the treated and control groups, respectively, whereas the HLM provides estimated treatment effects for the entire length of the propensity score distribution that falls within the region of common support. Since elite college attendance is a relatively rare event, even the female treatment group only had a propensity score of .33. The mean propensity score for the control group was .14. Therefore, the matching results, which reflect the expected treatment effect for a randomly drawn member of the treatment or control groups, tend to reflect the lower end of the propensity score distribution. The lack of distance between the average member of the control group and the average member of the treatment group may result in relatively similar estimated treatment effects even if a larger pattern of heterogeneity exists across the propensity score distribution.

DISCUSSION OF RESULTS

The results of propensity score matching and hierarchical linear models on the effects of elite college attendance suggest that there were not consistent effects on a broad range of outcomes during the Great Recession for individuals aged 25-29. This is consistent with much of the recent literature on elite college effects that finds null or inconsistent results (Black and J. A. Smith 2004; 2006; Brand and Halaby 2006; Dale and Krueger 2002). I hypothesized finding significant effects of elite college attendance during the Great Recession as a response to the growing competition over a dwindling supply of jobs. I expected these effects to be concentrated in the two measures of job quality: logged wages and occupational status. This hypothesis arose from the job

competition model of the labor market, which suggests that employers use a labor queue to fill open positions (Devereux 2003; Thurow 1975). During times of economic recession, there is a decrease in the supply of open positions, and thus increased competition for the relatively few positions that exist. Devereux (2003; 2004) finds a pattern of occupational upgrading during recessions, where occupations are filled by more educated people during recessions than expansions. Thus, college attendees and college graduates tend to occupy a larger range of occupations during recessions than they do during expansions. During expansions, those with high levels of education may be clustered in the highest-ranking occupations. During economic downturns, however, they may be more spread out, with some occupying jobs they would normally be overqualified for. Under these conditions, stratification within the highly educated group could become more pronounced. If employers use college prestige or selectivity to rank potential employees, this ranking will become more salient when job openings are relatively rare. Therefore, times of economic recession should provide the context in which we would expect to find the strongest effects of elite college attendance.

The propensity score matching analyses did not provide much support for these hypotheses overall. For men who attended at least some college, elite college attendance only seemed to have a significant positive effect on occupational status. Even then, this effect was only strong enough to reach statistical significance for the treated group. I hypothesized that, in addition to the TT, the TUT for occupational status would also be significantly greater than zero. Similarly, I expected both the TT and the TUT for logged hourly wages to be positive, though neither was significantly different from zero. These results suggest that among men who both attended college and were employed in 2009,

attending an elite college as opposed to a non-elite college did not result in significantly higher wages. However, the significant positive effect of elite college attendance on occupational status for the treated group did suggest that male elite college goers were employed in higher status jobs than their matched control cases. If early career occupational status predicts occupational status growth later in the career and subsequent wages (Blau and Duncan 1967), then these men may be better positioned as their careers progress. For example, at age 25, a waiter with relatively low occupational status and an entry-level office worker with a higher occupational status score may earn similar wages. However, as these two workers progress in their careers, their wages may diverge to more closely mirror the differences in their occupational status since there may be less room for advancement for those with low-status jobs. At this point, though, it remains unclear whether initial advantages in occupational status that male elite college attendees experienced during the Great Recession will translate into subsequent increases in wages or earnings as the economy recovers and these young men advance in their careers.

Although the TT for men's occupational status was positive while the TUT was not statistically significant, suggestive of a pattern of positive selection, the HLM shows a very modest level-2 slope ($b = 1.95$; $p=.87$) of the average treatment effects over the region of common support. The HLM therefore does not provide strong evidence for heterogeneous effects of elite college attendance across propensity score strata during the Great Recession for young men. These results stand in contrast to previous matching results from the Wisconsin Longitudinal Study, a larger data set of Wisconsin high school students who were seniors in 1957. Brand and Halaby (2006) found that the untreated group would have experienced positive effects of elite college attendance on the

occupational status of the respondent's first job. Wisconsin non-elite college attendees would have received an occupational status premium, while those who actually did attend elite colleges saw no such premium over otherwise similar non-elite college attendees.

There are several potential reasons that the results presented in this chapter differ from those reported in Brand and Halaby (2006). First, Brand and Halaby's (2006) analysis was not conducted during an economic recession. I have hypothesized based on the results from previous chapters and from the job competition model that elite college effects on job quality should increase for the treated relative to the untreated during recessions. The high TT for occupational status and the non-significant TUT would be consistent with that interpretation. However, there are several other differences between the analysis presented here and that presented in Brand and Halaby (2006) which could also explain these divergent results even if changes in economic context have no bearing on elite college effects for young workers. For example, the WLS (n = 1607) provides a larger sample size than the NLSY-97 (n = 342) in the final analysis for early career men's occupational status. Because of the small sample size, I operationalized the top three categories of selective colleges as elite, while Brand and Halaby (2006) restricted the elite group to the top two categories from *Barron's Profiles of American Colleges*. Narrowing the elite category should lead to stronger effects, as evidence from other studies suggests that elite college effects may be strongest at only the most elite colleges (Monks 2000; Rivera 2012). Another difference between the two studies that could explain the difference in results they measure occupational status at different points in time. In the present study, respondent's occupational status is measured in 2009, when they are between 25 and 29 years old. By contrast, Brand and Halaby (2006) measured

the occupational status of respondent's first jobs. The first ten years tends to be the most volatile period in workers' career. Young workers frequently change employers and experiencing a large portion of their eventual wage growth in the first ten years of their careers (Topel and Ward 1988). The early career volatility of wages might lead to different elite college effects at the time of the respondent's first job and his job several years later. However, Brand and Halaby's (2006) mid-career estimated TUT of elite college on occupational status, which was measured when respondents were generally 35 years old are still significantly greater than zero, though they are smaller in magnitude than the first job estimates.

Another important factor is the difference in birth year between cohorts. The WLS sample was drawn from a birth cohort from the mid-twentieth century, whereas the NLSY-97 sample was born in the 1980s. The interim 30 years saw changes in educational and labor market institutions, with access to college and returns to college increasing dramatically (Fischer and Hout 2006). These factors may have influenced elite college attendance and elite college effects on early career outcomes. However, these changes, which include greater reliance on technology and greater returns to education and ability (Fischer and Hout 2006; Taber 2001) would be more consistent with increasing elite college effects over time.

The other large discrepancy in the samples used here and by Brand and Halaby (2006) is that the NLSY-97 is a nationally representative sample, while Brand and Halaby (2006) rely on a sample drawn from Wisconsin high school students. In fact, the propensity score estimation presented above suggests that region of residence in adolescence is predictive of elite college attendance net of the included controls for

cognitive ability, high school grades, and socioeconomic and demographic background. Residents of the North Central region, where Wisconsin is located, were less likely than residents of the Northeastern region to attend elite colleges. However, previous investigations of the generalizability of status attainment results from the WLS have found that they largely mirror those using national probability samples (Brand and Halaby 2006; Sheridan 2001). While my analysis of elite college effects on early career men follows Brand and Halaby (2006) most closely, I have outlined several differences which may contribute to our diverging results. One of these differences is the context of the Great Recession for my sample. However, unlike Chapter 3, I am not able to isolate the impact of economic context because of data constraints. Therefore, this analysis cannot speak directly to the effects of recessions on elite college effects, though the divergence with Brand and Halaby (2006) suggests that this is an area where further empirical work is required.

The results for men may also provide further insight to Oreopolous et al.'s (2012) study of the effect of the business cycle on Canadian college graduates' wages. They find that graduates from highly-ranked Canadian colleges and universities experienced less severe wage penalties during recessions than graduates from non-elite colleges. They also found that elite college graduates recovered their lost wages due to recessions more quickly than their non-elite graduate counterparts. However, because their study does not control for precollege cognitive ability, secondary school performance, or socioeconomic background, Oreopolous et al. (2012) use college prestige primarily as a proxy for ability. Given the non-random sorting into elite colleges, this seems reasonable, especially since their goal was to describe some of the effect heterogeneity of recessions among the larger

population of college graduates. My null findings with respect to elite college effects on wages are consistent with Oreopolous et al.'s (2012) use of elite college attendance as a proxy for ability. However, Oreopolous et al. (2012) also benefitted from a large sample of Canadian college graduates, compared to the much smaller U.S.-based sample in the NLSY-97. Therefore, differences in national educational institutions or labor markets, or sampling error due to the much smaller sample in the NLSY-97, could have also influenced these comparisons.

Moving to measures of employment, the null effects of elite college on hours worked and weeks worked suggests that among early career men, both non-elite and elite college attendees worked roughly similar amounts during the Great Recession after controlling for the propensity to attend an elite college. This suggests that those who are positioned near the top of the labor queue in 2009 were able to find work at roughly the same rate whether or not they attended an elite college. Together with the positive effects on occupational status for employed men in the treated group, the propensity score matching analyses are consistent with the labor queue theory for the typical male elite college student, though the TT for wages would have also been hypothesized to be positive. Being positioned higher in the labor queue than non-elite college attendees, male elite college goers experienced a protective effect in terms of job quality as measured by occupational status. However, since even those that attend non-elite colleges are still positioned relatively highly in the labor queue, these workers should remain employed at high rates during recessions while taking lower status jobs than they normally would (Devereux 2003). Larger losses in employment should be felt lower in the labor queue, consistent with results from Chapter 2 and Chapter 3, as workers higher

in the labor queue may displace them from employment and there may be fewer lower status jobs for these workers to "fall to" (Devereux 2003).

The largely null results of elite college attendance for men were not replicated for early career women. For example, both the propensity score matching and the HLM provide evidence of negative selection for the effects of elite college attendance on bachelor's degree attainment. Thus, women in the NLSY-97 sample seemed to mirror the results for men from prior cohorts, such as the WLS. These results are also consistent with Goodman, Hurwitz, and Smith's (2015) regression discontinuity analysis of changing entrance exam requirements, which showed increases in bachelor's degree attainment for marginal students admitted to public four-year universities. In complementary work, Cohodes and Goodman (2014) show that inducing lower quality college enrollment decisions by offering subsidies reduced bachelor's degree completion on the margins of entering elite colleges.

Elite college attendance did not provide significant effects on early career women's earnings during the Great Recession after matching on the propensity to undergo the treatment. These results add to the literature which suggests that elite college effects on economic outcomes are inconsistent (Black and J. A. Smith 2006; Long 2010). The earnings results for women here are also consistent with the null results reported above for men in the NLSY-97. Elite college was also an insignificant predictor of hours worked for both treated and untreated women. It did, however, decrease women in the control group's joblessness, as women who attended non-elite colleges would have been employed on average for six additional weeks in 2009 had they undergone the treatment.

For women who were employed during 2009, elite college attendance did not increase wages, though, similar to men, it did increase occupational status for the treated group. Although the point estimate of the TUT on occupational status was close to the TT, the positive level-2 slope in the HLM suggests a pattern of positive selection. Consistent with one of my hypotheses, the positive selection pattern for both early career men and women's occupational status is consistent with occupational upgrading/downgrading predicted by the job competition theory (Devereux 2003). During a period of high unemployment, the average elite college goer tended to work a similar number of weeks and hours as an otherwise similar non-elite college attendee, resulting in null TT's for the two employment measures. However, these men and women worked in jobs with significantly higher occupational status scores than their non-elite counterparts. Furthermore, elite college attendance seemed to provide the largest benefit for those comparatively likely to attend elite institutions. Among those who were less likely to attend an elite college based on precollege observable characteristics, on the other hand, elite attendance did not increase occupational status conditional on employment. One important caveat is that due to data constraints and non-random selection into elite colleges, the region of common support does not extend to those who were predicted to have very high propensities (above roughly 0.8) of attending elite colleges. However, the propensity score matching results did not support a related hypothesis that predicted similar effects of elite college attendance on wages in the early career. The inconsistency between estimated treatment effects on elite college goers' wages and occupational status could exist for a few reasons. One reason is that occupational status includes measures of both the average earnings and the average

education level of workers in a given occupation. Therefore, elite college graduates may be employed in occupations with higher levels of average education without that translating to higher wages. Second, occupational status may provide a measure of the future prospects for workers' careers better than a snapshot of their wages at a single point in time, particularly because the wage distribution is narrower in the early career than later in the career when wages peak.

There are several limitations of this analysis that call for further research on this topic to help resolve. First, the sample size is quite small due to a combination of elite college attendance being an inherently rare experience, the survey design, and attrition. Finding larger sample sizes that accurately measure important precollege variables, such as family background, cognitive ability, and high school grades, can be difficult. These small sample sizes may increase sampling error for estimates of treatment effects.

Second, and in part due to the small sample size, the treatment group contains a relatively wide range of colleges. There is some evidence that elite college effects may be limited to a relatively small group of very selective colleges (Bowen and Bok 2016; Monks 2000). However, the treatment group would have simply been too small to analyze if I had restricted it to the highest single category or the highest two categories of selectivity. Thus, the reported estimates may be biased downward compared to a different, more precise measurement of "elite" colleges. Data constraints also precluded further splitting the sample by economic context to test its impact on elite college effects. It is unclear whether, for example, whether the pattern of positive selection for elite college effects on occupational status would change during a non-recessionary context. Finally, the small sample size and inherent rarity of attending elite colleges resulted in

very few cases with high predicted propensities of attending an elite college and a region of common support that did not extend above about 0.8 for either men or women. I am therefore unable to estimate the effects of elite college attendance for what many people think of as a typical elite college student with excellent high school grades, high socioeconomic background, and exceptional cognitive ability. Someone near the top of the cognitive ability and high school academic performance distributions may be very likely to attend an elite college—particularly when defined somewhat loosely—and thus be outside the region of common support attached to the estimated treatment effects reported above. A further limitation related to the small sample size was that I was unable disaggregate the sample by socioeconomic status and race and ethnicity. Prior studies of elite college effects have suggested that underrepresented minority groups and low income students in particular may benefit from attending elite colleges (Dale and Krueger 2002).

Future analyses of elite college attendance during the Great Recession could take several paths to improve on and expand the findings reported in this chapter, of which finding a suitable data source may be the most difficult. Such a data set would need to either include a large set of precollege covariates to model exposure to elite colleges or include a list of colleges that respondents applied to and were accepted to, in addition to the one they attended. Then, it would need to follow respondents long enough to gather labor market outcomes in at least the early career. Finally, ideally it would be large enough to be able to make comparisons across economic contexts during the late 2000's. The best path may be to look outside of the U.S. context where larger administrative data sets are more readily available. A more comprehensive data set may also provide enough

cases in the high end of the propensity score distribution to make comparisons between treated and control cases throughout the entire population.

Examining the impact of economic context on elite college effects for certain socioeconomic or demographic subgroups is also an important extension of this work that would require additional data. Previous research suggests that those from low socioeconomic backgrounds and underrepresented minority groups may benefit more from elite college attendance than others (Dale and Krueger 2002; Loury and Garman 1995). For example, black workers on average suffered more extreme employment losses during the Great Recession than white workers (Elsby et al. 2010). Under this scenario, steady or increasing returns to elite college attendance for black workers during economic recessions would lead to increasing heterogeneity in black labor market outcomes, with both vertical and horizontal axes of higher education stratifying workers in the labor market.

Despite the limitations listed above, the findings presented in this chapter contribute to the literature on elite college effects by adding a data point in the theoretically interesting context of the Great Recession. For now, there is little empirical evidence to suggest that elite college effects on earnings, employment, and wages increased substantially during the Great Recession after controlling for the propensity to attend an elite college, though replication and further study is necessary. One particularly interesting finding, however, is the apparent pattern of positive selection for occupational status. Though only speculative, contrasting my finding of positive selection with previous findings of negative selection (Brand and Halaby 2006) and other findings that seem consistent with negative selection (Dale and Krueger 2011; 2002; Monks 2000)

may suggest that a recessionary economic context increases the effect of elite college on occupational status most for those with high propensities of attending, similar to the findings presented in Chapter 3 for college completion. However, additional work is needed to answer this empirical question, and it should also be noted that the pattern of positive selection I find is limited to propensity scores under roughly .75. Therefore, the overall pattern of selection could change with better data assuming the overlap assumption can be met on a wider range of propensity scores.

This study is also one of the first to assess elite college effects among "Millennials," those born after 1980 and reaching adulthood in the early 2000's. The labor market that this generation has encountered is one unlike those found in previous surveys. Inequality is higher, with returns to education and skill continuing their increase over the past several decades (Fischer and Hout 2006; Hout 2012; Kaymak 2009). Employment prospects have been unstable (C. J. Goodman and Mance 2011). Meanwhile, elite colleges may be more accessible to students with limited means now that at any time prior as several elite private schools have drastically increased need-based financial aid offerings (Hoxby and Turner 2013). Both high school and college completion rates have risen to all-time highs, with 32 percent of individuals above age 25 having completed a bachelor's degree (NCES 2016). Despite these gains, the gap between high- and low-income students' college enrollment has been stagnant, as has the gap between white and black college completion rates, with whites aged 25-29 still roughly twice as likely to complete college as similarly aged blacks (NCES 2016). In a time of rising educational attainment, reduced job prospects, stagnant or growing inequality, and increasing returns to skill, elite college effects may themselves be

increasing. My findings do not offer strong support of this hypothesis, in line with much of the work on previous generations (Dale and Krueger 2011; 2002), but it is important to track elite college effects among this emerging generation of workers as they advance through their careers.

Appendix

Table 4-1. Odds ratios and standard errors predicting elite college attendance for men and women, NLSY-97.

	Men (n=704)		Women (n=858)	
	OR	**s.e.**	**OR**	**s.e.**
Race[1]				
Black	2.335	(1.71)	2.174*	(.82)
Hispanic	1.152	(.74)	2.577*	(1.10)
Region[2]				
South	.803	(.33)	.364**	(.13)
North Central	.199***	(.09)	.482*	(.16)
West	.115***	(.07)	.381*	(.17)
Live in MSA	1.028	(.41)	1.773	(.66)
Intact family	.917	(.36)	.777	(.22)
Sibship	.985	(.12)	1.078	(.10)
Mother's educ.	.993	(.07)	1.007	(.06)
Father's educ.	1.137†	(.08)	1.257***	(.06)
Log parental income	2.053*	(.59)	1.120	(.28)
College prep	1.702	(.74)	3.926**	(1.74)
Cognitive ability	2.929**	(1.03)	5.146***	(1.61)
HS GPA	5.074***	(2.34)	1.990*	(.67)
Peer college plans	1.005	(.56)	.991	(.01)
Teacher interest	1.865	(1.19)	.759	(.34)

*†p<.10; *p<.05; **p<.01; ***p<.001*

[1] Reference group for race is non-black, non-Hispanic

[2] Reference group for region is Northeast

Table 4-2. Means by gender and elite college attendance: NLSY-97.

	Men		Women	
	Non-elite	**Elite**	**Non-elite**	**Elite**
Propensity score covariates				
Black	.067	.033	.068	.041
Hispanic	.047	.042	.066	.060
North Central	.356	.183	.327	.396
South	.301	.480	.349	.277
West	.101	.059	.167	.126
Live in MSA	.789	.823	.818	.868
Intact family	.703	.839	.651	.815
Sibship	2.492	2.446	2.548	2.632
Mother's educ.	14.276	15.056	13.767	14.651
Father's educ.	14.455	16.026	13.964	15.230
Log parental income	4.081	4.398	3.918	4.257
College prep	.766	.907	.767	.938
Cognitive ability	.706	1.027	.579	.970
HS GPA	3.194	3.469	3.297	3.544
Peer college plans	68.585	74.431	71.444	72.068
Teacher interest	.921	.959	.913	.968
Propensity score	.135	.367	.139	.328
Bachelor's degree	.641	.901	.626	.946
Log earnings	10.344	10.620	9.684	10.357
Weeks Worked	48.479	48.595	43.601	47.800
Hours Worked	2165.12	2321.97	1768.51	1993.02
Log Hourly Wages	2.880	3.107	2.832	2.936
Occupational Status	36.572	44.479	35.869	42.376

Table 4-3. Estimated treatment effects of men's elite college attendance and HLM level-2 slopes: NLSY-97.

	TT	TUT	HLM
Bachelor's Degree	.058	.056	.069
	(.05)	(.11)	(.34)
Logged Income	.286	.129	-.198
	(.25)	(.30)	(.51)
Weeks Worked	-.153	-.125	-4.390†
	(1.91)	(2.34)	(2.64)
Hours Worked	173.66	98.75	-103.01
	(109.2)	(168.2)	(500.8)
Logged Wages	.108	.025	.122
	(.08)	(.12)	(.39)
Occupational Status	5.034*	4.078	1.951
	(2.41)	(3.87)	(11.99)

*† p<.10; *p<.05; **p<.01; ***p<.001*

Table 4-4. Estimated treatment effects of women's elite college attendance and HLM level-2 slopes: NLSY-97.

	TT	TUT	HLM
Bachelor's Degree	.211***	.330***	-.987***
	(.06)	(.09)	(.02)
Logged Income	.917**	.271	-.055
	(.33)	(.52)	(.62)
Weeks Worked	4.976*	5.572	-10.898*
	(2.48)	(3.39)	(5.19)
Hours Worked	227.30	-31.70	562.62
	(140.0)	(226.1)	(523.9)
Logged Wages	.042	-.003	-.076
	(.09)	(.11)	(.79)
Occupational Status	6.122**	6.410†	23.557*
	(2.35)	(3.69)	(9.22)

*† p<.10; *p<.05; **p<.01; ***p<.001*

Figure 4-1. Elite College Effects on Men's Bachelor's Degree Attainment: NLSY-97

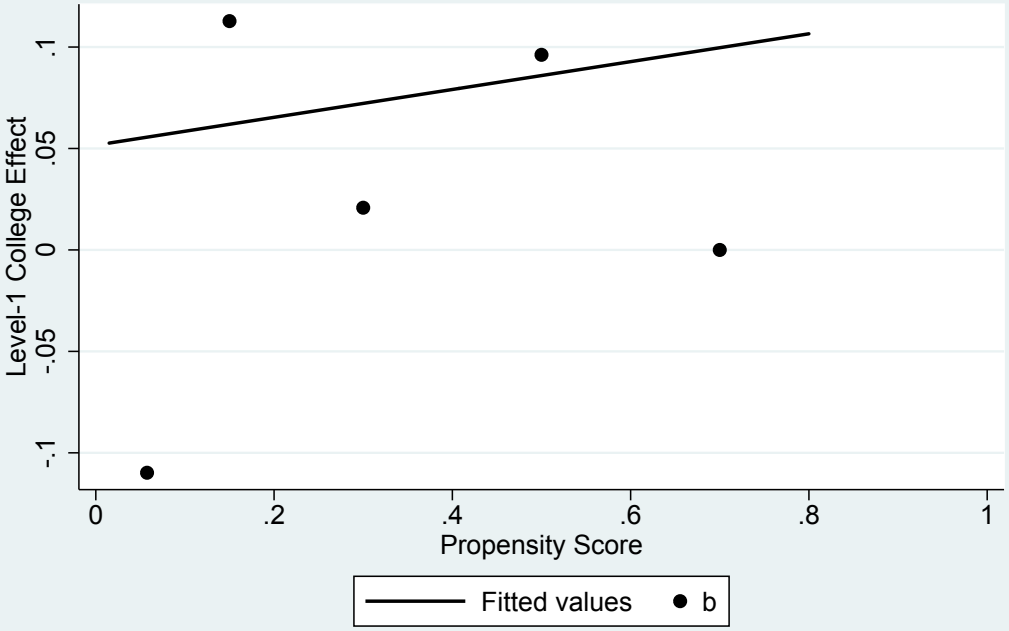


Figure 4-2. Elite College Effects on Men's Logged Earnings: NLSY-97

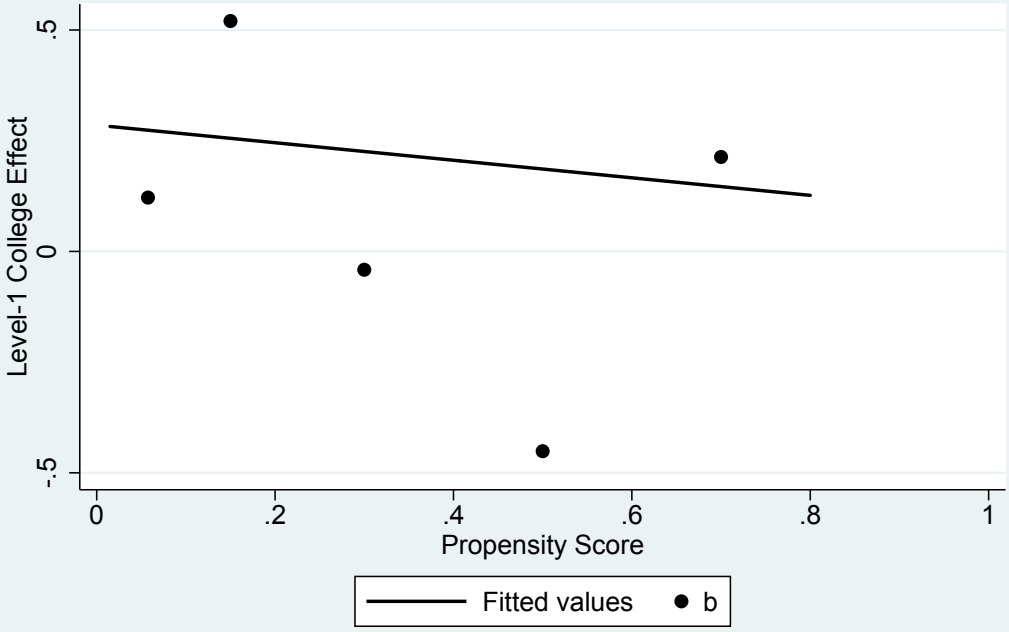


Figure 4-3. Elite College Effects on Men's Weeks Worked: NLSY-97

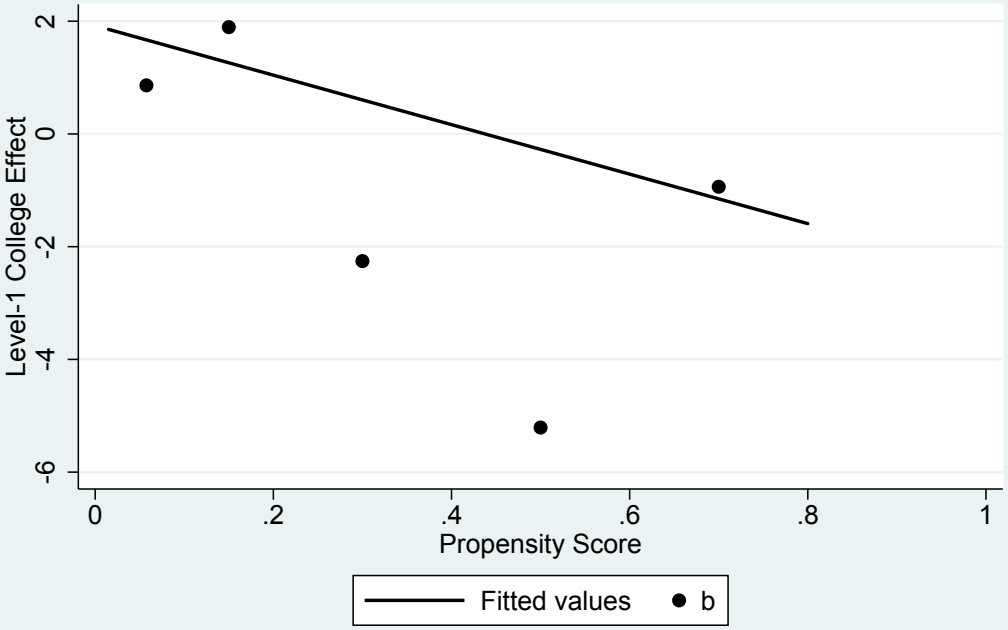


Figure 4-4. Elite College Effects on Men's Hours Worked: NLSY-97

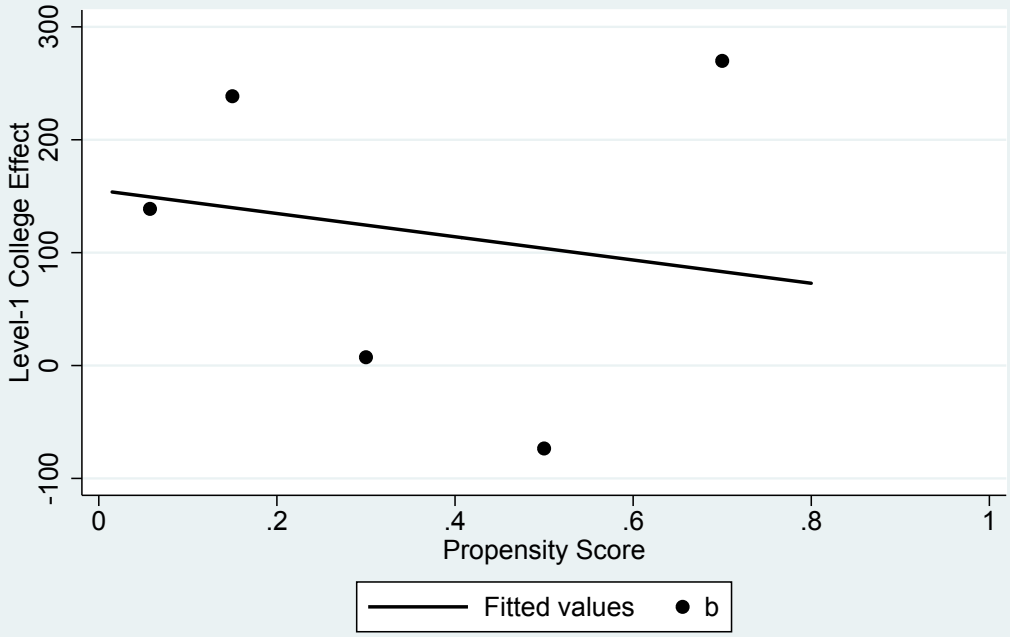


Figure 4-5. Elite College Effects on Men's Logged Hourly Wages: NLSY-97

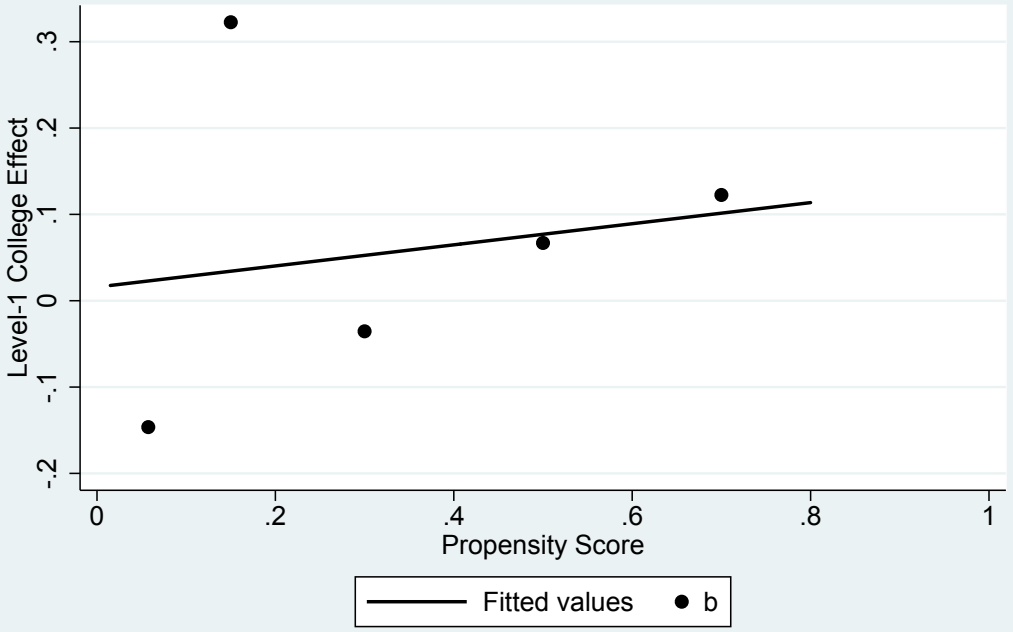


Figure 4-6. Elite College Effects on Men's Occupational Status: NLSY-97

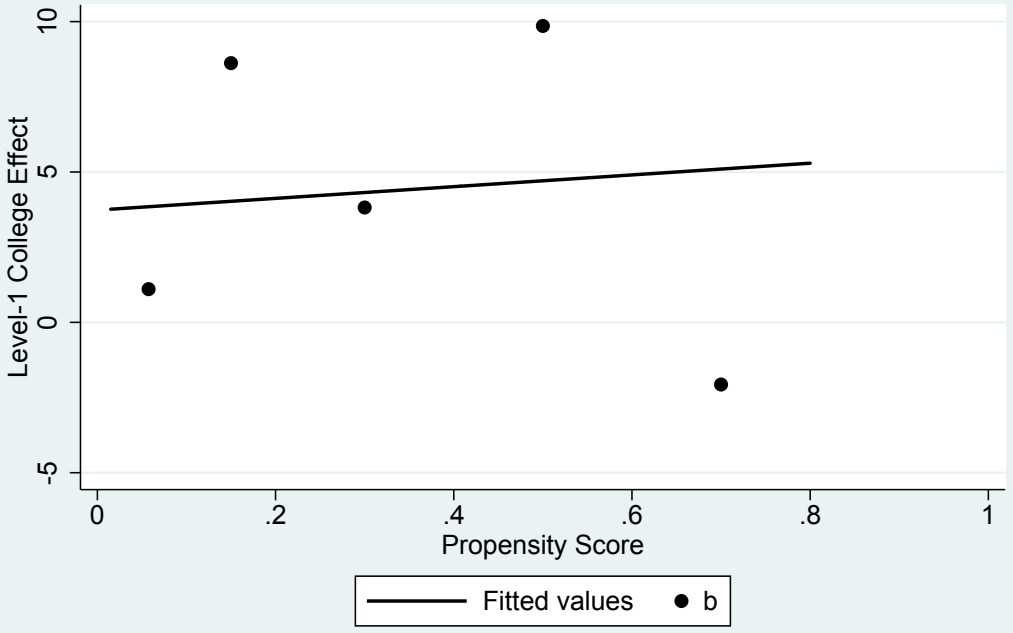


Figure 4-7. Elite College Effects on Women's Bachelor's Degree Attainment: NLSY-97

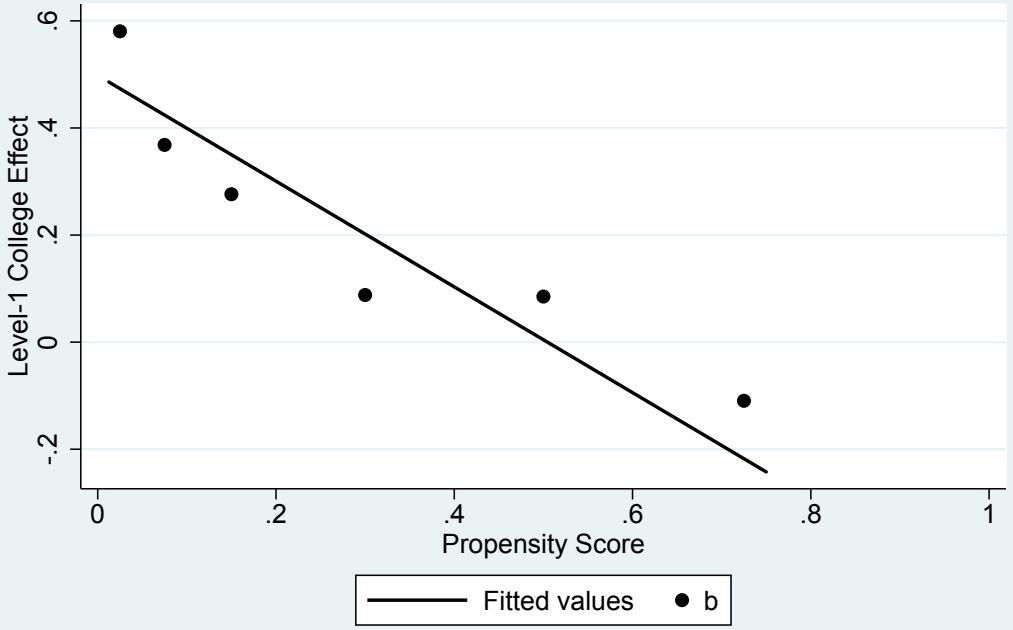


Figure 4-8. Elite College Effects on Women's Logged Earnings: NLSY-97

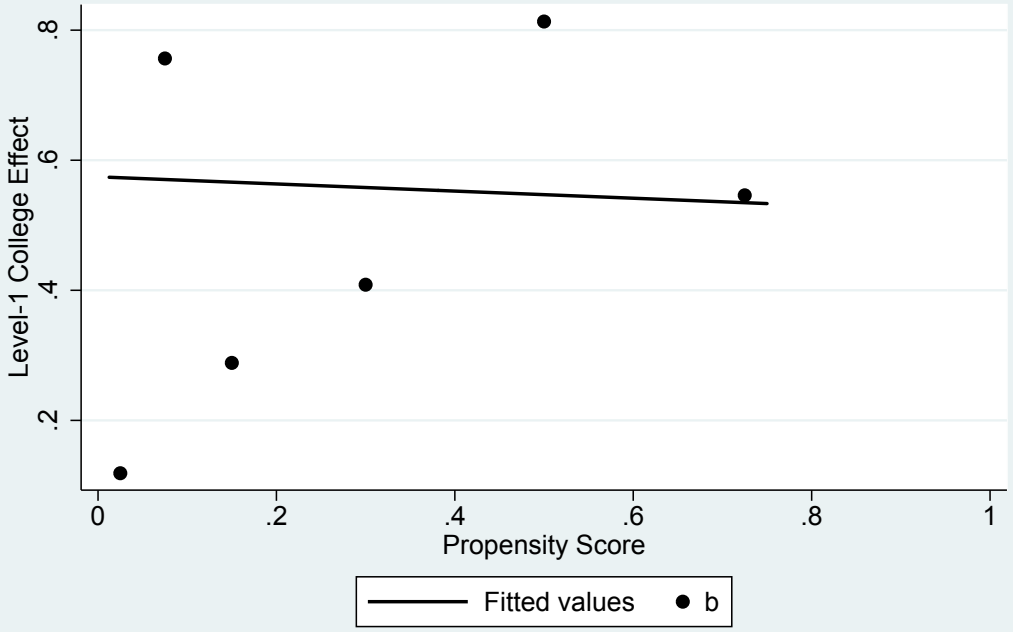


Figure 4-9. Elite College Effects on Women's Weeks Worked: NLSY-97

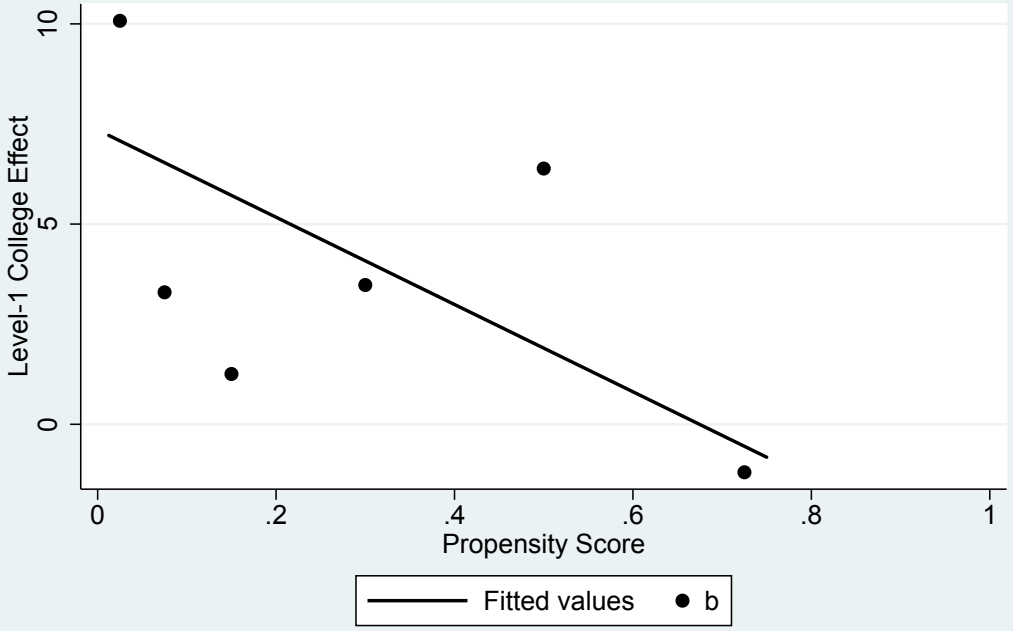


Figure 4-10. Elite College Effects on Women's Hours Worked: NLSY-97

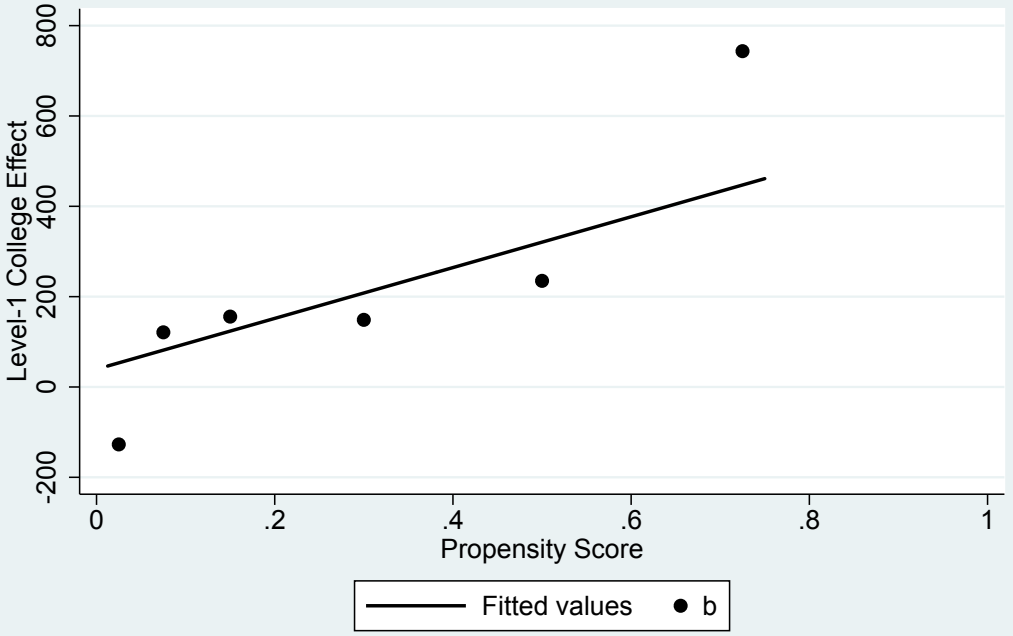


Figure 4-11. Elite College Effects on Women's Logged Hourly Wages: NLSY-97

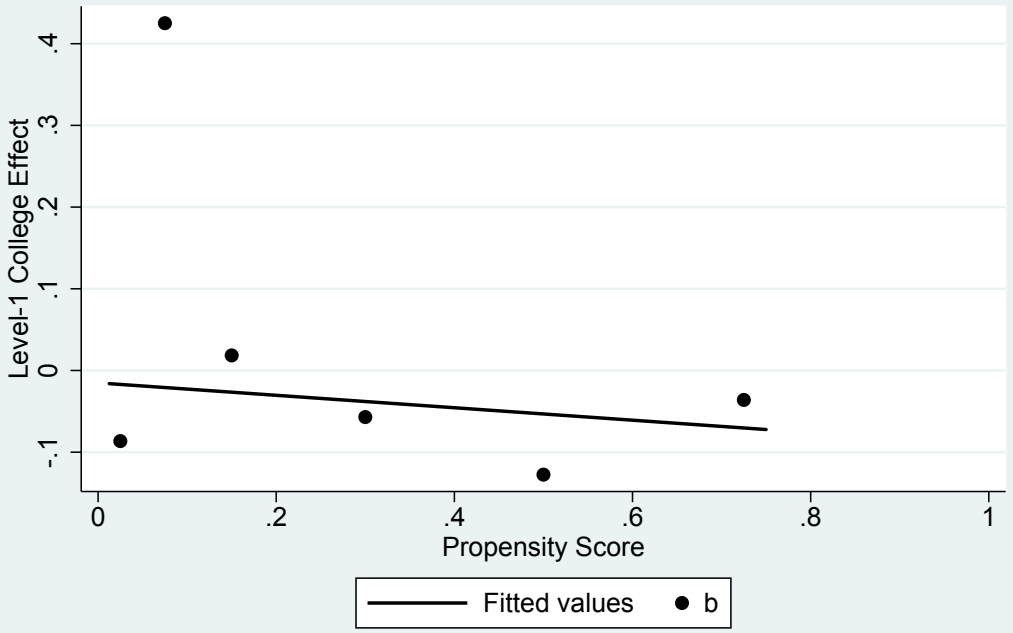
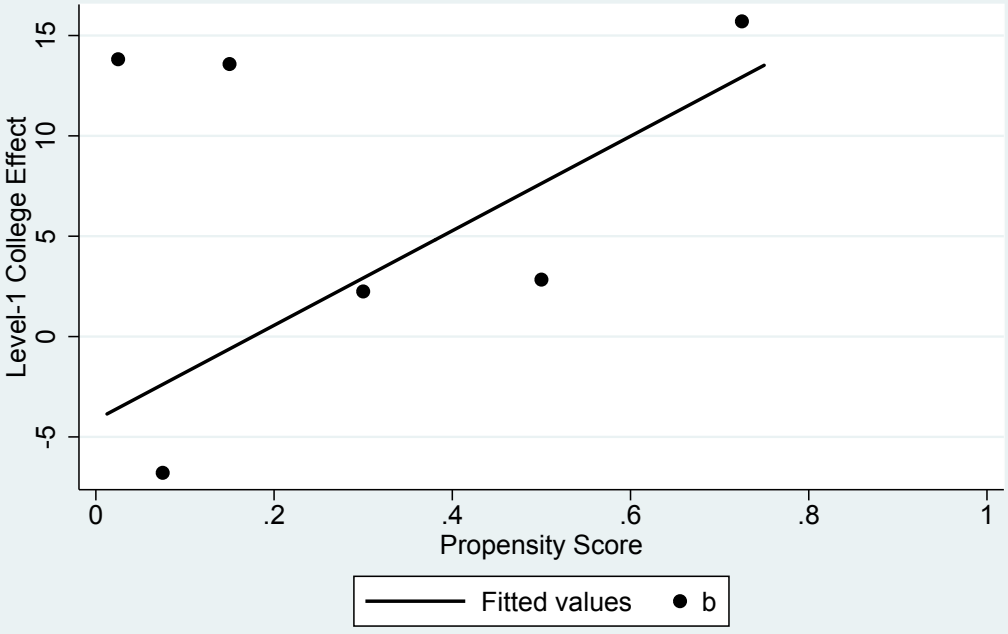


Figure 4-12. Elite College Effects on Women's Occupational Status: NLSY-97



CHAPTER 5: CONCLUSION

This dissertation focused on assessing the effects of higher education in the context of the Great Recession. Prior analyses of U.S. Census data following the recession showed that its negative consequences were spread unevenly throughout the population. In particular, educated workers seemed to "weather the storm" the best (Carnevale, Jayasundera, and Cheah 2012). Although individuals at every educational level suffered losses in employment, those with college degrees experienced a much smaller decline and recovered to pre-recession levels faster than those with less education (Carnevale et al. 2012; Elsby, Hobijn, and Sahin 2010; Hout, Levanon, and Burak 2011; Hoynes, Miller, and Schaller 2012). The positive correlations between educational attainment and labor market outcomes, such as employment and earnings, increased during the Great Recession. What remained unclear was whether this increasing correlation was due to a change in the nature of the causal relationship between education and labor market outcomes, or whether those who were likely to obtain more education were also likely to emerge from recessions relatively unharmed due to preexisting traits. To control for non-random selection into either college or elite colleges, I used a combination of methods that rely on estimating the propensity to receive a treatment before assessing the effect of that treatment. To estimate the propensity to undergo the treatment, I used a logistic regression to regress the treatment (either college completion or elite college attendance) on a set of previously validated measures of demographic and socioeconomic background, cognitive ability, prior academic achievement, high school academic experiences, and peer effects. Once the propensity score was estimated, I used

(1) propensity score matching and (2) a multi-level hierarchical linear model to assess average treatment effects and the potential heterogeneity of average treatment effects across the propensity score distribution. I conducted these analyses during the high-unemployment context of the Great Recession to assess the effects of both college completion and elite college attendance on five labor market outcomes during a recessionary context. In Chapter 3, I also compared estimates of college completion effects during expansionary contexts to college completion effects during recessionary contexts.

My findings suggest that during the high-unemployment contexts such as the Great Recession, college completion had positive effects on early- and late-career workers' earnings, employment, and job quality. By contrast, I do not find strong evidence to suggest consistent positive effects of elite college attendance on early career workers' labor market outcomes during the Great Recession. These analyses also revealed that the higher education effects that existed during the Great Recession were often heterogeneous. Individuals with different characteristics—birth cohort, gender, and the propensity to receive the given treatment—benefitted to different degrees from educational treatments during recessionary contexts. Furthermore, these patterns of heterogeneity often played out differently for measures of employment than measures of job quality.

One of the unsurprising findings from Chapter 2 was that, as suggested by zero order correlations between educational attainment and labor market outcomes during the Great Recession (Carnevale et al. 2012), college graduates maintain advantages in labor market outcomes during economic recessions precisely because they completed college.

Differences in observable characteristics that predate college entry, such as cognitive ability and demographic and socioeconomic background, are unable to fully account for the advantages in the labor market that college graduates enjoy relative to non-college graduates. Furthermore, the effects of college were heterogeneous during the Great Recession. Propensity score matching and hierarchical linear models supported earlier findings of negative selection (Brand and Xie 2010) for earnings and employment. That is, during the Great Recession, those who were least likely to complete college benefitted the most from it in terms of employment and earnings. For those who were employed, there was not a strong pattern of negative selection for the effects of college on logged hourly wages and occupational status, both of which measure job quality. Instead, there were either inconclusive results or evidence for positive selection. This suggests that during the Great Recession, the most disadvantaged college graduates may outperform otherwise similar high school graduates in terms of employment, but that conditional on employment, only more advantaged college graduates are able to parlay their degrees into better jobs. Thus, college provides different benefits to advantaged and disadvantaged workers during recessionary economic contexts.

During the Great Recession, there were also differences in the effects of college between early-career and late-career cohorts. The effects of college on employment and earnings during the Great Recession appeared to be stronger for early-career workers than late-career workers. Both cohorts experienced similar positive effects of college on job quality measures—logged hourly wages and occupational status. This is consistent with previous analyses of the career, which have found that the first ten years of work experience are the least stable, contain the most wage growth, and the most movement of

workers between firms (Topel and Ward 1988). This relative lack of stability during the early career seems to increase the vulnerability of young non-college graduates to recessions in particular. Spells of joblessness have had negative long-term consequences on the subsequent earnings and career stability for previous cohorts of workers (Gangl 2004; 2006; Gregg and Tominey 2005; Manzoni and Mooi-Reci 2011). Both the stigma attached to spells of joblessness and forgone human capital increases may lead to scarring effects of unemployment spells (Gregg and Tominey 2005; Jacobson, LaLonde, and Sullivan 1993; Stevens 1997). While younger workers may be more likely to experience spells of joblessness, such disruptions may be more consequential for those older workers who experience them (Manzoni and Mooi-Reci 2011). My findings suggest that younger workers are more likely to experience disruptions in their careers due to shocks such as the Great Recession. While these disruptions are likely to lead to further spells of joblessness and reduced wages and earnings many years into the future (Gangl 2006; Gregg and Tominey 2005; Jacobson et al. 1993; Kahn 2010; Oreopoulos, Wachter, and Heisz 2012; Stevens 1997), the negative long-term consequences of spells of joblessness may be strongest for workers already in later career stages.

In addition to differences by cohort, there were also some important gender differences in college effects during the Great Recession. Both early-career and late-career women seemed to experience stronger positive effects of college on earnings and employment, particularly among the untreated group. Conditional on employment, college provided benefits of similar magnitudes to men's and women's wages and occupational status. During the recession college was more predictive of women's employment than it was of men's employment after controlling for the propensity to

complete college based on observable precollege characteristics. Young women's and girls' employment aspirations and expectations are positively correlated with their future college completion rates (Goldin, Katz, and Kuziemko 2006). College, in turn, increases women's chances of employment (van Putten, Dykstra, and Schippers 2008) and delays women's first marriages and first children (Rindfuss, Morgan, and Offutt 1996), all of which may increase earnings. My results suggest that previously observed increased college earnings premiums for women (Jacob 2002) seemed to persist during the Great Recession.

EARLY CAREER COLLEGE EFFECTS ACROSS ECONOMIC CONTEXTS

While Chapter 2 focused on patterns of college effects at a static point during the Great Recession, Chapter 3 investigated how those effects may have shifted in response to the recession for young workers. Previous work has suggested that early career workers experience more dynamism and disruptions than older workers, and that recessions may have exacerbated these age effects (Elsby et al. 2010; Gregg and Tominey 2005; Manzoni and Mooi-Reci 2011). By holding age constant while allowing economic context to vary by taking advantage of the geographical distribution and multi-year age cohort in the NLSY-97, I was able to compare estimated treatment effects of college during expansionary contexts to college effects during recessionary contexts. Similar to previous economic studies (Kahn 2010), I used state unemployment rates to measure economic context.

I argue that college effects on labor market outcomes for early career workers respond to changes in economic context. However, during recessions, these effects do not

change uniformly across the population or across specific outcomes, such as earnings, employment, or job quality. Instead, the estimated treatment effects of college increase during recessions for some while decreasing for others, depending on the outcome being analyzed. My findings are largely consistent with hypotheses derived from the job competition model (Devereux 2003; Klein 2015; Thurow 1975), which relies on the labor queue to explain allocations of employment and wages. Job competition predicts that during recessions there is occupational downgrading and crowding out (Devereux 2003; Klein 2015). Those at the top of the labor queue, who are most desirable to employers, may experience occupational downgrading during recessionary contexts as the supply of open jobs shrinks relative to the pool of available workers (Devereux 2004). Crowding out occurs further down the labor queue, as relatively advantaged workers displace those below them in the labor queue from the jobs they would have occupied during more expansionary contexts (Klein 2015). These less educated individuals whom employers prefer the least may then be crowded out from the labor market altogether and experience longer spells of unemployment or less stable employment arrangements (Klein 2015).

Results from propensity score matching and hierarchical linear models largely support these hypotheses for early career workers from the NLSY-97. Among those with high propensities to complete college based on precollege characteristics, living in a recessionary context at age 26 was associated with increased effects of college on measures of job quality (i.e., logged hourly wages and occupational status). This provides evidence for occupational downgrading during recessions for those near the top of the labor queue. Roughly speaking, the most advantaged members of the labor force benefit from college during recessions by being able to hold on to high quality jobs even as their

less educated peers tend to experience drops in job quality. However, among this advantaged population, the effect of college on employment measures did not increase during recessions. The opposite pattern occurred for more disadvantaged individuals with low propensities of completing college. For these workers, the recession brought on increased returns to college in terms of employment and earnings, but a decline in the effects of college on wages and occupational status conditional on employment. Together, these changing patterns of college effects across economic context lead to opposing patterns of heterogeneous effects during expansions and recessions. During recessions, the selection pattern of treatment effects of college on employment measures became more negative (Brand and Xie 2010), with the largest benefits of college accruing to individuals least likely to receive the treatment. By contrast, heterogeneous treatment effects of college on job quality conditional on employment became more positive during recessions. Thus, the benefits of college changed for both low- and high-propensity college graduates during recessions, but did so in opposite directions.

These findings contribute to the literature on stratification and the effects of economic recessions by building on previous work that has recognized the uneven effects of recessions and of education on socioeconomic outcomes for individuals with different backgrounds (Brand and Xie 2010; Hoynes et al. 2012). Previous work on effects of the business cycle have shown that the negative consequences of recessions are felt most strongly by those with little education and those from historically disadvantaged socio-demographic groups (Carnevale et al. 2012; Elsby et al. 2010; Hout et al. 2011; Hoynes 1999). Work on the effects of education has also shown heterogeneous effects, with those from disadvantaged backgrounds tending to benefit more from educational attainment

(Brand and Xie 2010; Brand, Pfeffer, and Goldrick-Rab 2014). The results presented here show how these two phenomena interact to create differing patterns of heterogeneous effects of education for early career workers depending on the economic context in which they occur.

My analyses suggest that these general patterns held for both early career men and early career women. However, consistent with prior research suggesting men's employment to be more cyclical than women's employment, these patterns seemed stronger among the male subsample of the NLSY-97 than the female subsample (Elsby et al. 2010; Hoynes et al. 2012). Non-college educated men seemed to experience the most adverse effects of recessions relative to their more educated counterparts. These differing gender effects are most likely due to the previously reported differences in job losses according to sector and the gender and educational occupational segregation which results in less educated men being much more likely to fill jobs in construction and manufacturing, two of the most cyclical sectors (Hoynes et al. 2012).

While this study only speaks directly to the immediate impact of economic downturns on college effects, research on scarring effects of jobless spells and of recessions in general suggests there may be long-term changes in stratification outcomes for the cohorts exposed to the Great Recession (Gangl 2006; Kahn 2010; Manzoni and Mooi-Reci 2011; Mooi-Reci and Ganzeboom 2015; Oreopoulos et al. 2012). Human capital deficits and negative stigma attached to those adversely affected by the recession, as well as search frictions, may perpetuate the initial disadvantages that low-propensity non-college graduates in particular have experienced during the Great Recession. Further

research on these populations as the economic context improves is necessary to see whether the uneven effects of recessions continue through the life course.

ELITE COLLEGE EFFECTS DURING THE GREAT RECESSION

One of the fundamental arguments of job competition theory is that when an oversupply of workers exists relative to the number of open positions, employers become more discriminating (Thurow 1975). They are able to take advantage of this demand for employment and fill jobs with supposedly higher quality applicants than they would normally be able to (Devereux 2003). Previous work on elite college effects has shown inconsistent effects on labor market outcomes (Dale and Krueger 2011; Eide, Brewer, and Ehrenberg 1998; Long 2010; Rumberger and Thomas 1993). I hypothesized that, due to the increase in the supply of workers during the Great Recession, employers would use horizontal differences in education, such as college quality, in addition to differences in educational attainment to stratify potential employees. This would lead to positive effects of elite college attendance on labor market outcomes, particularly job quality. This hypothesis was informed by the job competition model and signaling theory (Rivera 2012; Spence 1973), which suggests that employers, who lack perfect information about the productive potential of job applicants to their firms, may use applicants' education as a proxy for pre-existing traits they find desirable, such as cognitive ability or an advantaged class background.

The results of my analyses of elite college attendance effects during the Great Recession provide some tepid support for these hypotheses, though I caution against drawing strong conclusions without additional empirical evidence. I found null effects of

elite college attendance on men's earnings, employment, and wages. However, employed men who attended elite colleges occupied higher status occupations than employed men who attended non-elite colleges. This finding is in line with the hypothesis that elite college attendance would provide benefits to job quality during times of economic downturn. On the other hand, the weak linear trend in the HLM and the null results for wages do not provide support for the hypothesis that elite college increases job quality during recessions for those at the top of the labor queue.

For early career women, elite college attendance also positively affected occupational status for the treated group. Although the average treatment effects for the treated and untreated on occupational status were similar, the significant positive level-2 slope in the HLM provides some evidence for positive selection, where those most likely to attend elite colleges saw the greatest benefit from them in terms of occupational status. Again, these results should be interpreted cautiously, though they are somewhat in agreement with the results for men and the hypothesis for job quality. Again though, null results for wages do not support the hypothesis of elite college attendance providing job quality benefits during the Great Recession.

My findings from this final empirical chapter contribute to the literature on elite college effects by adding another data point to estimates of elite college attendance effects. I chose to analyze elite college effects during the Great Recession specifically because high-unemployment contexts may increase the salience of elite college effects as employers look for ways to further differentiate among a set of highly qualified applicants (Devereux 2003). While there was some evidence to support hypotheses of elite college attendance improving job quality after controlling for the propensity to

undergo the treatment among high-propensity individuals, I was not able to draw particularly strong conclusions regarding the elite college effects during the Great Recession for young workers. Further analyses are required to better understand if and how attending different educational institutions affects returns to education during different economic contexts.

LIMITATIONS AND FUTURE RESEARCH

This dissertation is among the first to attempt to control for selection bias while assessing the heterogeneous relationship between education, individual labor market outcomes, and the economic context in which that relationship occurs. It is also among the first to investigate education effects for "Millennials," the generation that came of age during the Great Recession. The data requirements for conducting these analyses were somewhat onerous, and thus limiting. The data source had to be timed correctly, capturing labor market outcomes at a critical age period of the early career before and during the Great Recession. It also needed to include a set of precollege characteristics to account for selection bias, of which the most important was cognitive ability. It also needed to subsequently collect educational and labor market outcome variables. Finally, the methodology employed to assess effect heterogeneity across individuals did not allow for the inclusion of those with missing data unlike some previous studies with relatively small samples that imputed average values while including indicators of missingness (Black and Smith 2004). This is because the HLM required that all covariates used in the propensity score estimation be matched in each of the propensity score strata.

All of these requirements ruled out many data sources and resulted in relatively small sample sizes. These small sample sizes were most problematic in Chapter 4's analysis of elite college effects. Because of the inherent rarity of attending elite colleges and the relatively small sample size, I was not able to estimate average treatment effects at high propensity scores because no control cases (and very few treated cases) existed with estimated propensity scores above roughly 0.8. I was also unable to compare estimated elite college effects across economic context because the sample sizes were simply too low to further divide the sample. Larger samples would have also improved the precision of estimated effects in Chapters 2 and 3 as well, though they would have been particularly useful in Chapter 3 when I compared college effects across economic contexts. Because I divided the sample by gender and according to the economic context that respondents experienced at age 26, the matching samples in Chapter 3 tended to number under 300. Future analyses would benefit from larger sample sizes or perhaps from administrative records that would counteract attrition due to missingness on outcome variables.

Another important set of questions that this dissertation leaves unanswered has to do with the transition from recession to expansion or recovery. My analyses examined the effects of higher education during the Great Recession. When I did offer comparisons across economic contexts, I did so mainly to the pre-recession expansionary context. However, as Carnevale et al. (2012) note, the post-recession recovery proceeded at vastly different speeds depending on individuals' educational attainment. Furthermore, the set of studies on the scarring effects of recessions (Genda, Kondo, and Ohta 2010; Kahn 2010; Oreopoulos et al. 2012) suggest that workers carry recessionary effects with them

forward through their careers. An analysis that looks forward from the recession into the recovery while simultaneously attempting to control for selection into higher education is still needed before we can fully understand the protective effect that higher education can play to counteract the negative consequences of economic shocks.

Finally, the analyses presented here might be expanded upon by considering how recessions may impact other treatments, such as secondary education completion, or other outcomes, such as marriage and fertility, residential patterns, or physical or mental health. Prior sociological work has identified links between education and these various non-economic outcomes, yet their relationships across economic contexts remain understudied. Given the wide-reaching effects of economic shocks like the Great Recession, understanding the complex and heterogeneous ways in which those effects play out is important as sociologists attempt to characterize how structural forces interact with individual-level characteristics to produce stratification within society.

METHODOLOGICAL APPENDIX

Propensity Score Estimation

I feature constructs from the Wisconsin model of status attainment (Sewell, Haller, and Ohlendorf 1970; Sewell, Haller, and Portes 1969) prominently in my model of college completion and elite college completion. These include measures of socioeconomic background, mental ability, educational aspirations, significant others' influence, and academic performance, all of which act as mechanisms in the intergenerational transfer of status. I measure socioeconomic background similar to Sewell et al. (1969), including measures of household income, mother's and father's highest grade completed, and household head's occupational status. Household income is measured at baseline, and does not include income which the adolescent respondent earns. To measure occupational status of the head of household, I used the highest parent's score on Hauser and Warren's (1997) SEI. In most cases this corresponds to the respondent's father's occupation, but for respondent's who did not provide occupational information about their fathers or had mothers with high occupational statuses than their father's, mother's occupational status was used.

While socioeconomic background has direct effects on educational attainment, it also affects educational attainment indirectly through socialization processes that occur in the family and at school (Bozick et al. 2010). Some of these factors include cognitive ability, academic performance, significant others' influence, and educational expectations. Measures of cognitive ability are predictive of both educational attainment and socioeconomic destinations, though by no means is it the sole factor in determining these outcomes (Cawley et al. 1996; Cawley, Heckman, and Vytlacil 2001; Heckman,

Stixrud, and Urzua 2006; Sewell and Shah 1967). Furthermore, while cognitive ability can affect educational attainment, schooling also positively affects measured cognitive ability, by as much as 2-4 points per year (Hansen, Heckman, and Mullen 2004; Winship and Korneman 1997). Therefore, to accurately assess causal treatment effects, it is necessary to accurately measure cognitive ability before treatment assignment. As such, I measure cognitive ability using scores from the Armed Services Vocational Aptitude Battery (ASVAB) which was administered while respondents were still in high school, before they were assigned to treatment or control groups. To calculate a single score for cognitive ability, I first regress each subtest score on age separately by race and gender, and calculate the standardized residual for each test (12 residuals per respondent—one for each subject). These standardized residuals have a mean of zero and standard deviation of one. I then combine the twelve residuals into a single composite score, weighting the residual for each subtest equally (Cawley et al. 1996).

Non-cognitive ability is measured in the NLSY-79 using the Rotter Locus of Control Scale. Recent work has found that non-cognitive abilities, such as motivation and perseverance, have important effects that augment those of cognitive ability (Heckman, Stixrud, and Urzua 2006). In the NLSY-97, respondents were not given a similar non-cognitive test. However, I do have high school transcript data for a large portion of the NLSY-97 sample, and use high school GPA in part to control for non-cognitive skills. High academic achievement requires cognitive ability, but also attention to deadlines, perseverance, and self-control. In fact, high school GPA is more indicative of self-control than of intelligence, per se (Duckworth, Quinn, & Tsukayama, 2012).

One limitation, especially with regard to the NLSY-97 data, is that these surveys may not contain the best measures of non-cognitive skills. Even the Rotter scale in the NLSY-79 was not predictive of college completion in the propensity score estimation logistic regression. As such, it will be difficult to offer any strong conclusions regarding the efficacy of non-cognitive skills for estimating propensity to complete college or attend elite colleges. However, particularly for the NLSY-97, the addition of high school grades in addition to many of the other covariates that also correlate with both non-cognitive skills and college completion, such as educational expectations, will also help to alleviate concerns over omitted variable bias with respect to non-cognitive skills.

Another factor in the Wisconsin Model that mediates social origins and destinations is educational expectations. Including measures of the stability and persistence of aspirations and expectations would be ideal because educational expectations that are stable and held for longer periods of time are most predictive of educational attainment (Bozick et al. 2010), but the NLSY only contains a cross-sectional measure of educational expectations. Still, past studies have found that even a single measure of educational expectations during secondary school is still a significant predictor of later educational attainment (Sewell et al. 1969; Sewell and Shah 1968). In the NLSY-79, I use a dichotomous variable for whether the respondent expected to complete college when s/he was 17 years old. Respondent's estimates of their peer's educational plans were measured similarly. In the NLSY-97, educational expectations were not measured for 60 percent of the sample. At baseline, only respondents of high school age at the time (those born 1980-81, but not 1982-84) were asked to estimate the

percentage chance that they and their peers would complete college. I was thus unable to include educational expectations in the propensity score model for the NLSY-97.

The influence of teachers, parents, and peers—what Sewell et al. (1969) term "significant others"—is also central to the Wisconsin model of status attainment. Here, teachers' and parents' encouragement and peers' educational plans all affect educational attainment directly as well as indirectly through educational aspirations; Sewell et al. (1969) suggest that students base their own aspirations and expectations off of the expectations of those around them, but also find that even net of others' expectations, students with high aspirations attain more education than those with low aspirations. In the NLSY-79, significant others' influence is measured using a dichotomous measure of whether the respondents' friends plan to complete college, similar to Brand and Xie (Brand & Xie, 2010). In the NLSY-97, I also include a measure of peers' college plans, though the question is slightly different on the NLSY-97 survey. Instead of asking about a specific friend's educational expectations, the NLSY-97 asks for the perceived percentage of the respondent's peers who will completed college. The NLSY-97 also includes a measure of the respondent's perception of his/her teacher's influence. Respondents were asked whether they felt their teachers were interested in respondents' success.

School experiences during secondary school have also been found to predict college completion. One important measure is whether the respondent is in the college prep track, and therefore has a chance to qualify for entrance into a university. As such, I include a dummy variable for college prep courses. The other variables that should capture some of the respondent's experience in high school are peers' educational

expectations and high school GPA and teachers' influence, which were only available for the NLSY-97 sample.

I also include a wide range of demographic background characteristics in the propensity score estimations. Regional variation in college attendance has been shown in previous work (Stephan, Rosenbaum, & Person, 2009), with those from the Southern or Western regions often being less likely to attend college compared to those from the Northeast or Midwest. Living in urban versus rural areas has also been previously validated as a predictor of higher educational attendance and completion, as it may also be used as a proxy for accessibility of college, which has been shown to increase the chances of attending college, particularly for lower-SES students and racial minorities (Ainsworth, 2002; Turley, 2009). Additionally, sibship size and family structure are both associated with educational attainment. Growing up in a household with many siblings may contribute to resource dilution, since parental attention and economic resources may be spread thin over several children (Downey, 1995). Alternatively, the relationship may be spurious, with other factors such as family socioeconomic status or genetic factors influencing both sibship size and children's educational attainment (Guo and Van Wey 1999). Still, there is widespread consensus of a negative statistical correlation between sibship size and educational attainment. Students who live in households with both of their parents also have better educational outcomes than those who live in single-parent households (Sandefur & Wells, 1999). To measure whether the student lives in an intact family, I include a dummy variable for whether the respondent lives with both his/her biological parents.

In the course of choosing which variables to use in the logistic regression equation, I attempted to balance including the necessary measures and accounting for as much variation in the treatment as possible while also preserving as much of the sample as I could. The methodology I use, specifically the HLM, requires that each covariate be balanced within each propensity score stratum, meaning that the values of each explanatory variable of the treated and control cases must not be significantly different at the p=.01. Furthermore, since in Chapter 3 I divide the sample into recessionary and expansionary contexts and in all chapters I analyze men and women separately, some strata are quite small. Together, this means that adding covariates to the propensity score estimation makes meeting this balancing requirement exponentially more difficult. Some analyses that have used propensity scores but not also used an HLM have tried to get around missing data by setting the values of missing variables to zeroes or means and including a dummy variable for missingness (Black & Smith, 2004). This procedure would make meeting the balancing requirement effectively impossible for my sample.

[INSERT TABLE 6-1 HERE]

To show some of the variables I did not include, I present some auxiliary analyses below. I show two logistic regressions used to predict the propensity score for the male subsample of the NLSY-97. Column 1 in Table 6-1 shows a logistic regression using the same variables I used in Chapter 3 of the dissertation, and Column 2 adds mother's age at respondent's birth, whether the respondent's high school offer calculus, a dummy for whether the respondent was Jewish at age 17, and whether the respondent attended a public high school as covariates. The samples in both tables are restricted to the 758 cases that were not missing on any of the covariates in Column 2, though the original sample

for Column 1 was 869 cases. This means that including those additional covariates caused a loss of 111 cases. Comparing the BIC' score for each model, which measures model fit, we see a smaller (more negative) score for Model 1. The difference in BIC' of 22.09 suggests very strong evidence to prefer Model 1 over Model 2. Additionally, of the 758 cases in this sample, over 95 percent of respondents had predicted propensity scores from the two models that were within five percent of each other. The median difference in propensity score using the two different propensity score estimation equations was .008, less than one percent. This, combined with the advantages of additional sample size and allowing for the balancing property to more easily be met, led me to choose the covariates presented in the body of the dissertation over some of the other potential candidates.

Residential mobility and exposure to recession across levels of educational attainment

One of the primary concerns expressed in the limitations section of Chapter 3 was whether exposure to economic context and returns to college completion could both be correlated with some unobserved factor, such as industriousness. If, for example, the most industrious college educated workers move to expansionary areas during recessions, they might artificially increase returns to college in expansionary areas and decrease returns to college in recessionary areas. For this to hold, however, a similar phenomenon among non-college educated workers could not be taking place simultaneously. That is, if the most industrious non-college workers also moved to areas where finding employment was easier, they would cancel out any effect of the industrious college-educated workers

moving. In Chapter 3, I presented some evidence that this was not the case by showing that using the national unemployment rate instead of state unemployment rates yielded similar, though more blunted, patterns of effects, with the negative pattern of selection being exacerbated for the effect of college on employment during recession, and trending positive for college's effect on job quality.

Here, I provide additional analyses using the respondent's state at Wave 1 of the NLSY-97 and year of birth. In her study, Kahn (2010) also used this methodology to overcome a similar problem of non-random exposure to recessionary contexts. In Wave 1, respondents were between the ages of 12 and 17, and were thus unlikely to be choosing their states of residence on their own. Therefore, whether their state experienced a recessionary context at age 26 is no longer under any control of the individual respondent.

There was very little movement of respondents from recessionary to expansionary contexts between adolescence and age 26, suggesting that residential mobility is not a major confounding factor for this analysis. This may in part be due to measuring economic context with large categories such that every state with greater than a 6.6 percent unemployment rate in a given year was classified as a recessionary context, and every state under 5.0 percent was classified as an expansionary context. This may also be due to the severity and expansiveness of the Great Recession—birth year was a stronger predictor than state of birth as to whether a respondent experienced a recession at age 26. Of the 869 men in the NLSY-97 sample, only 21 (9 college graduates; 12 non-college graduates; 2.4% overall) would have been in a worse economic context (as defined in the dissertation in three broad groups) at age 26 had they stayed in the same state they were

in in 1997. Twenty-five men (9 college graduates; 16 non-college graduates; 2.9% overall) actually moved to worse contexts over the same time period. The vast majority of respondents experienced the same economic contexts at age 26 as they would have if no residential mobility were allowed between 1997 and the year in which respondents turned 26. Thus, I do not expect differential rates of residential mobility to be highly correlated with an omitted factor that causes large changes in the estimated effects of college on individual labor market outcomes.

Figures 6-1 through 6-5, which are shown in the appendix at the end of this section, show very similar patterns of college effects across the propensity score distribution for expansionary and recessionary contexts. Just as was reported in Chapter 3 of the body of the dissertation, college effects for early career men grew in terms of employment for low-propensity workers, but shrunk for job quality. The opposite pattern occurred at the high end of the propensity score distribution, causing a negative pattern of selection for measures of employment during recessionary contexts and a positive pattern of selection for job quality during recessionary contexts. These results combined with national-level results which also show similar general patterns of effects suggest that the results I present in Chapter 3 are not artifacts of omitted variable bias as it relates to residential mobility.

School enrollees not included in analyses

In Chapter 3, I showed evidence that being exposed to a recessionary context at age 26 based on state of residence did not seem to influence school enrollment decisions significantly. That is, recessionary contexts did not induce a fundamentally different type

of student to remain enrolled in school, and thus be outside the sample of this study. In Tables 6-2 for men and 6-3 for women, I show descriptive statistics for school enrollees and non-enrollees from the NLSY-97 sample relevant for Chapter 2.

[INSERT TABLE 6-2 HERE]

[INSERT TABLE 6-3 HERE]

Columns 3 and 4 of the tables show descriptive statistics for bachelor's degree holders by enrollment status in 2009, at the height of the Great Recession when respondents were between 25 and 29 years old. Non-enrollees were eligible to be included in the sample, while those enrolled in school in 2009 were ineligible to be included in the analysis sample based on their enrollment status. Respondents in these two columns all held bachelor's degrees, which meant that enrollment was for graduate school. For men and women with bachelor's degrees, there were not substantial differences between enrollees and non-enrollees in many of the most salient predictors of college completion, such as cognitive ability, high school grade point average, and parental education. Those enrolled in graduates school were not more fit than bachelor's degree holders in the labor market according to the observable precollege characteristics available in the NLSY-97. Columns 1 and 2 in Table 6-2 do suggest that there may be some differences between men enrolled in undergraduate education and non-college educated men who were not enrolled in undergraduate education in 2009. Those still enrolled in 2009 may have been marginally more likely to complete college based on precollege observable characteristics than their non-enrolled counterparts because they had higher average high school grades, cognitive ability, and parental education. However, even these differences are relatively small in magnitude. For example, men

enrolled in undergraduate education had about one-quarter of one standard deviation higher scores on cognitive ability, and about one-fifth of a letter grade higher GPA's than non-enrollees without college degrees. Differences between women enrolled in undergraduate education in 2009 and female non-enrollees without bachelor's degrees were even smaller, again suggesting that observable precollege characteristics used in the propensity score estimation were not predictive of school enrollment at ages 25-29 during the Great Recession.

The similarities in descriptive statistics between enrollees and non-enrollees in 2009 suggest that the most advantaged students did not use that advantage to disproportionately enroll in college or graduate school as a "safe port" in which to wait out the Great Recession (Betts & McFarland, 1995). Enrollees were not significantly different from non-enrollees on the observable characteristics I used to predict treatment—in this case, college completion. Thus, I do not expect that my estimates of the treatment effects of college during the Great Recession for early career workers are fundamentally biased because of this population. However, it is possible that some unobserved variable(s) may affect respondents' propensities to complete college, their earning potential in the labor market, and their propensity to try to wait out a poor labor market by enrolling in school. Future analyses would benefit from allowing this cohort to age and see whether any of the observed or previously unobserved precollege factors are associated with both school enrollment during the recession and subsequent labor market outcomes following school leaving.

[INSERT TABLE 6-4 HERE]

[INSERT TABLE 6-5 HERE]

Tables 6-4 and 6-5 show descriptive statistics for those enrolled in college compared to those not enrolled, and thus eligible for the sample, for Chapter 4, the elite college analysis. The tables from Chapter 4's analysis of elite college attendance are similar to Tables 6-2 and 6-3 in that they show very few differences in observable precollege characteristics between enrollees and non-enrollees in 2009. There are only very modest differences between enrollees and non-enrollees in the important predictors of treatment, such as cognitive ability, high school grades and socioeconomic background. Thus, it does not appear from the descriptive statistics that those enrolled in school in 2009 were fundamentally different prior to initial college enrollment than those who were in the labor market in 2009. Again, I do not expect the restriction of the sample to those not enrolled in school to affect the estimated treatment effects of college compared to the hypothetical case where all respondents were forced into the labor market.

Together, these tables and the evidence shown in Chapter 3 suggest that if my estimates of the effects of higher education on early career workers were biased due to school enrollment decisions, it is not immediately clear how. Those who were enrolled in school did not seem to differ significantly from those who were not enrolled in school on the observable measures provided above. However, further analyses may benefit from a longer timeframe. Following this cohort as they progress through the life course and a greater proportion of individuals completely finish schooling will provide updated results that may change the estimated treatment effects of college. Of course, even with this information, it is difficult to parse out the effects of age from those of the changing

sample composition due to changes in school enrollment, and therefore labor force participation.

APPENDIX

Table 6-1. Odds ratios and standard errors predicting men's college completion by age 25, NLSY-97.

	Model 1		Model 2	
	OR	**s.e.**	**OR**	**s.e.**
Race[1]				
Black	2.551*	.94	2.801**	1.04
Hispanic	1.576	.59	1.649	.62
Region[2]				
Northeast	2.512**	.87	2.633**	.92
North Central	1.412	.398	1.484	.42
West	.826	.27	.854	.28
Live in MSA	1.117	.29	1.078	.28
Intact family	2.128**	.53	2.150**	.54
Sibship	1.020	.08	1.019	.06
Mother's educ.	1.203***	.05	1.186***	.06
Father's educ.	1.102*	.05	1.090†	.05
Log parental income	1.145	.17	1.128	.17
College prep	2.800***	.67	2.904***	.71
Cognitive ability	1.623*	.33	1.629*	.34
HS GPA	.175	.35	.177	.35
HS GPA^2	2.030*	.71	2.049*	.71
Peer college plans	1.009	.01	1.008	.152
Teacher interest	1.353	.54	1.344	.54
Mother's age			1.025	.02
Offer calculus			.398	.23
Public HS			.761	.28
Jewish			1.383	1.20
BIC'	-311.830		-289.801	

*†p<.10; *p<.05; **p<.01; ***p<.001*

[1] Reference group for race is non-black, non-Hispanic

[2] Reference group for region is South

Note: Negative BIC' scores are evidence of model fit

Figure 6-1. College Effects on Early Career Men's Logged Earnings Across Economic Context: NLSY-97

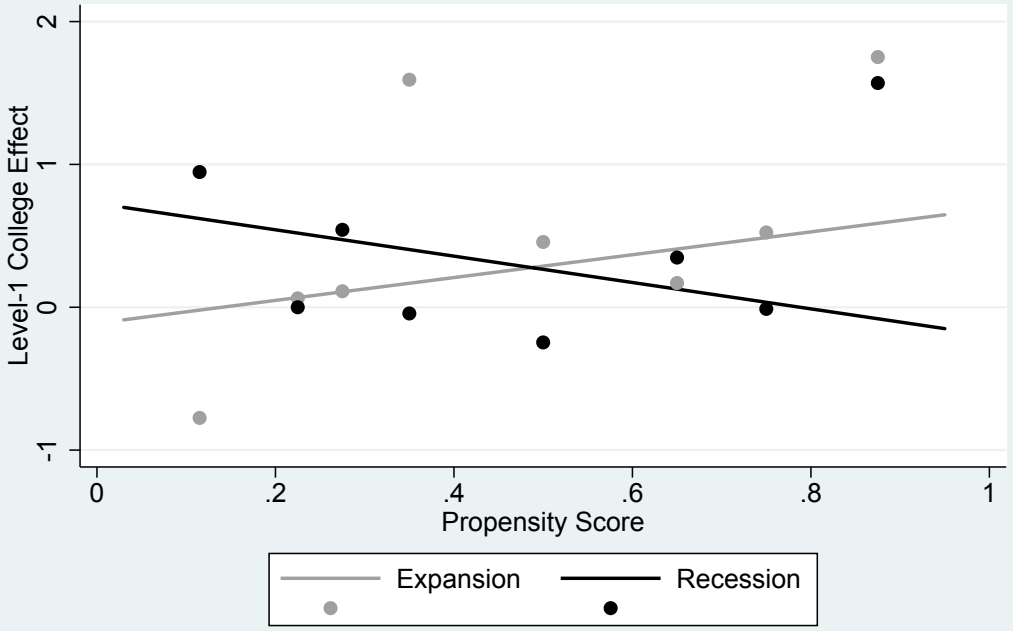


Figure 6-2. College Effects on Early Career Men's Weeks Worked Across Economic Context: NLSY-97

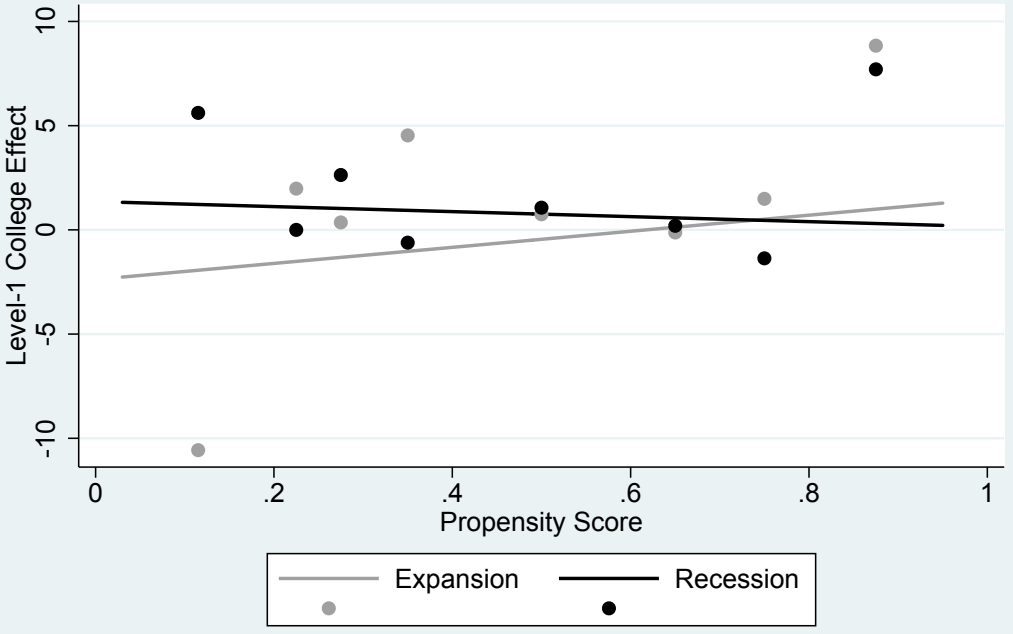


Figure 6-3. College Effects on Early Career Men's Hours Worked Across Economic Context: NLSY-97

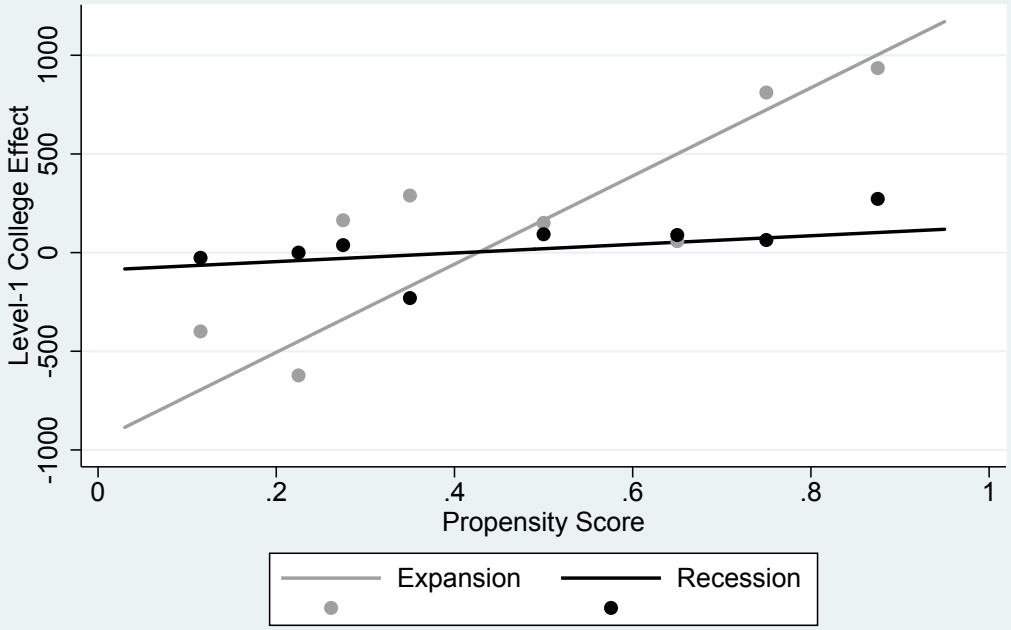


Figure 6-4. College Effects on Early Career Men's Logged Hourly Wages Across Economic Context: NLSY-97

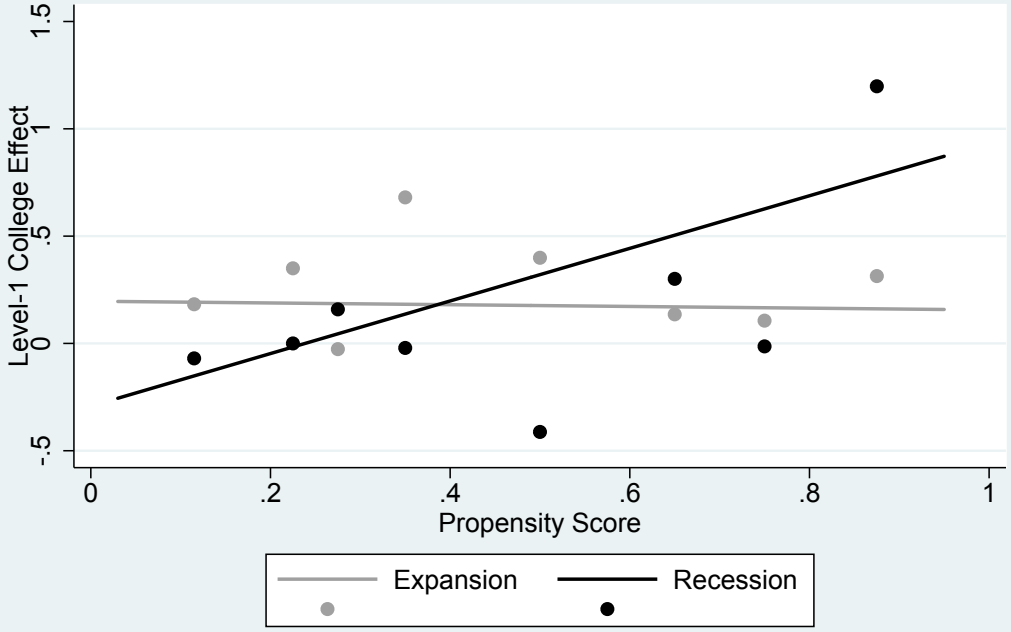


Figure 6-5. College Effects on Early Career Men's Occupational Status Across Economic Context:NLSY-97

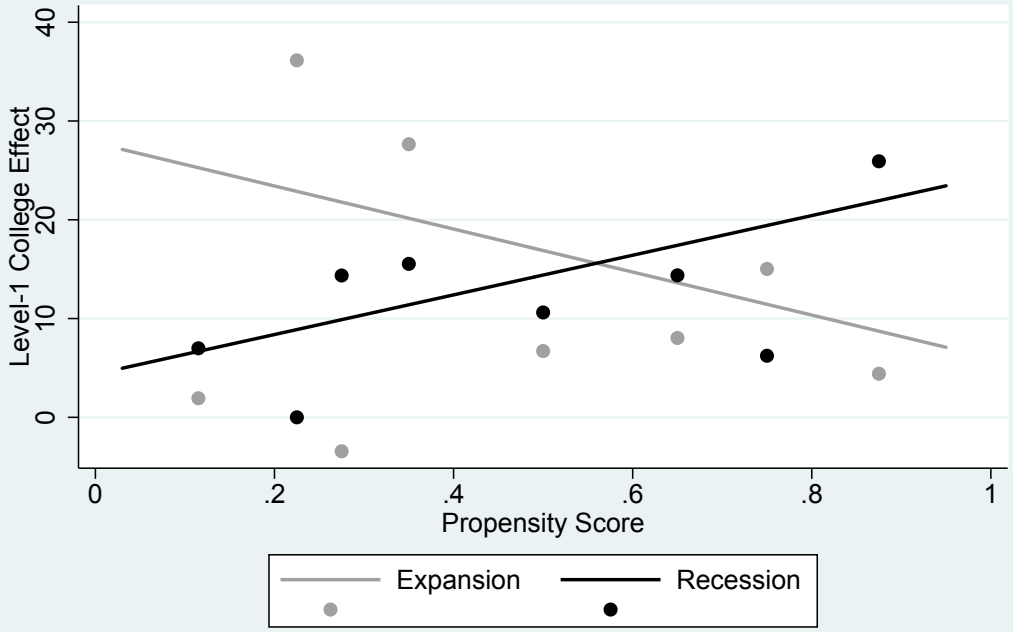


Table 6-2. Means by bachelor's degree completion and school enrollment, men: NLSY-97.

	No BA		BA	
	Not enrolled (N=729)	**Enrolled (N=113)**	**Not enrolled (N=316)**	**Enrolled (N=97)**
Black	.222	.177	.082	.124
Hispanic	.184	.239	.085	.124
Northeast	.143	.115	.187	.155
North Central	.280	.230	.323	.392
West	.219	.300	.165	.186
Live in MSA	.749	.823	.794	.856
Intact family	.497	.637	.769	.835
Sibship	3.080	2.850	2.598	2.588
Mother's educ.	12.329	13.053	14.491	14.794
Father's educ.	12.045	13.150	14.788	15.206
Log parental income	3.401	3.619	4.080	4.058
College prep	.365	.584	.782	.835
Cognitive ability	-.120	.150	.688	.639
HS GPA	2.531	2.746	3.253	3.259
Peer college plans	59.403	64.779	69.256	71.546
Teacher interest	.855	.885	.915	.928

Table 6-3. Means by bachelor's degree completion (treatment status) and school enrollment, women: NLSY-97.

	No BA		BA	
	Not enrolled (N=647)	Enrolled (N=168)	Not enrolled (N=427)	Enrolled (N=154)
Black	.241	.357	.152	.286
Hispanic	.190	.143	.098	.104
Northeast	.147	.137	.155	.143
North Central	.246	.268	.311	.240
West	.226	.214	.192	.169
Live in MSA	.757	.804	.824	.786
Intact family	.481	.381	0.74	.617
Sibship	3.182	3.232	2.513	2.773
Mother's educ.	12.207	12.429	14.037	13.890
Father's educ.	11.910	12.464	14.326	13.993
Log parental income	3.349	3.312	4.003	3.703
College prep	.386	.565	.803	.831
Cognitive ability	-.147	.062	.539	.507
HS GPA	2.707	2.776	3.365	3.317
Peer college plans	62.202	61.131	71.979	69.643
Teacher interest	.816	.786	.916	.864

Table 6-4. Means by elite college attendance and 2009 school enrollment, men: NLSY-97.

	Non-elite		Elite	
	Not enrolled (N=481)	Enrolled (N=153)	Not enrolled (N=70)	Enrolled (N=23)
Black	.083	.062	.034	.015
Hispanic	.066	.111	.042	.070
North Central	.356	.370	.200	.287
South	.256	.237	.460	.341
West	.206	.246	.068	.094
Live in MSA	.806	.815	.818	.852
Intact family	.668	.763	.814	.805
Sibship	2.648	2.657	2.427	2.21
Mother's educ.	13.924	14.303	14.915	15.365
Father's educ.	14.123	14.827	15.861	15.838
Log parental income	4.016	4.043	4.386	4.229
College prep	.691	.765	.887	.900
Cognitive ability	.554	.552	.983	.845
HS GPA	3.042	3.057	3.436	3.443
Peer college plans	66.637	69.076	73.522	67.334
Teacher interest	.879	.903	.937	1.000
Bachelor's degree	.526	.497	.909	.821

Table 6-5. Means by elite college attendance and 2009 school enrollment, women: NLSY-97.

	Non-elite		Elite	
	Not enrolled (N=562)	**Enrolled (N=227)**	**Not enrolled (N=93)**	**Enrolled (N=42)**
Black	.084	.170	.051	.141
Hispanic	.066	.056	.051	.073
North Central	.302	.310	.362	.210
South	.352	.346	.273	.330
West	.183	.175	.143	.155
Live in MSA	.778	.735	.874	.928
Intact family	.664	.576	.829	.584
Sibship	2.557	2.828	2.580	2.397
Mother's educ.	13.631	13.633	14.940	14.444
Father's educ.	13.747	13.710	15.566	15.171
Log parental income	3.927	3.752	4.318	3.852
College prep	.722	.725	.948	.869
Cognitive ability	.481	.429	.940	.873
HS GPA	3.240	3.156	3.508	3.340
Peer college plans	70.261	69.084	72.417	75.040
Teacher interest	.902	.856	.939	.826
Bachelor's degree	.582	.512	.958	.856

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