

ABSTRACT

Title of Document: PREDICTORS OF BACHELOR'S DEGREE COMPLETION AND THE RETURNS TO COLLEGE STUDENT EMPLOYMENT: AN APPLICATION OF PROPENSITY SCORE MATCHING.

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Drawing from Bean's (1990) student attrition model and human capital theory (Becker, 1993; Mincer, 1974), this study examined the relationships between college student employment, bachelor's degree completion, and post-college salary outcomes. Using NCES Beginning Postsecondary Student Longitudinal Study (BPS:04/09) data, the investigation was conducted in separate analytic phases involving logistic regression, propensity score matching, and fixed-effects regression techniques. The application of propensity score matching addressed the selection bias present in prior studies to refine the current understanding of the returns to college student employment.

The phase one results indicate many variables included in the analysis were associated with degree completion; most notably among them are the distance students live from campus, students' level of college engagement, their college

academic performance, and work activities during college. The results suggest that living on-campus, active engagement in clubs, study groups, and interaction with faculty are positively associated with degree completion. The results also indicate that working during college, up to 20 hours per week, is positively related to degree completion. Conversely, working in excess of 30 hours per week is negatively associated with completing a college degree.

The phase two results indicate several variables were associated with college students' future salaries, and include students' work activities during college, their institution's admissions selectivity, college degree major, and the relationship student's degree major has with their post-college job. The results indicate that working in excess of 30 hours per week while in college is positively associated with students' future earnings. The results also indicate that attending institutions with higher levels of admissions selectivity is positively related with post-college earnings. Student degree major and the relationship of students' college majors to their future jobs were also positively related to their post-college salary.

The results reveal college students' participation in higher education and their work activities are not entirely antithetical. This study illustrates that under certain conditions, working during college may be supportive of students' educational pursuits and financially beneficial to students' post-college careers. This conclusion has important implications for academic advising and college career center practices and improves our knowledge pertaining to the working college student.

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CHAPTER I: INTRODUCTION

Statement of the Problem

Americans believe in the economic value of a college education. According to a Gallup/Lumina study (English, 2011), the principal reason students enter college is to make more money. Gary Becker (1964; 1975; 1993) identified education and training as the two greatest factors influencing post-college income. While all college students participate in formal education, they also have the opportunity to receive training by being employed while in school. In fact, the majority of today's students simultaneously participate in formal education and job training (in college), while gaining work experience (through paid employment). In 2008, 83% of community college students and 76% of students at four-year institutions were employed (National Center of Education Statistics, 2008).

Historically, college participation and student employment have been viewed as competing for students' available time (Baffoe-Bonnie & Golden, 2007; Titus, 2010). However, research (Pascarella & Terenzini, 1991; 2005) indicates that in tandem, simultaneous participation in education and work may support and improve student outcomes. Researchers (Gleason, 1993; Griliches, 1980; Häkkinen, 2006; Hotz, Xu, Tienda, & Ahituv, 2002; Light, 2001; Molitor & Leigh, 2005; Stephenson, 1982; Titus, 2010) propose employment during college positively influences post-college earnings. However, few studies (i.e., Ehrenberg & Sherman, 1987; Gleason, 1993; Molitor & Leigh, 2005; Titus, 2010) have examined the relationships between college student employment, bachelor's degree completion, and post-college salary outcomes. With the high rate of college student employment and the scant research

available, a clearer and more complete understanding needs to be developed regarding the interconnections between college student employment, bachelor's degree completion, and post-college earnings.

Background of the Problem

Several researchers have investigated the monetary (e.g., Baum, Ma, & Payea, 2010; Bowen, 1997; Pascarella & Terenzini, 2005; Perna, 2003) and non-monetary (e.g., Baum, Ma, & Payea, 2010; Bowen & Bok, 1998; Bowen, 1999) benefits of completing a college degree. Research has examined how alumni incomes are influenced by college academic achievement/performance (e.g., Jones & Jackson, 1990; Rumberger & Thomas, 1993; Thomas, 2000; 2003), academic major (e.g., Arcidiacono, 2004; Rumberger & Thomas, 1993; Thomas, 2000), institutional quality (e.g., Black, Daniel, & Smith, 2005; Black & Smith, 2003; Dale & Krueger, 2002; Zhang, 2005), institutional type (e.g., Brewer, Eide, & Ehrenberg, 1999; Light & Strayer, 2004; Monks, 2000; Monk-Turner, 1994), and labor market information (e.g., Hofler & Murphy, 1994; Ogloblin & Brock, 2005; Polachek & Robst, 1998; Polachek & Xiang, 2006). But little research (e.g., Ehrenberg & Sherman, 1987; Gleason, 1993; Titus, 2010) has addressed the relationship between college work experience, bachelor's degree completion, and post-college income.

Originally, human capital theory (Becker, 1964) hypothesized that schooling and training (educational investments) were solely responsible for producing increased productivity and earnings. However, Mincer (1974) advanced Becker's (1964) work by acknowledging the unique returns labor market experiences provide, apart from those received from educational investments alone. Mincer (1974)

conceptualized the accumulation of education and work experience occurs in two non-overlapping phases: schooling and post-schooling work experience. More recently, researchers (e.g., Häkkinen, 2006; Light, 2001; Titus, 2010) have acknowledged that students may participate in schooling while simultaneously accumulating work experience. Studies that have extended human capital theory to examine returns to college student employment (i.e., Gleason, 1993; Häkkinen, 2006; Molitor & Leigh, 2005; Titus, 2010) have found positive associations between work experience (gained during college) and post-college income. However, these findings may be biased due to the potential use of heterogeneous sample populations. The presence of sample selection bias may undermine the internal and external validity of research findings by comparing non-comparable (i.e., heterogeneous) individuals. Riggert, Boyle, Petrosko, Ash, and Rude-Parkins (2006) suggested the utilization of more homogenous sample populations will correct for selection bias and improve the accuracy of research findings.

Purpose of the Study

The purpose of this study was to investigate the relationships between college student employment, bachelor's degree completion, and post-college salary outcomes. This study addressed the selection bias present in prior studies to refine the current understanding of the returns to college student employment. Two research questions guided this study:

- 1) After accounting for the number of hours college students worked for pay, as well as their background characteristics, financial characteristics,

academic characteristics, and academic and social integration, what contributes to the chance of bachelor's degree completion?

- 2) After controlling for the chance of degree completion and other variables, how are post-college salary outcomes related to hours worked during college, over and beyond other predictors of salary?

In college, students have the opportunity to experience several types of work settings. However, research literature studies two basic types: on-campus and off-campus student employment (Pascarella & Terenzini, 1991; 2005). Students participating in either work environment have the opportunity to develop work-related transferable knowledge and abilities. These fundamental skills may be applicable to alternative work settings, including their post-college employment. Within this study, students participating in on- and/or off-campus work-settings were included in the initial analytic sample. To avoid confounding the findings of this study, the initial sample was limited to students who began their tertiary level education at four-year institutions.

Conceptual Framework

To examine these questions, this study drew from industrial frameworks within the fields of higher education and labor market economics. To address the first research question, concepts from Bean's (1990) model of student attrition guided in the selection of variables that explain the chance of college completion. Bean's (1990) model of student attrition postulates that student decisions to leave college are analogous to employee resignation decisions. Students' decisions develop through a complex interrelationship between non-cognitive and environmental factors. As

students interact with their environment, beliefs develop, attitudes form, and intentions take shape. Using concepts from Bean's (1990) model of student attrition, this study addressed the chance of college completion in the first phase of the analyses.

In the second phase of this research, concepts from human capital theory (Becker, 1964; 1975; 1993) and Mincer's (1974) model of labor market returns were combined to examine how post-college salary outcomes relate to the number of hours students worked during college. Human capital theory (Becker, 1964; 1975; 1993) provides an explanation for observed variation in earnings. Becker (1964; 1975; 1993) asserts that earning increases are rewards for higher productivity levels and differences in productivity are created through individual's decisions to invest in their own human capital (e.g., education, on-the-job-training, geographic mobility, and their physical or emotional health). Human capital theory (Becker, 1964; 1975; 1993; Ellwood & Kane, 2000; Paulsen, 2001) assumes individual investment decisions are made through rational assessments, calculating the lifetime benefits over and beyond expected investment costs. Mincer's (1974) model of labor market returns extends Becker's (1964) theory by acknowledging the unique contribution that labor market experiences have on income, separate from educational investments alone (Heckman, Lochner, & Todd, 2003; Mincer, 1974).

Human capital theory (Becker, 1964; 1975; 1993) and Mincerian type models (Mincer, 1974) are used extensively to investigate the pecuniary returns to cumulative education and work experience (Chiswick, 2003). In this study, these concepts helped frame the analysis with respect to the relationship between hours worked (for

pay) during college and post-college salary.

Data

This study used data from the second (2009) follow-up to the 2004 Beginning Postsecondary Student Longitudinal Study (BPS:04/09), a restricted national database sponsored by the National Center for Education Statistics. For use in this study, the BPS:04/09 dataset was appropriate for at least three reasons. First, the BPS:04/09 followed the persistence and college completion of first-time, beginning undergraduate students. Second, the BPS:04/09 collected information germane to individuals' experiences throughout college and into the labor force. Third, the information included in the BPS:04/09 was derived from institutional records, national databases, and student surveys. The appropriate BPS:04/09 weights, provided by the National Center for Education Statistics, were used in this study.

Sample

Beginning Postsecondary Student Longitudinal Study (BPS:04/09) data were used to develop analytic samples to address each research question. To investigate students' chance of college completion, the first analytic phase utilized a sample limited to 2003-2004 four-year college entrants, who did not complete a bachelor's degree or completed a bachelor's degree at their first higher education institution. In the second analytic phase, the initial sample (used in the first analytic phase) was further restricted to subjects with statistically equivalent propensities for college completion who, six years after initial college enrollment, are participating in the labor market, but not pursuing graduate level education. This matched subsample

was used to investigate the relationship between college student employment participation and post-college annual earnings.

Variables

This study's research questions were investigated in separate analyses using different dependent variables. To address the first research question, the dependent variable was bachelor's degree completion status in 2009. The dependent variable used to address the second research question was (the natural log of) annual salary in 2009.

To address the first research question, concepts from Bean's (1990) model of student attrition, which explains college completion, were reflected in the selection of independent variables. In the first phase of analysis, six sets of independent variables were included: students' employment participation, background characteristics, financial characteristics, social integration, academic integration, and academic characteristics. Students' employment participation was reflected using the number of hours worked per week in 2006. Student background characteristics included: gender, race/ethnicity, and socioeconomic status (i.e., parents' educational attainment and income), college admissions score, unmet financial need, and students' campus residency status, all observed in 2003-2004. Student financial characteristics were reflected by students' monetary need (after receiving financial aid) during the 2003-2004 academic year. Student academic characteristics were reflected by students' cumulative grade point average in 2004. Reflecting college retention literature, measures of student social integration included the intensity of participation in fine arts activities, student clubs, and school sports, all during 2003-2004. Student

academic integration included the intensity of study group participation, and interactions with an advisor and faculty, during the 2003-2004 academic year.

To address the second research question, concepts from human capital theory (Becker, 1964; 1975; 1993) and Mincer's (1974) model of labor market returns, which explain post-college salary, were reflected in the selection of independent variables. In the second analytic phase, six sets of independent variables were included: student employment participation, student background characteristics, student academic characteristics, institutional characteristics, college completion status, and labor market characteristics. Students' employment participation was reflected using the number of hours worked per week in 2006. Student background characteristics included: gender, race/ethnicity, and socioeconomic status (i.e., parents' educational attainment and income). Student academic characteristics were reflected by students' cumulative grade point average as of 2006 and college major as of 2009. Institutional characteristics were reflected by students' college/university admissions selectivity, Carnegie institutional classification and control. College completion variables included students' propensity for degree completion and degree completion status as of 2009. Labor market characteristics in 2009 included number of hours worked weekly, current occupation's need for a college degree, job-major relationship, and the industry of one's current job, as well as, post-college job tenure and present occupation.

Analyses

This study utilized three statistical procedures: propensity score matching, logistic regression, and fixed-effects regression. Addressing the first research

question, in the first analytic phase, propensity score matching involved the use of a logistic regression model in which the dependent variable was college completion and the independent variables represented concepts from Bean's (1990) model of student attrition. Within this study, the combined use of propensity score matching (PSM) and logistic regression was appropriate for at least two reasons. First, logistic regression enabled conclusions to be drawn regarding what factors are associated with the binary dependent variable, college completion. Second, propensity score matching (PSM) aided in addressing potential sample selection bias in the second phase of analysis. Propensity score matching is a sub-sampling technique that uses a regression model to select comparable (i.e., homogenous) groups that differ on a discrete dependent variable, but who are statistically equivalent across the predictor variables (Guo & Fraser, 2010). In this study, propensity score matching usage was limited to creating a single subsample of subjects with comparable (i.e., homogenous) likelihoods of bachelor's degree completion. Following Riggert and associates (2006) recommendation, this homogenous analytic sample will mitigate selection bias and improve the accuracy of research findings in the second analytic phase.

To address the second research question, the generated matched sub-sample was used in combination with fixed-effects regression in which the dependent variable was salary and the independent variables represented concepts from human capital theory (Becker, 1993; Mincer, 1974). To examine the relationship between post-college salary outcomes and hours worked during college, fixed-effects regression usage was appropriate for at least four reasons. First, fixed-effects regression utilizes a continuous dependent variable. Second, fixed-effects regression

permits the use of multiple independent variables. Third, the technique allows users to identify relationships between the continuous dependent variable and independent variables of interest. Fourth, through the use of fixed-effects, this study took into account unobserved industry and occupational characteristics.

Temporal Considerations

This study involved BPS:04/09 data reflecting 2004 college entrants 2009 labor market outcomes. This timeframe (i.e., 2004-2009) is of particular interest as 2004 college entrants exited amid a period of labor market turmoil and economic recovery. The period from December 2007 through June 2009 (i.e., the Great Recession) has been noted as the worst American economic downturn since the Great Depression (Fogg & Harrington, 2011). While a college education provided substantial insulation from the effects of the Great Recession, bachelor's degree holders were not entirely immune (Grusky, Red Bird, Rodriguez, & Wimer, 2013; Stone, Van Horn, & Zukin, 2012). Recent college graduates of the Great Recession entered a labor market experiencing slight declines in employment rates, job desirability, and wages (Grusky et al, 2013). Comparing pre-recession (i.e., the period two years prior to December 2007) and post-recession (i.e., the period two years after June 2007) statistics, bachelor's degree holders experienced an employment decline of 7%, an underemployment increase of 3%, and a weekly earnings decline of 5%. Although slight, these changes in employment and earnings characteristics must be acknowledged when examining college students' post-Great Recession labor market outcomes.

Limitations

This study has at least four limitations. First, this research utilized data from a secondary source. Although the National Center for Education Statistics designed the Beginning Postsecondary Students Longitudinal Study Survey to collect information regarding students' college and labor force experiences, proxies were used to represent some constructs in this study. Second, given the data limitations of the Beginning Postsecondary Students Longitudinal Study, this study was restricted to examining bachelor's degree completion and salary outcomes up to 6 years after initial college enrollment. The third limitation pertains to the reliability of BPS:04/09 data. While the Beginning Postsecondary Students Longitudinal Study utilized institutional records and national databases for data collection, student surveys were also used. This study utilized BPS:04/09 participant reported data, including the second stage dependent variable (i.e., annual salary in 2009). The fourth limitation relates to appropriate model specification. Within this study, as with all research, complete model specification proved challenging. Given the numerous known predictors of earnings (previously introduced), variable omission and subsequently, incomplete model specification may have occurred. However, to ensure proper model specification, this study was informed using theory and prior research. A closer and more complete review of these limitations is discussed in chapter three.

Significance of Study

The results of this study have at least three major implications. First, this study identifies factors associated with working students' chances of earning a bachelor's degree. This knowledge may enable higher education stakeholders to more effectively assist working college students in the completion of college

bachelor's degrees. Second, this study adds to the developing field of returns to college student employment research. Third, this study addresses the research limitation of sample selection bias through the use of propensity score matching. The findings of this study further contribute to and refine what is known about the pecuniary rewards for working college students.

CHAPTER II: REVIEW OF THE LITERATURE

Introduction

A review of the current literature illustrates the limited research investigating post-college monetary returns to college student employment. While several scholars (e.g., Ehrenberg & Sherman, 1987; Gleason, 1993; Molitor & Leigh, 2005; Titus, 2010) examine this relationship, methodological limitations may hinder the accuracy of research findings. In an attempt to improve upon prior research, this study combined concepts from student attrition literature and human capital theory to assess how working while in college relates to both students' chance of bachelor's degree completion and salary outcomes in the labor market. In this study, post-college salary outcomes were examined after taking into account the chance of college completion.

Drawing from Bean's (1990) student attrition model and human capital theory (Becker, 1993; Mincer, 1974), this study examined the relationships between college student employment, bachelor's degree completion, and post-college salary outcomes. Specifically, this study answers the following research questions:

- 1) After accounting for the number of hours college students worked for pay, as well as their background characteristics, financial characteristics, academic characteristics, and academic and social integration, what contributes to the chance of bachelor's degree completion?
- 2) After controlling for the chance of degree completion and other variables, how are post-college salary outcomes related to hours worked during college, over and beyond other predictors of salary?

As such, this chapter delineates, in three sections, the theoretical underpinnings and

relevant literature used to inform this investigation. Addressing bachelor's degree completion, the chapter begins with a historical overview of Bean's (1990) student attrition model before explaining the framework premises and the explanatory advantages over alternative frameworks. Focusing on students' work behaviors during college, the chapter then moves to briefly review the impact working during college has on post-college outcomes. To address returns to college student employment, the review examines human capital theory's central assumptions and conceptual advancements (Becker, 1964; 1975; 1993; Mincer, 1974). Following an overview of this study's guiding frameworks, the chapter reviews relevant returns to student employment research, followed by an in-depth examination of the methodological limitations found within the literature. The subsequent section presents a human capital theory (Becker, 1964; 1975; 1993; Mincer, 1974) based conceptual framework to guide this investigation into the returns to college student employment. The chapter concludes by summarizing the major findings introduced through the review of literature.

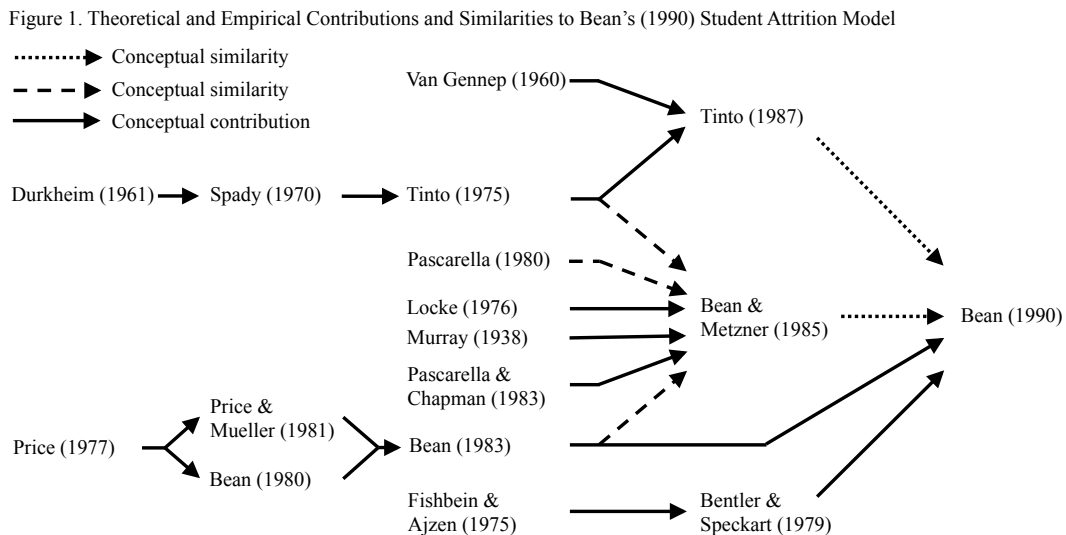
Student Persistence Frameworks

Several frameworks (e.g., Astin, 1977; 1985; Bean, 1980; 1990; Bean & Metzner, 1985; Kamens, 1971; 1974; McNeely, 1937; Pascarella, 1980; Spady, 1970; Tinto, 1975; 1987; 1993; 1997) have been advanced explaining the college dropout process (Braxton, 2000; Pascarella, 1982; Pascarella & Terenzini, 1991; 2005; Seidman, 2005). However, Tinto's (1975; 1987; 1993; 1997) interactionist theory of student departure and Bean's (1980; 1982a; 1982b; 1983; 1985; 1990) or Bean and associate's (1985; 1990) student attrition frameworks guide most college persistence

and departure studies (Cabrera, Nora, Castañeda, & Hengstler, 1992; DesJardins, Kim, & Rzonca, 2002-2003; Titus, 2004).

The theoretical and empirical attrition studies contributing to the development of Tinto's (1975; 1987; 1993; 1997) interactionist theory and Bean's (1980; 1982a; 1982b; 1983; 1985; 1990) or Bean and associate's (1985) student attrition models follow several lines of conceptually related, but non-overlapping research (Figure 1). Tinto's (1975; 1987; 1993; 1997) interactionist theory emphasizes students' college integration as a critical precursor to successful college persistence, while the nontraditional student attrition model (Bean & Metzner, 1985) emphasizes the influence of external factors. Bean's (1990) student attrition model blends the central components of his prior work (Bean, 1980; 1982a; 1982b; 1983; 1985; Bean & Metzner, 1985), organizational and environmental influences, with the focus of Tinto's (1975; 1987; 1993; 1997) theories, student integration.

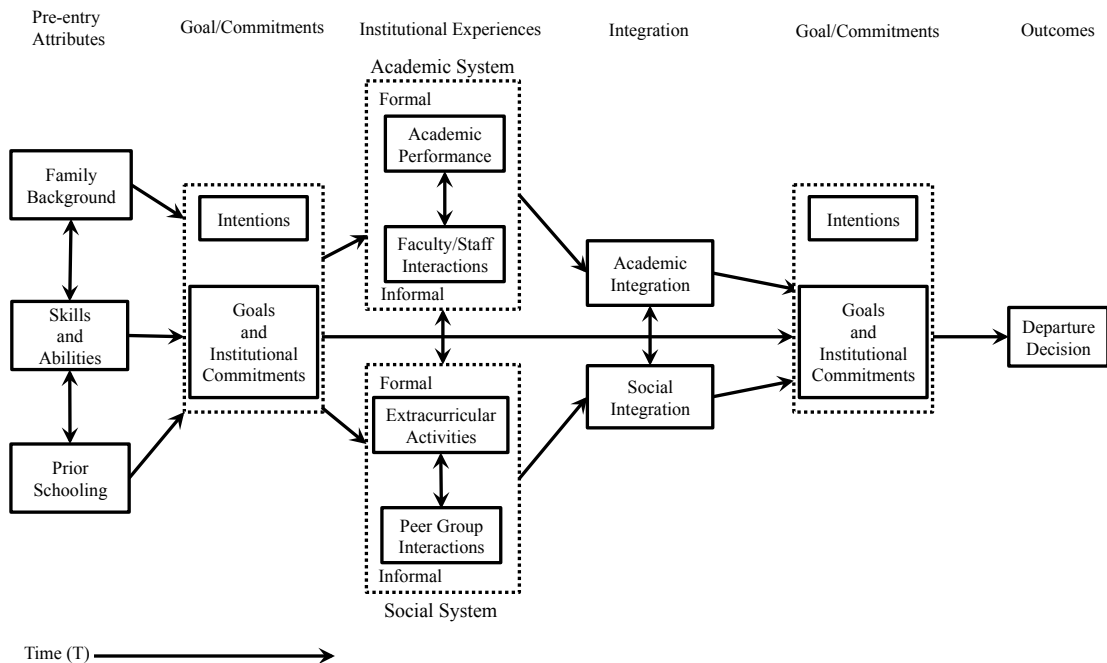
What follows is a brief overview of Bean's (1990) student attrition model. Beginning with an overview of the principal antecedents to Bean's (1990) model, Tinto's (1975; 1987; 1993; 1997) student interactionist theory and Bean and



Metzner's (1985) nontraditional student model, the section proceeds to examine the student attrition model (Bean, 1990) presenting the underlying assumptions, components, and variables involved.

Tinto's (1987) student interactionist theory. Connecting the works of Émile Durkheim (1951), William Spady (1970), and Arnold Van Gennep (1960), Tinto's (1975; 1987; 1993, 1997) student interactionist theory explains college persistence as a product of student's characteristics, goals and commitments, their post-secondary experiences, and their levels of academic and social integration (Figure 2). Central to Tinto's (1975; 1987; 1993, 1997) theory are students' collegiate experiences. College students perceive academic and social experiences as assessments of personal integration within the institution. Students' self-appraisal of campus integration produces institutional commitment. Within the student interactionist theory (Tinto, 1975; 1987; 1993, 1997), students' level of

Figure 2. Student Interactionist Model (Tinto, 1987, p.114)



commitment, or integration, is positively associated with college persistence and influences dropout decisions.

Paralleling Durkheim (1951), Tinto (1975; 1987; 1993) equates college student dropout to suicide decisions. Durkheim (1951) held that community membership and suicide are inversely related. The less a person is connected to a community, the more likely he/she will voluntarily withdraw from that environment (i.e., suicide) (Durkheim, 1951). Similarly, low levels of post-secondary integration increase the likelihood of student departure from college (Tinto, 1975; 1987; 1993).

Using Spady (1970) and Van Gennep (1960), Tinto (1975; 1987; 1993) positively related student interaction to integration and institutional departure. The student interactionist theory (Tinto, 1975; 1987; 1993) maintains students' on-campus interaction facilitates institutional integration (Spady, 1970), which supports college persistence. But college persistence is dependent on sustained levels of collegiate integration and removal from external factors. To achieve complete college integration, students must pass through three stages (Tinto, 1975; 1987; 1993). Akin to Van Gennep's (1960) Rites of Passage, the student interactionist theory (Tinto, 1987; 1993) terms these stages: separation, transition, and incorporation.

New college entrants begin the separation stage by withdrawing from pre-college and external communities (e.g., family members, high school friends, and high school staff and teachers) (Tinto, 1993). Remaining unattached in the transition phase, the newly separated students shift their attachments from pre-college relationships to relationships within their educational environments (e.g., faculty,

staff, and other college students) (Tinto, 1993). Only students who attain and maintain full integration into their college communities achieve and remain in the incorporated stage (Tinto, 1993). Within this three-stage progression, students' pre-college and external relationships serve as inhibitors to collegiate integration and encourage student dropout. The more college students are involved in maintaining pre-college relationships, the greater the likelihood a student will leave college. Conversely, the greater students integrate into college, the more likely students will remain enrolled.

The student interactionist theory (Tinto, 1975; 1987; 1993) was altered (Tinto, 1997) identifying places designated for learning (e.g., classrooms, labs, study areas) as the primary locations where academic and social interactions are linked and integration is most likely to occur. However, the emphasis of each theoretical variation (Tinto, 1975; 1987; 1993; 1997) maintains students' perceptions of their interactions, over the behaviors themselves, influence student dropout.

Tinto's theory (1975) and reformulated variations (Tinto, 1987; 1993; 1997) have been extensively used in single institution studies to examine college persistence (Braxton & Lien, 2000; Braxton, Sullivan, & Johnson, 1997). However, a review of research conducted by Braxton, Sullivan, and Johnson (1997) conclude few proposals advanced in Tinto's (1975; 1987; 1993; 1997) interactionist theory are supported by empirical research. Braxton and Lien (2000), and Braxton, Sullivan, and Johnson (1997) found little to no research supporting Tinto's (1975; 1987; 1993; 1997) assertion that persistence is influenced by academic integration. But Braxton, Sullivan, and Johnson (1997) found Tinto's (1975; 1987; 1993; 1997) conceptual

relationship between persistence and social integration well supported. In summary, Braxton, Sullivan, and Johnson (1997) contend Tinto's (1975; 1987; 1993; 1997) sociological dependent theory is logically sound, but empirically inconsistent. The integration of organizational, economic, and psychological perspectives is recommended for the improvement in the explanatory power of a persistence framework (Braxton, Sullivan, & Johnson, 1997). Extending Tinto's (1975) sociological based theory, Bean and Metzner (1985) also incorporated psychological and environmental perspectives.

Bean and Metzner's (1985) nontraditional student model. Bean and Metzner's (1985) model of nontraditional student attrition is regularly employed in studying college persistence. Like Tinto's theory (1975; 1987; 1993; 1997), Bean and Metzner's (1985) model conceptualizes persistence as the product of complex interactions between multiple factors across time (Hossler, 1984). Both models (Tinto, 1975; 1987; 1993; 1997; Bean & Metzner, 1985) take into consideration the impact pre-college characteristics have on student success (Hossler, 1984). Both frameworks also take into account the influence external collegiate environments have on student outcomes. The nontraditional student model (Bean & Metzner, 1985) possesses hallmarks of Tinto's (1975; 1987; 1993; 1997) theory, but unlike the student interactionalist model (Tinto, 1975; 1987; 1993; 1997) it is not solely dependent on the concept of cultural integration to explain college persistence. Instead, Bean and Metzner's (1985) work targets students not greatly influenced by integration into collegiate environment, but who are primarily concerned with the utility of educational offerings and opportunities. Through the integration of Bean's

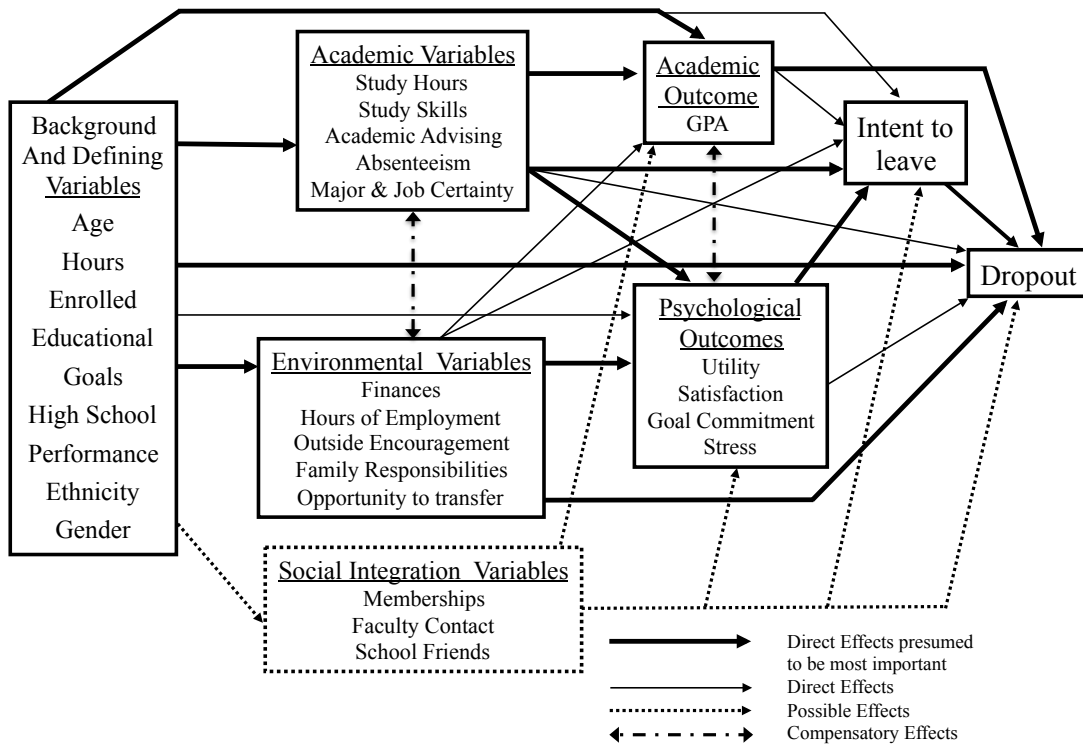
(1983) prior work with that of Tinto (1975), Pascarella (1980), Pascarella and Chapman (1983), Murray (1938), and Spady (1970), Bean and Metzner's (1985) model combines socio-psychological and environmental perspectives to explain college dropout among nontraditional students.

Unlike Spady (1970), Tinto (1975; 1987; 1993; 1997), and Pascarella (1980), Bean and Metzner (1985) do not assume academic and social integration are equally contributive to persistence decisions. Instead, Bean and Metzner (1985) argue, based on Pascarella and Chapman (1983), the underlying dropout process differs for traditional and nontraditional students. Compared to traditional, full-time students who reside on-campus, nontraditional students encounter different levels of environmental pressures (Bean & Metzner, 1985; Murray, 1938). For example, nontraditional students are typically older than 24, parents, employed, do not reside on-campus, and/or are enrolled in college less than full-time (Bean & Metzner, 1985). One or any combination of these characteristics may produce a college experience vastly different to what is considered traditional. Bean and Metzner (1985) projected these types of students would experience less integration within college communities and greater interactions with noncollegiate environments, while participating in traditional educational activities. While social integration is still important for students, the location for social interaction differs between Tinto's (1975, 1987; 1993; 1997) theory and Bean and Metzner's (1985) model. Traditional students socially integrate through campus-based interaction (Tinto, 1975; 1987; 1993; 1997), while nontraditional students receive social integrative support through external

relationships (e.g., family, friends, co-corkers, and significant others) (Bean & Metzner, 1985).

The nontraditional student model (Bean & Metzner, 1985) (Figure 3) posits dropout decisions are influenced by one or more of the following variables (Seidman, 2005): (1) background and defining variables, (2) environmental variables, (3) academic variables, (4) psychological outcomes, (5) academic outcomes, (6) students intent to leave, and (7) social integration (Bean & Metzner, 1985). Students' background and defining characters are at the core of the model and include: age, campus residency status, educational goals, ethnicity, gender, SES, employment status, enrollment intensity, and high school performance. These characteristics determine students' social and academic integration needs through the influence each has on students' noncollegiate attachments, collegiate interactions, and academics. In

Figure 3. Metzner and Bean's (1985, p.491) Nontraditional Student Attrition Model



sum, the experiences produced through the interaction between these variable sets (background and defining variables, environmental variables, academic variables, social integration) shapes student's educational attitudes (Locke, 1976). These attitudinal outcomes impact academic outcomes and behavioral intentions, which ultimately affect students' dropout decisions (Bean & Metzner, 1985).

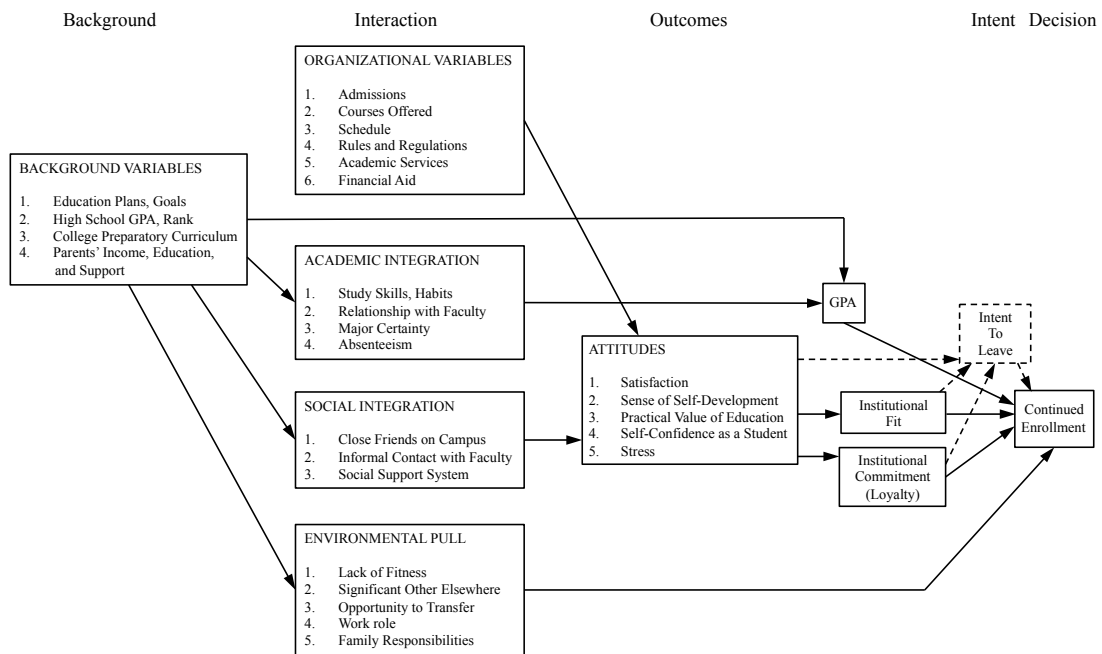
The nontraditional student framework also identifies, similar to Tinto (1975; 1987; 1993; 1997) and Pascarella and Chapman (1983), compensatory effects within the model. These compensatory relationships are defined between: (1) academic and environmental variables; and (2) academic performance and psychological outcome variables (Bean & Metzner, 1985). Conceptually, each pair of variable sets work in concert amplifying or diminishing the combined influence the pair imparts on dropout decisions.

While Tinto's (1975; 1987; 1993; 1997) theory focuses on institutional commitment to explain persistence, Bean and Metzner (1985) argue the influence noncollegiate factors have on student attitudes and decision making are more important than campus-based activities in the explanation of nontraditional student dropout (Hossler, 1984). Compared to Tinto's (1975; 1987; 1993; 1997) theory, Bean and Metzner (1985) offer a more complete model through the incorporation of the effects noncollegiate forces and student characteristics have within the educational lives of students (Hossler, 1984; Pascarella & Terenzini, 1991; 2005). However, a major limitation of the nontraditional student model (Bean & Metzner, 1985) is that it minimally takes into account institutional characteristics to explain college student dropout. Accounting for institutional characteristics, Bean's (1990)

student attrition model, building upon Tinto's (1975; 1987) sociological and Bean and Metzner's (1985) socio-psychological and environmental based explanations, examines the college dropout process through an industrial perspective.

Bean's (1990) student attrition model. Bean's (1990) student attrition model (Figure 4) contends college persistence is a result of students' satisfaction. Over time, the more an institution is able to meet the needs of a student, the greater their satisfaction and likelihood of persistence. Bean (1990) drew from his previous usage (Bean, 1980; 1983) of Price and Mueller's (1981) worker turnover model and Bentler and Speckart's (1979) attitude-behavior investigation, as the foundation for explaining student persistence. Analogous to Price and Mueller (1981), Bean's (1990) student attrition model is built upon the basic assumption that the college student dropout process shares commonalities with voluntary employee resignation.

Figure 4. Bean's (1990, p.152-153) Model of Student Attrition



Price and Mueller's (1981) research identified four core factors determining employee resignation: employee socialization, promotional opportunity, job satisfaction, and intent to stay. The process by which these variables influence worker turnover can be interpreted when examined through the conclusions developed in Bentler and Speckart's (1979) attitude-behavioral study. Bentler and Speckart (1979) assert experiences shape attitudes, which define intentions that guide behaviors. Based on Bentler and Speckart's (1979) conclusions, Price and Mueller's (1981) findings suggest employee socialization and opportunities for advancement influence worker satisfaction. Employees' work satisfaction informs their intentions and employment decision-making processes that guide turnover behaviors.

Analogous to employees, students interact with their educational institutions organizationally, academically, and socially (Bean, 1990). These experiences allow students to develop attitudes reflective of perceived measures of institutional fit and loyalty. Students' institutional fit and loyalty influence students' intent to leave and ultimately, departure decisions.

Similar to the frameworks proposed by Bean and Metzner (1985), Pascarella (1980), Spady (1970), and Tinto (1975; 1987; 1993; 1997), the student attrition model (Bean, 1990) includes student background variables. Student background variables include student demographic and pre-college educational characteristics (Bean, 1990). Students' background variables are expected to directly influence students' ability to academically and socially integrate into the university. Akin to the work of Tinto (1975; 1987; 1993; 1997), Spady (1970), Pascarella (1980), and Bean and Metzner (1985), Bean's (1990) framework hypothesizes that appropriate levels of

academic and social involvement fosters college integration, increasing students' likelihood to persist. But non-collegiate environmental pull factors are predicted to negatively influence student integration and chance of completion (Bean, 1990; Bean & Metzner, 1985; Pascarella, 1980; Tinto, 1993; 1997). These environmental pull factors include the influence of significant others external to the college environment, opportunities to transfer, financial need, family responsibilities, and employment (Bean, 1990).

Work as an environmental pull factor. Bean's (1990) student attrition model suggests environmental pull factors, such as student employment, may have a negative influence on students' academic performance and integration, and ultimately, degree completion. Research findings (i.e., Bella & Huba, 1982; Bradley, 2006; Curtis & Nimmer, 1991; Dallam & Hoyt, 1981; Ehrenberg & Sherman, 1987; Furr & Elling, 2000; Gleason, 1993; Goldstein & High, 1992; Hammes & Haller, 1983; Hood, Craig, & Ferguson, 1992; King, 2003; Pascarella & Terenzini, 1991; 2005; Pike, Kuh, & Massa-McKinley, 2008) suggest a non-linear relationship exists between work intensity and academic performance and integration. As predicted within Bean's (1990) student attrition model, limited student workforce participation (less than 15 hours per week) has not been found to impact academic performance (Bella & Huba, 1982; Bradley, 2006; Curtis & Nimmer, 1991; Dallam & Hoyt, 1981; Ehrenberg & Sherman, 1987; Furr & Elling, 2000; Gleason, 1993; Goldstein & High, 1992; Hammes & Haller, 1983; Hood, Craig, & Ferguson, 1992) or integration (Hammes & Haller, 1983). However, research (King, 2003; Pascarella & Terenzini, 1991; 2005; Pike, Kuh, & Massa-McKinley, 2008) has also found working in excess

of 20 hours per week adversely impacts academic performance and integration.

Examined through the student attrition model (Bean, 1990), student employment intensity will influence students' academic performance and integration, affecting their persistence behaviors. Higher education stakeholders can anticipate students work intensity during college to affect students in at least two ways: extending student's time-to-degree and persistence to degree completion. Similar to the non-linear relationship between working and academic performance and integration, research (Pascarella & Terenzini, 1991; 2005) suggests the impact employment has on student time and persistence to degree is dependent primarily on the intensity of student work activities.

Time-to-degree completion. Pascarella and Terenzini (2005) concluded students' employment and enrollment intensity are inversely related. Meaning, as the number of hours student work increases, the number of college credits students undertake decreases (Pascarella & Terenzini, 2005). Across semesters, college students have been found to maintain stable employment intensity while managing the number of college credits based on their perceived course difficulty and performance goals (Henke, Lyons, & Krachenberg, 1993). For college students, working leads to longer average time to completion (King, 2002; Stern & Nakata, 1991).

Persistence to degree completion. As hypothesized in Bean's (1990) model, working college students experience less involvement within college communities and greater interactions with noncollegiate environments, while participating in traditional educational activities (Fjortoft, 1995; Lundberg, 2004). While social

integration is still important for students, working students receive social integrative support through external relationships (e.g., family, friends, co-workers, and significant others) (Bean & Metzner, 1985). The relationships formed within students' work environments, especially those formed while working on-campus, may strengthen students' institutional fit and encourage persistence (Ziskin, Torres, Hossler, & Gross, 2010). As predicted within Bean's (1990) student attrition model, research (e.g., Choy, 2000; Horn & Berkold, 1998; King, 2002; St. John, 2003) has found that working a limited number of hours (no more than 15) has no adverse effect on persistence and in one study (Choy & Berker, 2003) it was found to encourage degree completion. Conversely, excessive employment intensity (working greater than 15 hours per week), especially off-campus, has been found to encourage college student dropout (Beeson & Wessel, 2002; Cuccaro-Alamin & Choy, 1998; Ehrenberg & Sherman, 1987; King, 2002; Kulm & Cramer, 2006; Pascarella & Terenzini, 2005; St. John, 2003). Bean's (1990) model also suggests institutions have considerable influence to counteract the pull of environmental factors.

Neutralizing the environmental pull of work. Bean (1990) postulated the likelihood of college graduation is dependent on institutions ability to offer appropriate programming to support student needs. For example, institutional use of financial aid has been found to positively influence student integration, their attitudes, levels of commitment, performance, intent, and ultimately, persistence (Cabrera, Nora, & Castañeda, 1992). Beyond the institutions' use of financial aid, the student attrition model (Bean, 1990) suggests organizational variables, consisting of institutional characteristics such as, college admissions, curriculum, rules and

regulations, and academic services, influence student outcomes (Bean, 1990). Similar to levels of student integration, student's positive experiences with institutions' organizational characteristics are hypothesized to positively influence student attitudes and persistence (Bean, 1990). Attitudes are a reflection of students' satisfaction with their overall college experience contributing to their assessment of institutional fit and commitment. Students' attitudes are a central component to the socio-psychological process that relates behavioral experiences to an emotional context that determines future behaviors (Fishbein & Ajzen, 1975; Bentler & Spackart, 1979). Within the student attrition model (Bean, 1990), students' self-appraisal of institutional fit, their institutional commitment, and attitudes inform their behavioral intent, a precursor and predictor of persistence.

Contrasting Persistence Frameworks

Bean and Metzner's (1985), and Tinto's (1975; 1987) frameworks are two of the most utilized explanations in undergraduate retention and persistence research (Cabrera, Castañeda, Nora, & Hengstler, 1992; DesJardins, Kim, & Rzonca, 2002-2003; Titus, 2004). It is important to note these frameworks (i.e., Bean, 1990; Bean & Metzner, 1985; Tinto, 1975; 1987) are conceptually similar, but fundamentally different in origin (Figure 1). The differences between these explanations lie in the perspectives each uses to explain the dropout process. Bean and Metzner's (1985) nontraditional student framework uses socio-psychological and environmental perspectives to explain persistence, while Tinto's (1975; 1987; 1997) interactionist theory employs a sociological perspective. Bean's (1990) model of student attrition, which merges concepts from Bean and Metzner's (1985), and Tinto's (1975; 1987)

frameworks, develops an explanation through an industrial perspective.

Further, these perspective(s) define the explanatory focuses of each framework (i.e., Bean, 1990; Bean & Metzner, 1985; Tinto, 1975; 1987). Tinto's (1975; 1987; 1993; 1997) student interactionist theory emphasizes student's integration and institutional commitment. Bean and Metzner's (1985) nontraditional student model stresses the influence of student attitudes and environmental factors. In particular, Bean and Metzner's (1985) nontraditional student model focuses on the influence non-collegiate student activities have on dropout behaviors. For example, students may neglect their educational pursuits by working. And as students devote more time to work, the less available time they have to study, interact with other students, and participate in college events. The model suggests the more time students devote to non-collegiate activities, such as working, the greater chance students have to dropout. While Bean's (1990) student attrition model accounts for the influence of student attitudes and environmental factors, the model underscores the importance of organizational fit.

The perspective(s) and explanatory emphasis used in Bean and Metzner's (1985) framework and Tinto's (1975; 1987; 1993; 1997) theory limits each framework's explanatory ability. By diminishing the importance of college integration and emphasizing the role of non-collegiate environmental factors, Bean and Metzner's (1985) model overlooks students who integrate into their educational institution by working on-campus. Alternatively, Tinto's (1975; 1987) theory does not stress non-collegiate factors but emphasizes student integration. The student interactionist theory (Tinto, 1975; 1987; 1993) focus limits its explanatory

application to college students who reside on a college campus. However, Bean's (1990) model of student attrition provides a more complete explanation by building upon the explanatory focus of his prior work (Bean, 1983; Bean & Metzner, 1985) while incorporating concepts emphasized by Tinto's (1975; 1987; 1993; 1997) theory. In doing so, Bean's (1990) model of student attrition presents a persistence explanation that takes into account the influential interactions between students, their post-secondary institution, and factors external to the collegiate environment. According to Bean's (1990) model, achieving a balance between students' college integration, their involvement with significant others (non-collegiate), and (paid) employment participation is critical for college persistence.

Several studies (e.g., Bean, 1980; 1983; 1985; Berger & Braxton, 1998; Cabrera et al., 1992) validate the conceptual relationships formulated by Bean's (1990) student attrition model. Using Bean's (1980; 1983) framework, Berger and Braxton (1998) examined the college persistence of 718 students attending a highly selective private residential university with path analysis. The study results indicate students' satisfaction with institution's organizational characteristics have a positive and direct influence on students' social integration and their subsequent persistence decisions. An earlier persistence study conducted by Bean (1983) using 820 full-time, first-time, freshmen females attending a large mid-western university and ordinary least squares regression, found that students' satisfaction with organizational variables, their academic performance, and intention to remain in college positively affect student persistence. These conclusions reaffirmed Bean's earlier findings. In a previous study, using a sample of 1,171 students attending a major university and

path analysis, Bean (1980) found students' satisfaction, their academic performance, and the lack of transfer opportunities positively affected student persistence. Cabrera, Castañeda, Nora, and Hengstler (1992) and Bean (1985) concluded the environmental constructs present in the student attrition model (Bean, 1980; 1982a; 1982b; 1983; 1985; 1990) better explain student persistence compared to Tinto's (1975; 1987; 1993; 1997) student interactionist theory. The inclusion of environmental factors in Bean's (1980; 1982a; 1982b; 1983; 1985; 1990) student attrition model was found to explain six percent more (44 versus 38) of the variance in student persistence compared to the student interactionist theory (Tinto, 1975; 1987; 1993; 1997) (Cabrera et al., 1992).

While Bean's (1990) model of student attrition identifies major factors influencing student college persistence, the influence of students' interactions, activities, and learning experiences do not terminate with the completion of the college degree (Pascarella & Terenzini, 2005). As students move beyond college and into the labor market, their prior involvements in and outside college may support their transition into full-time employment. Students who worked during college may benefit from their prior work experience(s).

Influence of college student employment on post-college outcomes

Bean's (1990) model of student attrition suggests and research findings (e.g., Beeson & Wessel, 2002; Cuccaro-Alamin & Choy, 1998; Ehrenberg & Sherman, 1987; King, 2002; Kulm & Cramer, 2006; Pascarella & Terenzini, 2005; St. John, 2003) indicate increasing levels of employment participation during college adversely influences students' chances of degree completion. Research (Pascarella &

Terenzini, 2005) has also examined the influence working during college has on post-college outcomes in the areas of cognitive growth, the development of career related skills, and students ability to secure employment (after college).

While limited research has been conducted, no known study has found that working during college positively influences student cognitive growth (Inman & Pascarella, 1998; Pascarella, Bohr, Nora, & Terenzini, 1996; Pascarella, Edison, Nora, Hagedorn, & Terenzini, 1998.) However, student employment research has found college employment to positively affect career related skills and improve students' opportunity to gain fulltime employment in the post-college labor market (Pascarella & Terenzini, 2005). Research (Astin, 1993; Broughton & Otto, 1999; Hackett, Croissant, & Schneider, 1992; Kuh, 1995) suggests working during college enhances students' development of career-related skills. The career skills gained by working during college have also been found to enhance students' likelihood of securing full-time employment directly after graduation (Casella & Brougham, 1995; Knouse, Tanner, & Harris, 1999; Reardon, Lenz, & Folsom, 1998), especially when the work experience was related to their majors (Kysor & Pierce, 2000).

According to Bills (2003) and Merton (1967), several explanations (e.g., human capital, signaling-screening, control, cultural capital, institutional, and credentialism theories) link individuals' abilities, skills, and knowledge to success (i.e., skill development, securing employment and earnings) in the labor market. While each explanation provides reasons for gainful employment, only human capital theory (Becker, 1964; 1975; 1993; Mincer, 1974) explains private monetary rewards and differences in the earnings received for individuals' unique productive capacities

and work experience. However, researchers (e.g., Block, 1990; Elster, 1983) have challenged human capital theory's (Becker, 1964; 1975; 1993; Mincer, 1974) foundational assumptions.

Within the context of this study, the most notable criticism pertains to human capital theory's reliance on the notion that economic self-interest is the sole determinant for individuals' investment decisions. Block (1990) contends that economic self-interest provides a narrow and incomplete explanation of human behavior that fails to account for social, cultural, and political determinants of individuals' actions. Further, human capital theory (Becker, 1964; 1975; 1993; Mincer, 1974) assumes individual investment decisions are rationally made weighing lifetime benefits against the expected costs. However, Elster (1983) argues that under complex and uncertain conditions, the difference between rational action and perfect rationality can be substantial. Elster (1983) suggests that regardless of the explanatory rationale for individuals' investment decisions, no decision can be made knowing the total cost and benefits associated with subjects' choices. Despite these noted criticisms, when compared to alternative theories (e.g., signaling-screening, control, cultural capital, institutional, and credentialism theories) explaining labor market success, human capital theory (Becker, 1964; 1975; 1993; Mincer, 1974) remains the most suitable framework to examine differences in private earnings.

Returns to college student employment

This study further utilized the industrial perspective, included in Bean's (1990) model of student attrition, by employing human capital theory (Becker, 1964; 1975; 1993; Mincer, 1974) to examine the impact student employment has on post-

college earnings. This section discusses the human capital concepts developed by Becker (1964) and advanced by Mincer (1974) to examine the investment rewards and consequences associated with college student employment.

Becker's (1963) incentivized investment structure. Human capital theory suggests firms monetarily reward employees at a commensurate level given the productive utility of their human capital or knowledge, skills, and/or health (Becker, 1964; 1975; 1993). The enhancement of an individual's human capital is costly (i.e., time and money), but can be principally improved through education and on-the-job training (Becker, 1964; 1975; 1993). While human capital's productive value is vital to firms, the ownership of human capital makes firm sponsored human capital development prohibitive (Becker, 1964; 1975; 1993).

Human capital is a nonphysical asset that cannot be separated from the individual or employee. In a competitive labor market, competing employers can bid away a fully trained individual relatively free of any training or educational costs (Becker, 1964; 1975; 1993). Rather than sponsoring the complete education and training of employees, firms have incentive to only offer specific training to develop knowledge and skills uniquely applicable to work environments within a specific firm. Instead, firms shift the cost of general training (skills and knowledge that can be used within other firms) to employees when competition for skilled labor exists (Becker, 1964; 1975; 1993). Thus firms are able to rent the general skills (Becker, 1964; 1975; 1993) of previously educated and/or trained individuals, while only having to pay specific training cost (Becker, 1964; 1975; 1993). The education and training cost savings can instead be used to attract, rent, specifically train, and retain

laborers commensurate at each employee's productive human capital level. The labor market demand for distinct types of human capital and the availability of workers that possess those varieties of human capital characteristics produces earnings differences (Becker, 1964; 1975; 1993; Mincer, 1974). A labor market's supply of and demand for educated and trained labor determines the monetary reward for private human capital investments. The monetary reward received for private human capital investments provides incentive for individuals to invest and enhance their human capital through formal schooling and on-the-job training (Becker, 1964; 1975; 1993; Mincer, 1974). However, Becker's (1963; 1975; 1993) human capital theory fails to acknowledge the earnings contributions of work experience (Light, 2001; Rosen, 1977).

Mincer's (1974) model of labor market returns. In addition to education and training, employment may further enhance one's human capital through the productive application and improvement of previously developed knowledge, skills, and/or health (Hotz et al., 2002; Pascarella & Terenzini, 2005). This conclusion is supported by Mincer's (1974) investigation into the impact education and post-school work experience has on earnings. Mincer (1974) developed and utilized a human capital earnings function that suggests earnings are a product of individuals' accumulated education and post-school work experiences. Mincer's (1974) findings indicate work experience is a significant contributor to post-college earnings.

Mincer's (1974) human capital earnings function neatly divides lifetime human capital development into two, non-overlapping phases: schooling and post-schooling work experience. Mincer's (1974) conceptual division in lifetime human

capital acquisition overlooks the potential for knowledge and skill development produced by working during the schooling phase. However, Mincer's (1974) hypothesis (i.e., work experience enhances previously developed human capital) can be directly extended to in-school work experience (Light, 2001). This application suggests working during the schooling phase will produce monetary reward through the development of individual's work quality, their willingness to accept supervision and direction, time management, and interpersonal skills (Casella & Brougham, 1995; Ehrenberg & Sherman, 1987; Gleason, 1993; Hotz et al., 2002; Light, 1999; 2001; Reardon, Lenz, & Folsom, 1998; Ruhm, 1997; Stephenson, 1982). Human capital theory (Becker, 1964; 1975; 1993; Mincer, 1974) assumes students will rationally choose to invest in the development of these skills by comparing the expected lifetime (monetary and nonmonetary) benefits against the associated costs (Becker, 1964; 1975; 1993; Ellwood & Kane, 2000; Paulsen, 2001).

Anticipated benefits from college student employment. As previously introduced, human capital theory (Becker, 1964; 1975; 1993; Mincer, 1974) suggests employed college students simultaneously develop marketable skills and knowledge through their educational and work activities. These early work experiences are presumed to develop marketable knowledge and skills beyond those gained in school alone (Casella & Brougham, 1995; Ehrenberg & Sherman, 1987; Gleason, 1993; Hotz et al., 2002; Light, 1999; 2001; Reardon, Lenz, & Folsom, 1998; Ruhm, 1997). All else being equal, working college students will depart college with greater levels of human capital when compared to their non-working counterparts. The additional human capital produced by working during college is predicted to produce higher

initial earnings than a college education alone.

Earnings. Despite the important financial implications of college student employment and the large number of working college students, limited research is known to exist investigating the influence student employment has on earnings. The general consensus of this literature indicates that student employment positively affects post-student salary outcomes. The research leading to this conclusion (e.g., Coleman, 1984; D'Amico & Baker, 1984; Ehrenberg & Sherman, 1978; Gleason, 1993; Griliches, 1980; Häkkinen, 2006; Hotz et al., 2002; Light, 1998; 1999; 2001; Meyer & Wise; 1982; Molitor & Leigh, 2005; Ruhm, 1997; Stephenson, 1982; Titus, 2010) may be limited due to potential sample selection biases (DesJardins, McCall, Ahlburg, and Moye, 2002; Porter, 2006; Titus, 2007; Thomas and Perna, 2004). However, corrective measures can be introduced to reduce the potential for estimation biases (Häkkinen, 2006; Hotz et al., 2002; Light, 1999; 2001; Molitor & Leigh, 2005; Ruhm, 1997; Titus, 2010). What follows is a critical examination of returns to student employment research in an effort to explore research trends, findings, limitations, as well as uncover research opportunities to improve our current understanding of the relationship between college student employment and post-college returns.

Returns to Student Employment Research

Despite the fact that the majority of students participate in paid employment, limited research has been conducted examining what impact work experience has on post-educational earnings. A general examination of this literature reveals distinct characteristics. First, returns to student employment research are not limited to

examining students' work experience gained during a particular education level. Instead, returns to student employment research can be disaggregated into three separate categories: Work experience gained during secondary education (e.g., Coleman, 1984; D'Amico & Baker, 1984; Light, 1998; 1999; Meyer & Wise, 1982; Ruhm, 1997; Stephenson, 1981), cumulative in-school work experience (secondary and higher education) (e.g., Griliches, 1980; Hotz et al., 2002; Light, 2001; Stephenson, 1982), and work experience gained during higher education alone (e.g., Ehrenberg & Sherman, 1987; Gleason, 1993; Häkkinen, 2006; Molitor & Leigh, 2005; Titus, 2010). Second, no known return to student employment study has found a negative relationship between college work experience and post-school earnings, with only one investigation (i.e., Ehrenberg and Sherman, 1987) reporting no significant influence. Three studies examining returns to college student employment (i.e., Gleason, 1993; Molitor & Leigh, 2005; Titus, 2010) found a positive association between early work experience and later labor-market returns. While returns to college student employment literature suggest working during college positively influences post-college earnings, conclusive evidence has yet to be established. What is evident is that the methodological approaches previously used to examine returns to college student employment are diverse.

Research Examining Returns to College Student Employment

This methodological diversity can be observed in the guiding frameworks, datasets, analytic samples, variables, and analytic techniques used across the returns to college student employment literature. Over time, new frameworks and data become available but the use of advanced statistical methods can be interpreted as an

individual attempts to produce more precise estimates. Within the larger returns to student employment literature, researchers (e.g., Light, 2001; Hotz, Tienda & Ahituv, 2002; Häkkinen, 2006; Molitor & Leigh, 2005; Ruhm, 1997, Titus, 2010) have recognized the possibility of endogeneity bias adversely influencing estimations.

Endogeneity bias exists when predictor variables are correlated with the error term, suggesting any observed relationship between the dependent and endogenous independent variables may be spurious. Endogeneity can result from measurement error, omitted variables, and sample selection. Since its acknowledgement, returns to college student employment studies have attempted to address endogeneity bias through several methods. Several studies (e.g., Ehrenberg & Sherman; Molitor & Leigh, 2005; Titus, 2010) have indirectly addressed selection bias in a limited fashion by creating a subsample matched on one or more observed characteristics.

Alternatively, investigations (e.g., Ehrenberg & Sherman; Molitor & Leigh, 2005; Titus, 2010) have also included additional control variables hypothesized to influence both in-school work behaviors and post-college earnings. Other approaches have opted to involve statistical methods of correction, such as the Heckman correction (or two-stage least square regression) (i.e., Ehrenberg & Sherman, 1987) or instrumental variable regression techniques (i.e., Titus, 2010). The following discussion presents this literature in an order according to the increasing methodological complexity used to correct for endogeneity bias.

The simplest approach to examine the relationship between college work experience and post-college earnings is a trend analysis conducted by Gleason (1993). Using a sample (n=4,068), developed from the National Center of Education

Statistics (NCES) High School and Beyond (HSB:80/86) restricted dataset, Gleason (1993) compared college students' work behaviors against their post-college hourly wage. To accomplish this, students' reported in-college work behavior data were converted to represent what percentage of a 45-hour workweek each student was involved in during college. Students were then sorted into nine categories, ranging from no college work experience (0%) to full-time employment (100%). For each category, students' mean post-college wage was calculated. From these data, Gleason (1993) observed a general trend suggesting students who worked more in college earned higher wages up to two years after graduation compared to students who did not work or worked very little. This relationship was uncovered without accounting for student characteristics beyond in-college work behavior or the possibility of endogeneity bias. Without the application of more sophisticated analytic techniques it is impossible to determine if a relationship between college student work behaviors and post-college earnings exists. Compared to Gleason's (1993) simple trend analysis, Molitor and Leigh's (2005) study uses ordinary least squares regression to offer a slightly richer insight.

Using the Bureau of Labor Statistics' National Longitudinal Survey of Youth (NLSY:79), Molitor and Leigh (2005) developed an analytic sample (n=2,145) composed of males (16 years or older in 1978) with identical family background and ability characteristics. This sample was used in conjunction with ordinary least squares regression to examine the influence college students' work experience (in years) has on post-college hourly wage. Guided by the Mincer-type production function (Mincer, 1974), the analysis controlled for students' background

characteristics, ability, post-college employment information, and labor market conditions. The regression results indicate students who accumulate one year (or 2000 hours) of work experience earned 7.4% more (5-8 years after last attendance) compared to students with no post-secondary employment history. Rather than manipulating an analytic sample to reduce endogeneity bias, Ehrenberg and Sherman (1987) used Heckman's (1979) two-stage statistical correction approach.

Ehrenberg and Sherman (1987) used NCES' National Longitudinal Study of the 1972 High School Class (NLS72) to assemble a sample (n=2,000) of full-time four-year college male students to examine the influence the number of hours college students' worked per week has on post-college average weekly and annual earnings. Guided by a utility-maximization framework, Ehrenberg and Sherman (1987) analyzed this sample using Heckman's (1979) two-stage correction technique controlling for student's background characteristics, ability, academic performance, educational characteristics, labor market conditions and included the corrective inverse Mills ratio. The results indicate college student employment has no significant relationship with earnings up to three years after exiting college. On the contrary, Titus (2010) found a positive relationship between college student employment and post-college earnings through the use of instrumental variable regression, an approach similar to the Heckman correction.

To investigate the effect college work behaviors have on students' post-college earnings, Titus (2010) used fixed-effects instrumental variable regression (and estimated using general method of moments techniques) involving a sample (n=1,702) of four-year college entrants (in the fall of 1995) who were employed in

2001 (NCES' Beginning Postsecondary Students Longitudinal Study [BPS:96/01] dataset). The analysis utilized human capital theory (through a Mincer-type production function) controlling for background characteristics, academic performance, educational characteristics, degree completion information, post-college employment information and included the instrument, whether a student declared a major in 1995. The results indicate college students' weekly work behaviors during their third year of college were positively related to their annual salary six years after first enrollment (controlling for other variables in the model).

The research conducted by Ehrenberg and Sherman (1987), Gleason (1993), Molitor and Leigh (2005), and Titus (2010) offer considerable insight into the analytic challenge of investigating the relationship between college student employment and post-college earnings. The potential presence of endogeneity bias has encouraged researchers (e.g., Ehrenberg & Sherman, 1987; Gleason, 1993; Molitor & Leigh, 2005; Titus, 2010) to use a diverse set of analytic techniques. However, each approach previously used is severely limited in its ability to produce unbiased and accurate estimates.

Methodological Limitations within the Prior Research

Across the returns to college student employment literature, most researchers (i.e., Ehrenberg & Sherman, 1987; Molitor & Leigh, 2005; Titus, 2010) have made efforts to reduce the methodological threat of selection bias. Molitor and Leigh (2005) attempted to develop a homogeneous sample by selecting subjects based on their family background and ability. Ehrenberg and Sherman (1987) and Titus (2010) utilized more advanced techniques to correct for selection bias. Ehrenberg and

Sherman (1987) used a Heckman correction approach, while Titus (2010) used instrumental variable regression. However, the degree to which these approaches correct for sample selection or endogeneity biases is questionable as each carries with it practical and methodological limitations.

Within Molitor and Leigh's (2005) study, an attempt to address sample selection bias was made through the analytic use of a sample composed of male subjects identical across family background and ability characteristics. The development of a sample matched on multiple dimensions is limited to very few observed attributes (Rosenbaum & Rubin, 1983). This method of purposive sampling limits the inclusion of subjects to individuals exhibiting specific researcher defined characteristics. Reliant on identifying subjects with exact characteristics, each additional attribute used in this sample selection process further excludes larger segments of the population. At best, this method will produce a reduced analytic sample that remains potentially heterogeneous across factors influential to the outcome under investigation. However, alternative methods of addressing selection bias have also been used. Unlike Molitor and Leigh's (2005) use of purposive sampling to address potential selection biases, Ehrenberg and Sherman (1987) and Titus (2010) utilized statistical methods.

Ehrenberg and Sherman (1987) used the Heckman (1979) correction method to account for possible selection bias. The Heckman (1979) correction is a two-step technique, first involving the use of a probit selection model to produce an inverse Mill's ratio. Calculated from residuals or unobserved variables in the probit model, the inverse Mills ratio permits the evaluation of potential bias. The subsequent step

includes the inverse Mills ratio as an additional explanatory variable in an ordinary least squares model. However, the Heckman (1979) correction method assumes errors are normally distributed and the relationships between dependent and independent variables are linear. When the errors of the probit and ordinary least square model are correlated, the ordinary least square regression estimates may be biased. To circumvent the assumptive challenges of the Heckman correction technique, Titus (2010) used instrumental variable estimation.

Like the Heckman (1979) correction method, instrumental variable regression is also used to correct for the potential presence of selection bias (Heckman, 1997). Instrumental variable regression is appropriate when a variable (or instrument) in a statistical model is identified as related to the independent variable of interest, but not the outcome under investigation (Titus, 2007). Instrumental variable regression uses this instrument within an ordinary least square regression model to control for self-selection on unobserved factors. The technical difficulty of identifying an instrument unrelated to the unobservables poses a significant challenge (Heckman, 1997; Titus, 2007). So much so, Carneiro and Heckman (2002) contend most instruments used to examine returns to other human capital investment (e.g., education) are invalid, and have produced biased and inconsistent estimates (Heckman and Li, 2004).

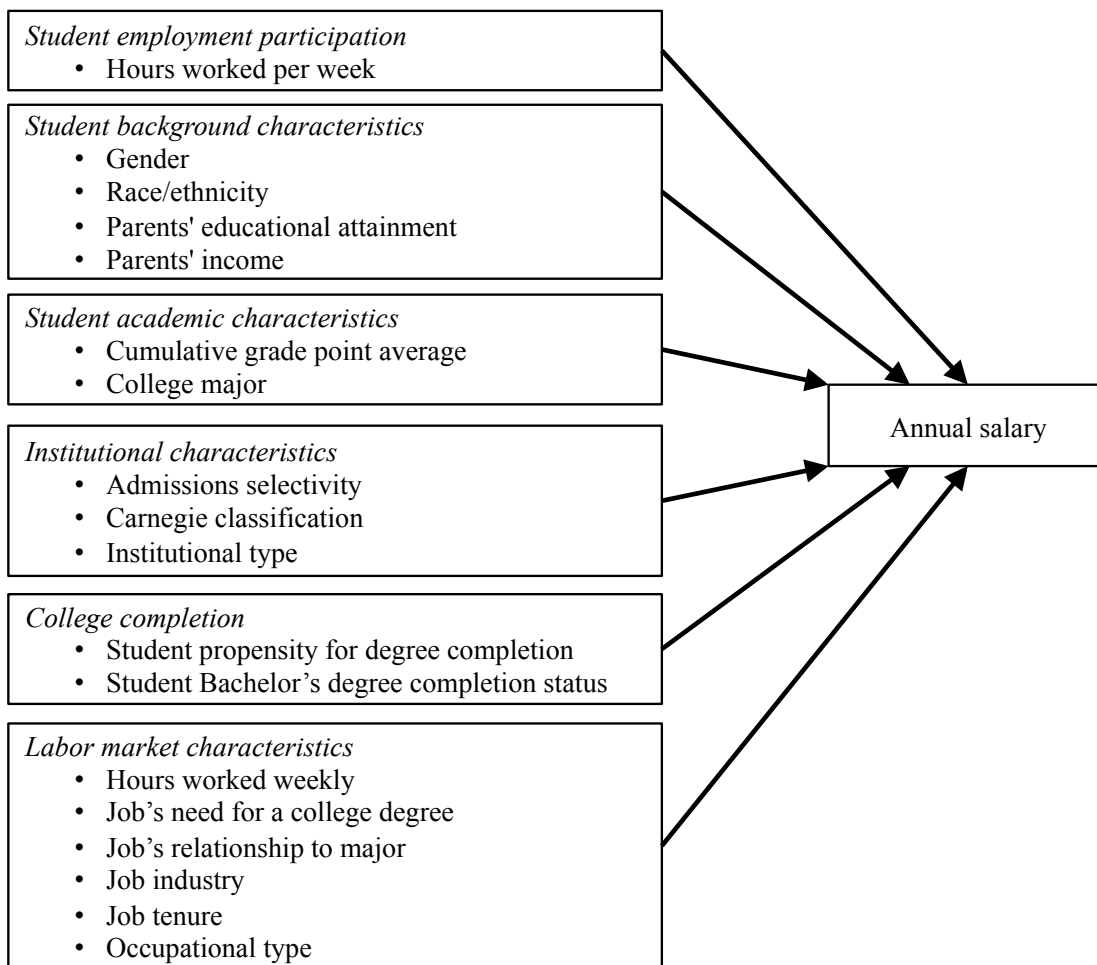
Despite the researchers' (i.e., Ehrenberg & Sherman, 1987; Molitor & Leigh, 2005; Titus, 2010) efforts to address potential selection bias, the reported associations between college student employment and post-college earning may remain inaccurate. Given the methodological limitations within the returns to college student

employment literature, previous conclusions must be reevaluated using recently developed techniques (i.e., propensity score matching) to address selection bias.

Conceptual Framework

After careful review of the literature, this study drew concepts from human capital theory (Becker, 1964; 1993), Mincer’s (1974) model of labor market returns, and returns to college student employment research in the development of a conceptual framework (Figure 5) to guide this investigation into returns to college

Figure 5. Conceptual Framework: Factors Contributing to Post-College Salary



student employment. The conceptual framework developed for this investigation into the returns to college student employment explains post-college salary as a product of the combined influence of students' employment participation during college, their education, and post-college labor market characteristics, as well as, their background, academic, and institutional features. This model focuses on individuals' major human capital developing activities (i.e., education, work experience gained during college and post-college labor market experiences), while accounting for factors (i.e., students' background, academic, and institutional characteristics) identified within the literature as also influencing post-college salary.

Summary

Examining the returns to college student employment literature reveals a complex and at times contradictory relationship between student employment decisions and labor market outcomes. The literature examining returns to college student employment suggests employment while in college may increase post-college earnings. However, prior analyses in the presence of endogeneity or sample selection biases may distort research findings. To improve our understanding of the contributions college student employment has on post-college earnings, this study acknowledged and directly addressed the use of non-comparable (i.e., heterogeneous) samples in prior returns to college student employment research.

CHAPTER III: METHOD

Research Design

This study investigated the relationships between college student employment, bachelor's degree completion, and post-college salary outcomes. Specifically, this study addressed the following research questions:

- 1) After accounting for the number of hours college students worked for pay, as well as their background characteristics, financial characteristics, academic characteristics, and academic and social integration, what contributes to the chance of bachelor's degree completion?
- 2) After controlling for the chance of degree completion and other variables, how are post-college salary outcomes related to hours worked during college, over and beyond other predictors of salary?

To answer these research questions, this observational study utilized a quantitative research design. The goal of this study was to address the selection biases present in prior studies to refine the current understanding of the returns to college student employment. As such, these questions were investigated in separate analytic phases.

Drawing concepts from Bean's (1990) student attrition model, the first analytic phase utilized a nationally representative sample of 2003-2004 four-year college entrants, developed from the Beginning Postsecondary Students Longitudinal Study (BPS:04/09), in conjunction with propensity score matching involving a logistic regression model to address students' chance of college completion. The use of propensity score matching in the first analytic phase aided in the development of a subsample, matched across multiple covariates, that was used in the second analytic

phase.

Drawing concepts from human capital theory (Becker, 1964; 1975; 1993; Mincer, 1974), the second analytic phase utilized a subsample of 2003-2004 four-year college entrants that possess statistically equivalent propensities for college completion. This matched subsample was used in combination with fixed-effects regression to examine how differences in college student employment participation impact post-college labor-market annual earnings. This chapter discusses the data source, analytic samples, variables, the analytic strategy, statistical methods, and limitations of this study.

Data

For use in this study, the Beginning Postsecondary Student Longitudinal Study (BPS:04/09) was the most appropriate dataset for at least three reasons. First, the BPS:04/09 follows the persistence and college completion of first-time, beginning undergraduate students. Second, the BPS:04/09 collects information germane to individuals' experiences throughout college and into the labor force. Third, the information included in the BPS:04/09 is derived from institutional records, national databases, and student surveys. What follows is an extended discussion regarding the development of the BPS:04/09 dataset.

This study used data from the second (2009) follow-up to the 2004 Beginning Postsecondary Student Longitudinal Study (BPS:04/09), a restricted national database sponsored by the National Center for Education Statistics. The BPS:04/09 followed first-time undergraduate 2003-2004 cohort members' experiences throughout college and into the labor force. Sampling students (in the United States and Puerto Rico)

who previously participated in the 2004 National Postsecondary Student Aid Study (NPSAS:04), the BPS:04/09 dataset is derived by combining previously collected NPSAS:04 data with student surveys and institutional records. The BPS:04/09 collected student information at three points in time: during students' initial academic year (2003-2004) as part of the NPSAS:04 survey, then by survey three (2006) and six years (2009) later. Each data collection cycle emphasized different aspects relative to subjects' anticipated educational, life, and employment transitions, while re-visiting prior topics in later data collection cycles to provide continuity over time.

The Beginning Postsecondary Students Longitudinal Study (BPS:04/09) initial data collection includes information collected for the 2004 National Postsecondary Student Aid Study (NPSAS:04) base year (Cominole, Wheelless, Dudley, Franklin, & Wine, 2007). Using nationally representative and cross-sectional samples of postsecondary students and institutions, the National Postsecondary Student Aid Study (NPSAS) has collected information following student cohorts in 1990, 1996, and 2004. Also sponsored by the National Center for Education Statistics, the NPSAS is designed to collect information examining how students and their families pay for postsecondary education. The initial data collection also captured information pertaining to demographic characteristics, as well as school and work experiences.

The first follow-up survey (BPS:04/06) captured the academic progress and persistence, focusing on students' continued educational experience, educational financing, workforce participation, and the relationship between postsecondary education participation and societal/personal outcomes (Cominole et al., 2007). The

second follow-up survey (BPS:04/09) assessed completion rates, focusing on bachelor's degree completion, while continuing to collect information pertaining to education and employment, including the transition to post-college employment. Questions relating to changes in family formation and individuals were also investigated. In addition to the student surveys, postsecondary transcripts were requested during each data collection cycle and used to collect data regarding institutions attended, terms enrolled, academics (awards and/or probation by term), tests (institutional and/or admissions scores), degrees, majors, and coursework undertaken. The final BPS:04/09 dataset possesses information reflecting nearly 16,700 students attending 1,360 postsecondary institutions.

The Beginning Postsecondary Student Longitudinal Study (BPS:04/09) focus on individuals' experiences throughout college and into the labor force provides a unique reservoir of information for an investigation into identifying factors associated with students' chance of bachelor's degree completion and the relationship college student work experience has with post-college earnings. The BPS:04/09 dataset includes detailed information pertaining to students' background, academic, social, institutional, and employment characteristics, as well as, students' post-college labor market attributes. This information served to approximate constructs within the frameworks that guided this study. This chapter continues by discussing in what ways data from all three BPS:04/09 collection cycles were used to identify analytic samples and represent framework constructs used within this study's two analytic phases.

Sample Selection

This investigation utilized Beginning Postsecondary Student Longitudinal Study (BPS:04/09) data to develop analytic samples for each research phase. To investigate students' chance of college completion, the first analytic phase utilized a sample limited to 2003-2004 four-year college entrants, who did not complete a bachelor's degree or completed a bachelor's degree at their first higher education institution. For use in the second analytic phase, this initial sample was further restricted to subjects who, six years after initial college enrollment, are participating in the labor market, but not pursuing graduate level education. From this subsample, college students with statistically equivalent propensities for bachelor's degree completion were selected to form the final analytic sample.

In the second analytic phase, the matched subsample of 2003-2004 four-year college entrants with statistically equivalent propensities for college completion was used to investigate the relationship between college student employment participation and post-college annual earnings. Table 1 provides information detailing the BPS:04/09 variables used for the progressive development of samples in this study. This information includes variable names, descriptions, and data usage.

Variables

This study's research questions were investigated in separate analyses using different dependent variables. To address the chance of bachelor's degree completion, the dependent variable was bachelor's degree completion status in 2009, measured as a yes/no indicator variable. The dependent variable used to address post-college salary outcomes was annual salary in 2009, measured as the natural log of 2009 annual earnings.

Table 1

Analytic Sample Selection Variable Descriptions, Exclusions, and Usage

Variable Type	Variable	Beginning Postsecondary Students 04/09 Variable Information			Data Usage	
		Name	Description	Original BPS Coding Structure	Data Exclusion(s)	Analytic Phase (1) (2)
Sample Selection variables						
	Institutional type first attended, 2003-2004	FLEVEL	Indicates the level of the first institution the respondent attended during the 2003-2004 academic year.	4-year (1), 2-year (2), Less-than-2-year (3)	Drop subjects who did not first attend a 4-year institution. Drop 2-year (2), and less-than-2-year (3) students	x x
	Bachelors degree attainment at first institution through 2009	ATBAFI6Y	Indicates whether the respondent attained a bachelor's degree at the first institution as of June 2009.	No degree (0), Attained bachelor's degree, at first institution (1), Attained bachelor's degree, not at first institution (2)	Drop subjects who did not complete bachelor's degree at first institution (2)	x x
	Graduate student status, 2009	GRENRO9	Indicates whether the respondent was enrolled in graduate school in 2009.	No (0), Yes (1)	Drop subjects enrolled in graduate school in 2009 (1)	x
	Employment status, 2009	JOBST09	Indicates whether the respondent was employed at the time of the interview in 2009	No (0), Yes (1)	Drop subjects not employed in 2009 (0)	x
	Looking for job at time of interview, 2009	UNEMPL09	Indicates whether the respondent is currently looking for a job as of 2009 interview	No (0), Yes (1)	Drop case if individual was not looking for employment in 2009 (0)	x

Note: (#) denotes coding structure

Source: BPS:04/09

To address the first research question, concepts from Bean's (1990) model of student attrition, which explains college completion, were reflected in the selection of independent variables. In the first phase of analysis, six sets of independent variables were included: students' employment participation, background characteristics, financial characteristics, social integration, academic integration, and academic characteristics. Students' employment participation was reflected using the number of hours worked per week in 2006. Student background characteristics included: gender, race/ethnicity, and socioeconomic status (i.e., parents' educational attainment and income), college admissions score, unmet financial need, and students' campus residency status, all observed in 2003-2004. Student academic characteristics were reflected by students' cumulative grade point average in 2004. Reflecting college

retention literature, measures of student social integration included the intensity of participation in fine arts activities, student clubs, and school sports, all during 2003-2004. Student financial characteristics were reflected by students' monetary need (after receiving financial aid) during the 2003-2004 academic year. Student academic integration included the intensity of study group participation and interactions with an advisor and faculty, in 2003-2004. Table 2 provides information detailing the variables used to address factors associated with bachelor's degree completion. This information relates constructs found in Bean's (1990) model of student attrition to data found in the BPS:04/09 dataset.

In addition, NCES provides sample weights to correct for over- and/or under-represented population segments within the BPS:04/09 dataset. To produce accurate estimates across all racial and ethnic groups, panel weights developed by NCES were included in both analytic stages. The use of panel weights limits the presence of sampling bias and improves the estimates produced in both analytic stages.

Further, the complex sampling features of the BPS:04/09 must be taken into account. The BPS:04/09 sampled subjects who participated in the NPSAS:04 (Cominole, et al., 2007). The NPSAS:04 employed a two-stage stratified sampling design. Because the data were not collected using simple random sampling, the use of traditional methods for computing sampling variance and standard errors would produce imprecise estimates (Stapleton, 2010). The use of balanced repeated replication was employed in the first analytic phase, as advised by NCES (Cominole, et al., 2007), to adjust the standard errors.

To address the second research question, concepts from human capital theory (Becker, 1964; 1975; 1993) and Mincer's (1974) model of labor market returns, which explain post-college salary, were reflected in the selection of independent variables. In the second analytic phase, six sets of independent variables were included: student employment participation, student background characteristics, student academic characteristics, institutional characteristics, college completion status, and labor market characteristics. Students' employment participation was reflected using the number of hours worked per week in 2006. Student background characteristics included: gender, race/ethnicity, and socioeconomic status (i.e., parents' educational attainment and income). Student academic characteristics were reflected by students' cumulative grade point average as of 2006 and college major as of 2009. Institutional characteristics were reflected by students' college/university admissions selectivity, Carnegie institutional classification and control. College completion variables included students' propensity for degree completion and degree completion status as of 2009. Labor market characteristics in 2009 included number of hours worked weekly, the employment need for a college degree, job-major relationship, and the industry of one's current job, as well as, post-college job tenure and present occupation. Table 3 provides information detailing the variables used to investigate returns to college student employment. This information relates prior investigations usage of human capital (Becker, 1964; 1975; 1993; Mincer, 1974) concepts, found in the BPS:04/09 dataset, to investigate labor market outcomes.

Unlike the first analytic stage, balanced repeated replication was not employed in the second analytic phase, due to a technical requirement violation.

Table 2

Analytic Phase I Variable Descriptions: BPS:0409 Proxies for Bean's (1990) Model of Student Attrition Constructs

Variable Type	<i>Framework construct</i>	<i>Proxy</i>	Name	<u>BPS:04/09 Variable Info.</u> Description
Dependent Variables				
	Bachelor's degree completion status, 2009		ATBAFI6Y	Indicates whether the respondent attained a bachelor's degree at the first institution as of June 2009.
Independent Variables				
<i>Student employment participation</i>				
	Hours worked per week, 2006		HRSWK06	Indicates the average hours the respondent worked per week, 2006
<i>Student background characteristics</i>				
	Gender		GENDER	Indicates the respondent's gender.
	Race/ethnicity		RACE	Indicates whether the respondent's race-ethnicity.
	Parents' educational attainment		PAREduc	Indicates the highest level of education of either parent of the respondent during the 2003-2004 academic year.
	Parents' income		DEPINC	Indicates the dependent student's parents' total income for 2002.
	College admissions score		TESATDER	Indicates either the sum of SAT I verbal and math scores or the ACT composite score converted to an estimated SAT I combined score.
	Unmet financial need		SNEED2	Indicates the remaining need after all financial aid (need-based and non-need-based) the respondent received during the 2003-2004 academic year.
	Campus residency status, 2003-2004		LOCALRES	Indicates the respondent's type of housing while enrolled at the most recent school.
<i>Student academic characteristics</i>				
	Cumulative grade point average, 2003-2004		GPA	Indicates the respondent's cumulative Grade Point Average (GPA) for the 2003-2004 academic year.
<i>Student social integration</i>				
	Informal interactions with Faculty, 2003-2004		FREQ04A	Indicates whether or how often the respondent had informal or social contacts with faculty members outside of classrooms and the office.
	Fine arts activities, 2003-2004		FREQ04D	Indicates whether or how often the respondent attended music, choir, drama or other fine arts activities.
	Student club participation, 2003-2004		FREQ04E	Indicates whether or how often the respondent participated in school clubs
	Participation in school sports, 2003-2004		FREQ04F	Indicates whether or how often the respondent participated in varsity, intramural, or club sports
<i>Student academic integration</i>				
	Interactions with faculty, 2003-2004		FREQ04B	Indicates whether or how often the respondent talked with faculty about academic matters, outside of class time (including e-mail) when last enrolled.
	Interactions with advisor, 2003-2004		FREQ04C	Indicates whether or how often the respondent met with advisor concerning academic plans when last enrolled.
	Study group participation, 2003-2004		FREQ04G	Indicates whether or how often the respondent attended study groups outside of the classroom when last enrolled.
<i>BPS calibrated panel weight</i>				
			WTB000	
<i>BPS calibrated replicate weights</i>				
			WTB001-WTB200	

Source: BPS:04/09

Table 3

Analytic Phase 2 Variable Descriptions: BPS:04/09 Proxies for Human Capital Theory (Becker, 1993; Mincer, 1974) Constructs

Variable Type	Variable Set	Variable Name	BPS:04/09 Variable Info. Description	Examples of Prior Research Usage
Dependent Variables				
	Annual salary, 2009	INCRES09	Respondent's annual income at current job as of June 2009.	Ehrenberg & Sherman, 1987; Häkkinen, 2006; Titus, 2010
Independent Variables				
<i>Student employment participation</i>				
	Hours worked per week, 2006	HRSWK06	Indicates the average hours the respondent worked per week, 2006	Ehrenberg & Sherman, 1987; Gleason, 1993; Titus, 2010
<i>Student background characteristics</i>				
	Gender	GENDER	Indicates the respondent's gender.	Häkkinen, 2006; Titus, 2010
	Race/ethnicity	RACE	Indicates whether the respondent's race-ethnicity.	Ehrenberg & Sherman, 1987; Light, 2001; Molitor & Leigh, 2005; Titus, 2010
	Parents' educational attainment	PAREduc	Indicates the highest level of education of either parent of the respondent during the 2003-2004 academic year.	Häkkinen, 2006
	Parents' income	DEPINC	Indicates the dependent student's parents' total income for 2002.	Ehrenberg & Sherman, 1987; Häkkinen, 2006
<i>Student academic characteristics</i>				
	Cumulative grade point average, 2006	GPA09	Indicates the respondent's grade point average when last enrolled through 2009.	Ehrenberg & Sherman, 1987; Jones & Jackson, 1990; Rumberger & Thomas, 1993; Thomas, 2000; 2003; Titus, 2010
	College major, 2009	MAJ09B	Respondent's primary 12-category major or field of study when last enrolled in 2009.	Arcidiacono, 2004; Häkkinen, 2006; Rumberger & Thomas, 1993; Thomas, 2000; Titus, 2010
<i>Institutional characteristics</i>				
	Students' college/university admissions selectivity	SELECTV2	Indicates the level of selectivity of the first institution the respondent attended during 2003-2004.	Black, Daniel, & Smith, 2005; Black & Smith, 2003; Brewer, Eide, & Ehrenberg, 1999; Dale & Krueger, 2002; Ehrenberg & Sherman, 1987; Zhang, 2005
	Carnegie institutional classification	CC2005C	Indicates the Basic Carnegie classification of the first institution attended.	Monks, 2004
	Institutional control	FCONTROL	Indicates the control of first institution (public, private not-for-profit, or private for-profit) the respondent attended during the 2003-2004 academic year.	Brewer, Eide, & Ehrenberg, 1999; Monks, 2004
<i>College completion</i>				
	Students' propensity for degree completion*			
	Bachelor's degree completion status, 2009	ATBAFI6Y	Indicates whether the respondent attained a bachelor's degree at the first institution as of June 2009.	Titus, 2010
	Hours worked weekly, 2009	JOBHRS09	Average hours the respondent worked per week at job in 2009	Titus, 2010
	Job's need for a college degree, 2009	JOBRDG09	Indicates whether the respondent was required to obtain a 2-year or 4-year college degree as a condition for the current job.	Titus, 2010

Table 3 (conti.)

Analytic Phase 2 Variable Descriptions: BPS:04/09 Proxies for Human Capital Theory (Becker, 1993; Mincer, 1974) Constructs

Variable Type	Variable Set	Variable	Name	<u>BPS:04/09 Variable Info.</u>		<u>Examples of Prior Research Usage</u>
				Description		
Independent Variables (conti.)						
<i>Labor market characteristics</i>						
		Job related to major, 2009	JOBRLM09	Indicates whether the respondent's current job was related to the respondent's major or field of study when he/she last enrolled as an undergraduate.		Fuller & Schoenberger, 1991
		Industry of one's job, 2009	JOBIND09	Indicates the type of industry in which the respondent worked as of 2009.		Titus, 2010
		Post-college job tenure, 2009	JOBMON09	The total number of months the respondent had worked at current job and any similar job that the respondent had before it.		Titus, 2010
		Occupational Type, 2009	JOBOCC09	Respondent's job title in 2009.		Titus, 2010
		<i>BPS calibrated panel wieght</i>		WTB000		
		<i>BPS institutional cluster identifier</i>		BPS09PSU		

Note: * denotes variable will be estimated during phase 1 analysis

Source: BPS:04/09

Data inspection revealed 44% of the strata represented in the propensity score matched sample possessed the necessary two or more primary sampling units (i.e., clusters) to correctly run variance estimation procedures. However, to account for the BPS:04/09 complex sampling features, the (NCES-provided) cluster identifier variable was used to estimate clustered robust standard errors.

Analytic Strategy

The data for this study were analyzed using STATA 13 in separate and related stages. Addressing the first research question, in the first analytic stage, involved the use of a logistic regression selection model in which the dependent variable was college completion and the independent variables were reflected by concepts from Bean's (1990) model of student attrition. The logistic regression enabled conclusions

to be drawn regarding what factors relate to college completion (dichotomous variable). The logistic regression model was used, in conjunction with propensity score matching, to select a subsample of comparable (i.e., homogeneous) subjects to address selection bias in the second analytic stage. To produce accurate estimations of a relationship, the association under evaluation must be free of threats to internal validity (Guo & Fraser, 2010). These internal validity threats include: ambiguous temporal precedence, selection, history, maturation, regression, attrition, testing, instrumentation, and additive and interactive effects (Shadish, Cook, & Campbell, 2002).

Whether overt or covert, the presence of one or more of these threats introduce the possibility of selection bias (Guo & Fraser, 2010); resulting in a sample of individuals who differ prior to the condition in a manner influential to the outcome (Rosenbaum, 2002). Any analysis in the presence of selection bias equates to a comparison of non-comparable (i.e., heterogeneous) subjects (Heckman, Ichimura, & Todd, 1997). To avoid an analysis compromised by selection bias, this study used propensity score matching to reduce or eliminate selection bias (Guo & Fraser, 2010). Using logistic regression generated propensity scores, propensity score matching permitted the selection of a statistically homogenous subsample with comparable likelihoods of bachelor's degree completion. Following Riggert and associates (2006) recommendation, the use of a homogenous analytic sample will correct for selection bias and improve the accuracy of research findings in the second analytical phase.

To address the second research question, in the second analytic stage, the matched sub-sample (developed in first stage) was used in combination with fixed-

effects regression in which the dependent variable was salary (continuous variable) and the independent variables represented concepts from human capital theory (Becker, 1993; Mincer, 1974). Using fixed-effects regression permitted the examination of the relationship between post-college salary outcomes and hours worked during college. Further, the use of fixed-effects took into account unobserved industry and occupational effects.

A further presentation of individual techniques involved in the analytical strategy is needed. What follows is a discussion of logistic regression, propensity score matching, and fixed-effects regression.

Analytic Techniques.

Logistic Regression. To address the first research question, logistic regression was used in the first stage of analysis. Logistic regression is a statistical technique used to examine whether a binary outcome has a significant predictive relationship with one or more independent variables selected based on a guiding framework (Cohen, Cohen, West, & Aiken, 2003). The use of logistic regression analysis was the most appropriate statistical technique as the dependent variable for research question one (i.e., bachelor's degree completion) was dichotomous and the independents reflected concepts from Bean's (1990) model of student attrition. The logistic regression results permitted the identification of the significant relationships and determined the strength and direction of each relationship.

Interpretation. Logistic regression results can be reported in several formats (e.g., logged odds, odds, odds ratios, and probabilities) (Pampel, 2000). The standard logistic regression coefficients are generated in terms of logged odds. While logged

odds are additive and linear (identical to ordinary least squares regression), the natural logarithm of the odds (i.e., logged odds) lacks a meaningful metric. To alleviate the difficulty of interpretation, researchers commonly report odds ratios (Tabachnick & Fidell, 2007). Odds ratios reflect the relative likelihood of an outcome occurring for a comparison group compared to a reference group (Hosmer and Lemeshow, 2000). An odds ratio of one signifies that both (comparison and referent) groups have equivalent likelihoods of an outcome occurring; odds ratios above one indicate an increased likelihood for one group as compared to the other and values below one represent a reduced likelihood for the focal group. The reliability of logistic regression results is contingent on utilizing a statistically sufficient sample size, and an appropriately specified model, with minimal multicollinearity amongst the independent variables.

Data Requirements and Diagnostics. Hosmer and Lemeshow (2000) provide a conservative recommendation of at least 50 observations for each independent variable. This study utilized a vector of 38 independent variables to represent concepts within Bean's (1990) model of student attrition. Using Hosmer and Lemeshow's (2000) recommended 50 observations per predictor, this study required a minimal sample size of 1,900. Additional diagnostic tests were conducted to assess model specification and multicollinearity.

Model specification refers to the determination of the functional form and variables included in a statistical model (Cohen, et al., 2003). Failure to properly specify a model may result in producing biased and inconsistent estimates (Lee, Lee, & Lee, 1999). A link test was conducted to assess model specification. In addition to

model specification, the selected independent variables must not exhibit excessive levels of multicollinearity.

Multicollinearity is the existence of high levels of linear dependency (or correlation) amongst the independent variables (Hosmer & Lemeshow, 2000). The presence of multicollinearity suggests the same concepts or phenomena are being measured. Regression analysis requires the independent variables themselves must be free of multicollinearity. Multicollinearity was assessed through an examination of variance inflation factors (VIFs). A conservative VIF of five or more provides evidence of serious multicollinearity (O'Brien, 2007).

Matching on Propensity Scores. The goal in the second analytic stage was to estimate the return to college student employment, free of selection bias. Given the richness of the BPS:04/09 dataset, propensity score matching (PSM) may be the most appropriate method to achieve this objective. The Neyman-Rubin counterfactual framework (N-RCF) (Neyman, 1923; Rubin, 1974; 1978; 1980; 1986) enables propensity score matching (PSM) to utilize subjects' predicted probability of exhibiting a condition (based on predictors of the condition) to select an appropriate sample of highly similar or equivalent comparison groups (Guo & Fraser, 2010). This sample selection approach (i.e., matching subjects on calculated predicted likelihoods) effectively reduces or eliminates selection bias. Propensity score matching is routinely used in impact evaluation studies to evaluate the causal comparative influence an intervention has on an outcome.

This subsection discusses the traditional use of propensity score matching by reviewing the challenge of causal inference, the use of N-RCF to overcome those

challenges, the assumptions involved, and the implementation of the N-RCF through propensity score matching. The PSM discussion focuses on the application of the N-RCF within this study. Within this chapter's subsection (i.e., matching on propensity scores), the words condition, assignment, intervention, and treatment were used synonymously to mean a subject or group's state of affairs given the completion of a behavior (e.g., counseling, educational remediation) or the expression of a time invariant characteristic (e.g., ethnicity, place of birth).

Assessing causal comparative influence. The routine question in impact evaluation studies is, "to what extent does participation affect an outcome, compared to non-participation (Guo & Fraser, 2010)?" Addressing this question requires a two-step process before a causal inference can be made. First, the relationship under evaluation must be found to meet the basic, and generally accepted, characteristics of a causal relationship: succession, covariation, and genuineness (Campbell, 1957). That is, in order to infer a condition "causes" an outcome, the condition must have occurred (and terminated) prior to the outcome. Further, the condition and outcome must exhibit correlated variation, whereby the condition and outcome change together. Lastly, the association must be free of factors, other than the condition, influencing the relationship. Second, to accurately compare the outcomes associated with conditional participation and non-participation, the groups being compared must be equivalent on all factors influential to the outcome with the exception of their participation status.

The most direct and efficient approach to assess a condition's influence on an outcome would be a comparison of observed outcomes in the presence and absence of

the condition for a single subject (or group) at a unique time period (Caliendo & Kopeinig, 2005; Guo & Fraser, 2010; Heinrich, Maffioli, & Vázquez, 2010; Khandker, Koolwal, & Samad, 2010). This scenario avoids introducing threats to internal validity, most notably selection bias, into the analysis by comparing outcomes for hypothetical groups who would be identical prior to being selected into a conditional state. However, in reality, only one potential outcome (associated with the condition subjects were selected into) can be observed in the data. The fundamental challenge of causal (comparative) inference is estimating the counterfactual or the unobserved outcome (associated with the condition subjects were not selected into) (Caliendo & Kopeinig, 2005; Guo & Fraser, 2010; Holland, 1986; Heinrich, Maffioli, & Vázquez, 2010; Khandker, Koolwal, & Samad, 2010). Propensity score analysis overcomes this missing data problem using the N-RCF (Neyman, 1923; Rubin, 1974; 1978; 1980; 1986) to develop comparison groups to estimate the counterfactual (Caliendo, & Kopeinig, 2005; Guo & Fraser, 2010; Heinrich, Maffioli, & Vázquez, 2010; Khandker, Koolwal, & Samad, 2010). The N-RCF provides the basis for using observed data to develop comparison groups focusing on the elimination of selection bias.

Neyman-Rubin counterfactual framework and its assumptions. Due to the missing data problem, the N-RCF (Neyman, 1923; Rubin, 1974; 1978; 1980; 1986) contends a subject's counterfactual outcome cannot be directly estimated. Instead, the N-RCF shifts the comparative focus to an evaluation of the observed outcomes between subjects participating in different conditional states (e.g., treatment and control) (Guo & Fraser, 2010). To avoid a comparison of non-comparable groups

(i.e., selection bias), the evaluation must utilize groups equivalent across characteristics predicting conditional assignment. Although this evaluation is a comparison of subjects (within different groups) participating in different conditional states, the imposed similarity (i.e., homogeneity) between the subjects' pretreatment characteristics reduces the analysis to a comparison of outcomes unaffected by factors other than the conditional assignment. Because the subjects do not differ prior to their observed conditional assignment in a manner meaningful to the outcome, the N-RCF attributes the difference between the matched subjects outcomes to the conditional assignment (as a causal effect).

In essence, the N-RCF answers the question, “what would participants’ outcomes have been, if they had not participated (Guo & Fraser, 2010)?” Scaled up to the group level, answering this question allows researchers to calculate the average gain from participation for participants (average treatment effect on the treated or ATT), the expected average gain from participation for non-participants (average treatment effect on the untreated or ATU), and the expected gain from participation for a randomly selected unit from the population (average treatment effect or ATE) (Guo & Fraser, 2010; Heinrich, et al., 2010; Khandker, et al., 2010; Titus, 2007). To ensure an accurate evaluation of a condition’s ATT, ATU, and ATE, the comparative samples must adhere to the three assumptions embedded within the N-RCF: stable unit treatment value assumption, the ignorable treatment assignment assumption, and the assumption of common support.

Assumptions. The stable unit treatment value assumption (SUTVA) states treatment (e.g., bachelor’s degree completion within this study) should be uniform

(i.e., exhibiting no variation) for all subjects within a treatment level (e.g., either students completed a college degree or did not) (Guo & Fraser). Further, subjects' outcomes should be dependent on the treatment they were assigned and not the treatments of other subjects (Guo & Fraser; Titus, 2007). A violation of SUTVA or the presence of spillover effect can exist when there is interference between subjects or when at least one unrepresented treatment level exists. Violations of the SUTVA will produce inaccurate group outcome estimations (Guo & Fraser).

Often absorbed within the SUTVA, the ignorable treatment assignment assumption (ITAA) is uniquely important as it ensures comparison groups are credibly comparable (Guo & Fraser, 2010). Also known as unconfoundedness (Rosenbaum & Rubin, 1983), selection on observables (Barnow, Cain, & Goldberger, 1980), and conditional independence (Lechner, 1999), the ITAA (Guo & Fraser, 2010) states that conditioned on the predictors of receiving treatment, subjects' assignment to treatment or a comparison group is independent of the outcome and that unobserved bias is ignorable (Thoemmes & Kim, 2011). That is, regardless of subjects' observed conditional assignment, matched subjects must not display an observed and unobserved bias toward assignment to a specific condition. The ITAA assumption ensures subjects are equivalent across pretreatment characteristics, therefore isolating subjects' assigned treatment as the only factor influencing the outcome.

A further requirement, beyond the SUTVA and ITAA, is the assumption of common support, also known as the overlap condition. The common support assumption asserts pre-matching data must possess both participants and

nonparticipants with highly similar or equivalent propensity scores. (Caliendo & Kopeinig, 2005; Guo & Fraser, 2010; Heinrich, et al., 2010; Khandker, et al., 2010; Titus, 2007). Only through the presence of common support can comparison groups, with statically equivalent propensity scores, be selected (through matching) and treatment effects assessed.

The challenge in estimating a condition's treatment effect on an outcome (i.e., ATT, ATU, and ATE) is the identification of comparable (i.e., homogeneous) groups and the evaluation of the matched subsample's adherence to the methodological assumptions (Guo & Fraser, 2010). Propensity score matching is the analytic technique used to implement the N-RCF. The PSM process generally includes the estimation of propensity scores, the assembly of comparison groups balanced on propensity scores, followed by an evaluation of N-RCF assumptions. This subsection (i.e., matching on propensity scores) continues by discussing PSM's implementation of the N-RCF, focusing on the techniques usage within this study.

Neyman-Rubin counterfactual framework implementation. To succinctly review PSM's conceptual foundations, the N-RCF argues causal influence can be assessed through a comparison of observed outcomes between groups in different conditional states (e.g., treatment and control), who share highly similar or equivalent probabilities for receiving treatment (i.e., propensity scores), based on subjects' pretreatment characteristics (Guo & Fraser, 2010). Due to the imposed similarity between the comparison group's pretreatment characteristics (i.e., the elimination of selection bias), the difference in the group outcomes is inferred to be the result of the conditional assignment. Satisfying the N-RCF's conceptual requirements for

developing comparable (i.e., homogeneous) groups involves a three-step procedure enabling post-matching analysis of treatment effects.

Estimating propensity scores. The first step in PSM is the generation of subjects' propensity scores (Guo & Fraser, 2010). A propensity score is a subject's probability of exhibiting a condition given a vector of covariates (Rosenbaum & Rubin, 1985). Several options are available to estimate propensity scores, including logistic, probit, discriminant or multinomial logit analyses. The selection of analytic variables depends on the condition being assessed for treatment effects. While the dependent variable represents the condition being evaluated, the independent variables should represent concepts predicted to influence conditional assignment. Within this investigation, the logistic regression model used to address the first research question (in the first analytic stage) was also used to generate subjects' propensity scores. The propensity scores developed during the first analytic stage represent subject's predicted likelihood of bachelor's degree completion, conditioned on concepts from Bean's (1990) model of student attrition. The propensity scores estimated in the first stage were used in the next PSM step to assemble comparison groups.

Matching on propensity scores. Propensity score matching's second step involves the systematic matching of subjects, in different conditional states, with highly similar or equivalent propensity scores (Gou & Frazer, 2010). The conceptual goal within this step was to develop comparison groups who were as equivalent as possible in terms of their calculated propensity scores. Three categories of algorithms are available to conduct the matching: Greedy, Mahalanobis metric, and optimal

matching (Guo & Fraser, 2010).

The unique matching methods, across these categories, differ based on the utilization of cases whose propensity score values may be difficult to match and include within the final sample (Guo & Fraser, 2010; Heinrich, et al., 2010; Titus, 2007). Each matching method presents a tradeoff in the presence of selection bias with the precision of estimating treatment effects (Caliendo & Kopeinig, 2005; Guo & Fraser, 2010; Heinrich, et al., 2010; Khandker, et al., 2010). In that, the more exacting matches are made, the less selection bias will be present between the comparison groups. However, stringent matching methods diminish the number of possible matches (reducing the final subsample size), potentially increasing the variance observed in the outcome variable. This increased variance leads to the estimation of less precise treatment effects.

While numerous matching methods are available, the literature does not identify a single “best” approach (Guo & Fraser, 2010; Heinrich, et al., 2010; Titus, 2007). Instead, an examination of select matching methods was conducted to identify the most appropriate algorithm for use within this study. For this examination, nearest neighbor within caliper, kernel-based, and local linear matching techniques were investigated. The algorithm demonstrating the greatest reduction in selection bias was identified and used to develop a matched subsample, based on subjects’ observed characteristics.

To evaluate each matching algorithm’s overall selection bias reduction, a comparison of pre- and post-matching median absolute standardized bias (MASB) was conducted (Thoemmes & Kim, 2011). The MASB assesses the difference in the

independent variables' marginal distributions. The overall reduction in the MASB (from pre- to post-matching) is an indication of the overall improvement in the balance of pretreatment characteristics between comparison groups (Caliendo & Kopeinig, 2005; Sianesi, 2004; Thoemmes & Kim, 2011). The matching technique (i.e., nearest neighbor within caliper, kernel-based or local linear) observed to generate the greatest bias reduction was used to develop a matched subsample for use in this study's second analytic stage.

Matching algorithms. Nearest neighbor one-to-one within caliper (non-replacement) matching uses a pre-specified threshold (i.e., caliper) to restrict the absolute propensity score difference between matched subjects (Caliendo & Kopeinig, 2005; Guo & Fraser, 2010; Heinrich, et al., 2010; Khandker, et al., 2010). The chosen caliper size determines the similarity (or the level of homogeneity) between matched subjects and ultimately, the comparability between groups (Guo & Fraser, 2010). Determined by the researcher, the caliper is the maximum standard deviation distance (difference) allowed between matched subjects. Beginning with Rosenbaum and Rubin's (1983) recommended .25 of a standard deviation, the caliper width can and was adjusted to ensure groups were statistically equivalent across all predictor variables. With the removal of subjects for whom matches could not be found, the remaining subsample reflected groups of individuals with equal likelihoods of exhibiting a condition.

Nearest neighbor one-to-one within caliper (non-replacement) matching focuses on developing comparison groups with highly similar or equivalent propensity scores (Caliendo & Kopeinig, 2005; Guo & Fraser, 2010; Heinrich, et al.,

2010; Khandker, et al., 2010). While comparability between the groups is a major advantage of the method, a large amount of data (i.e., subjects) can be lost.

Alternative matching methods, kernel-based and local linear, have been designed to more efficiently use data producing larger analytic samples and more precise treatment estimates. However, these improvements come at the expense of increasing levels of heterogeneity between matched comparison groups (due to imperfect matching of subjects).

Kernel-based matching estimates the counterfactual using propensity scores to match conditioned subjects with the weighted averages of unconditioned subjects (Guo & Fraser, 2010; Morgan & Winship, 2007; Titus, 2007). The weights are based on the calculated distance between conditioned and unconditioned subjects (Guo & Fraser, 2010; Heinrich, et al., 2010; Khandker, et al., 2010; Morgan & Winship, 2007; Titus, 2007). In this method, selection of the kernel function and bandwidth parameters is of particular importance (Heinrich, et al., 2010). For instance, some kernels match using all unconditioned subjects (e.g., Gaussian kernel), while others use subjects within a researcher specified probability bandwidth (e.g., Epanechnikov) (Guo & Fraser, 2010). The choice of the bandwidth size also influences the trade-off between selection bias and precision (Guo & Fraser, 2010; Titus, 2007). Larger bandwidths provide greater tolerance for matching subjects with dissimilar propensity scores, allowing for more efficient use of available data and greater precision in estimating treatment effects. Conversely, specifying a narrow bandwidth reduces precision and selection bias. Kernel-based and local linear matching similarly use a weighted matching scheme for counterfactual imputation (Heinrich, et al., 2010;

Khandker, et al., 2010; Titus, 2007). However, local linear matching matches unconditioned subjects' propensity scores with the weighted average of all conditioned subjects. The weights used in the local linear matching process are based on the conditioned outcomes within a propensity score range.

The subsamples produced through nearest neighbor within caliper, kernel, and local linear matching techniques differ based on efficiency of data utilization (Guo & Fraser, 2010; Heinrich, et al., 2010; Titus, 2007). Using the same original data, the subsamples produced by each matching method are expected to differ across sample size and the presence of selection bias (i.e., comparability). Within this study, the goal of the second analytic stage was to produce estimates free of selection bias. By that objective, the algorithm demonstrating the greatest selection bias reduction, through a comparison of median absolute standardized biases (MASB), was used to develop a matched subsample, based on subjects' observed characteristics.

Assumptional evaluation. The second step (in PSM) is to select comparable (i.e., homogeneous) groups, based on subjects' observed characteristics (Guo & Fraser). Given that different matching methods produce different levels of comparability, PSM's third and final step involves examining the matched subsample's intergroup comparability through an evaluation of the N-RCF assumptions (i.e., SUTVA, common support, and ITAA). The stable unit treatment value assumption (SUTVA) states all known treatment levels must be accounted for and treatment must be uniform within each level (Guo & Fraser, 2010).

As previously suggested, the SUTVA has been satisfied as the treatment variable (within this study), bachelor's degree completion, is observed as a binary

condition. In that, bachelor's degree completion can only exist in one of two states, either an institution has or has not conferred a bachelor's degree, based on the completion of all degree requirements and institutional processes. Identifying matched pairs of subjects across these groups requires the original data to satisfy the assumption of common support.

The common support assumption ensures subjects in both groups share highly similar or equivalent propensity scores (conditioned on observed characteristics) (Caliendo & Kopeinig, 2005; Guo & Fraser, 2010; Heinrich, et al., 2010; Khandker, et al., 2010; Titus, 2007).). It is only in this area of overlap that credible matches can be made. Evaluating the common support area is a straightforward visual inspection. Researchers can gauge the extent of propensity score overlap between the conditional groups (pre- and post-matching) through density-distribution plots (e.g., histograms). More formally, Kolmogorov-Smirnov tests can be performed to verify what the density plots suggest (Heinrich, et al., 2010).

Having established a clear distinction between conditional states (i.e., SUTVA) and assessed the degree of propensity score overlap between them, the compositional comparability between post-matching comparison groups must be assessed through an evaluation of the ignorable treatment assignment assumption (ITAA). The ITAA asserts that conditioned on the predictors of assignment, assignment is independent of the potential outcome (Guo & Fraser, 2010). The ITAA requires a subject and their matched pair to have statistically equivalent probabilities for assignment into both conditional states (Thoemmes & Kim, 2011). The ITAA cannot be empirically tested, however alternative methods are employed to assess

observed and unobserved bias (Guo & Fraser, 2010; Heinrich, et al., 2010; Khandker, et al., 2010).

The generally accepted convention employed to assess the presence of observed bias in the matched subsample are bivariate analyses for each independent variable and the dichotomous treatment (outcome) variable (used in PSM's first step) (Heinrich, et al., 2010; Khandker, et al., 2010, Guo & Fraser, 2010). Chi-square tests were used when the independent variable was categorical and independent sample t-tests when the independent variable was continuous. A rejection of the null hypothesis ($\alpha = .05$) suggests a significant correlation exists between treatment assignment and outcome that is conditional on the independent variables. This assumptional violation would suggest the comparison groups differ in manner meaningful to conditional assignment. Within this study, sampling distribution analyses (i.e., chi-square and independent sample t-tests) were used to examine observed bias; while a Rosenbaum bound analysis (DiPrete & Gangl, 2004; Rosenbaum, 2002) was conducted to investigate unobserved (or hidden) bias.

The presence of unobserved (or hidden) bias can undermine the selection process and subsequent post-matching analysis (Becker & Caliendo, 2007; DiPrete & Gangl, 2004; Lanehart, Rodriguez de Gil, Kim, Bellara, Kromrey, & Lee, 2012; Rosenbaum, 2002; Thoemmes & Kim, 2011). The Rosenbaum bound sensitivity analysis determines how influential an unobserved variable must be to affect the selection process and alter conclusions drawn from analyses involving the matched subsample (DiPrete & Gangl, 2004; Rosenbaum, 2002).

Based on the Wilcoxon signed-rank test, the Rosenbaum bound sensitivity

analysis tests for the ATT at a hypothetical level of hidden bias (DiPrete & Gangl, 2004). Expressed as Γ , the set level of hidden bias reflects the assumption of bias treatment assignment due to an unobserved covariate. For each hypothetical Γ level tested, the calculated level of significance (i.e., p-value) represents the bound significance level of the treatment effect in the case of bias selection into a treatment condition. Through a comparison of the Rosenbaum bounds at different Γ levels, researchers can assess the strength an unobserved variable must have in order to undermine the matching analysis. Low levels of sensitivity suggest all important covariates and potential confounders were accounted for in the selection process (Thoemmes & Kim, 2011), suggesting the estimated treatment effect is unbiased (Lanehart, et al., 2012).

It is important to note Rosenbaum bounds are worst-case scenario results based on the existence of a hypothetical and unobserved variable, and not the presence of unobserved bias (DiPrete & Gangl, 2004). However, the information communicates the level of influence an unobserved variable must have in order to bias the selection process and subsequently, research conclusions. In order to doubt post-matching analysis research findings, researchers must first have reason to believe the selection model omitted a variable that possesses a minimum level of influence (as determined by Rosenbaum bound analysis) to undermine the selection process.

Following the post-matching evaluation of the N-RCF's assumptions, the matched sub-sample can be used in post-matching analyses. Within this study, the

matched subsample was utilized in combination with fixed-effects regression to estimate the returns to college student employment.

Fixed-effects Regression. Analysis of the PSM generated matched subsample was used in combination with regression, involving fixed-effects in regards to industry and occupation, to address the second research question. Fixed-effects regression is a statistical technique used to explain the variability in a dependent variable given a vector of the independent variables selected based on theory (Allison, 2009). The fixed-effects regression is an extension of ordinary least squares regression. Unlike the dichotomous dependent variable used in logistic regression, fixed-effects regression utilizes a continuous variable. The use of fixed-effects regression analysis was the most appropriate statistical technique as the dependent variable for the second research question (i.e., post-college annual salary) was continuous, and the independents reflected concepts from human capital theory (Becker, 1964; 1975; 1993; Mincer, 1974). Further, fixed-effects regression uses dummy independent variables to account for invariant unobserved effects that may be correlated with observed independent variables. Within this study, fixed-effects were used to account for unobserved industry and occupational effects. The use of propensity score matching and fixed-effects regression were combined to restrict sample selection bias and estimate the return to college student employment. An alternative approach to correct for the potential presence of selection bias, but not dependent on propensity matching's ignorable treatment assignment assumption (ITAA), would be the use of instrumental variable regression (Wooldridge, 2010).

Instrumental variable regression is appropriate when a variable (or instrument)

in a statistical model is identified as related to the independent variable of interest, but not the outcome under investigation (Titus, 2007). Instrumental variable regression uses this instrument within an ordinary least square regression model to control for self-selection on unobserved factors. The technical difficulty of identifying an instrument unrelated to the unobservables poses a significant challenge (Heckman, 1997; Titus, 2007). In fact, Carneiro and Heckman (2002) contend most instruments are invalid, and have produced biased and inconsistent estimations (Heckman and Li, 2004). Given that the reliability of instrumental variable regression is dependent on identifying and utilizing a suitable instrument, instrumental variable regression should be pursued when the outcome is not conditionally independent of the treatment (Wooldridge, 2010).

The combined use of propensity score matching and fixed-effects regression allowed for the reduction in sample selection bias when examining the relationship between the hours students' work during college and their post-college annual salary. However, the reliability of the regression results is contingent on utilizing a statistically sufficient sample size, and an appropriately specified model, which lacks multicollinearity and heteroskedasticity.

Data Requirements and Diagnostics. Babyak (2004) provides a recommendation of at least 10 observations for each independent variable when using ordinary least square (OLS) regression. This study utilized a vector of 84 independent variables to represent concepts within Bean's (1990) model of student attrition. Using Babyak's (2004) recommended 10 observations per predictor, this study required a minimal sample size of 840 cases. Additional diagnostic tests were

conducted to assess model specification, multicollinearity, and heteroskedasticity.

Model specification refers to the determination of which independent variables should be included and excluded from a statistical analysis (Cohen, et al., 2003). Failure to properly specify a model may result in producing biased and inconsistent estimates (Lee, Lee, & Lee, 1999). A link test was conducted to assess model specification. In addition to appropriate model specification, the independent variables must not exhibit excessive levels of multicollinearity.

Multicollinearity is the existence of high levels of linear dependency (or correlation) amongst the independent variables (Hosmer & Lemeshow, 2000). The presence of multicollinearity suggests the same concepts or phenomena are being measured. Regression analysis requires the independent variables themselves must be free of excessive multicollinearity. Multicollinearity was assessed through an examination of variance inflation factors (VIFs). A conservative VIF of five or more provides evidence of serious multicollinearity (O'Brien, 2007).

The final diagnostic evaluates the presence of heteroskedasticity or the unequal variance in the error term of the regression equation (Allison, 1999). Analyses using heteroskedastic data will generate unbiased estimates, but the reported standard errors may be bias above or below the population variance. The potentially biased standard errors may lead to biased inferences. To assess the presence of heteroskedasticity, scatter plots were visually inspected to assess the variance of the residuals.

Study Limitations

This study has at least four limitations. First, this research utilized data from a secondary source. Although the National Center for Education Statistics designed the Beginning Postsecondary Students Longitudinal Study to collect information regarding students' college and labor force experiences, proxies were used to represent some constructs in this study. For example, the BPS:04/09 does not capture study participants' total employment experience, limiting the inclusion of this work experience characteristic to either the number of hours worked per week or the length of time subjects have held the same or similar job. Second, given the data limitations of the Beginning Postsecondary Students Longitudinal Study, this study is restricted to examining bachelor's degree completion and salary outcomes up to 6 years after initial college enrollment. The final two limitations require a closer and expanded discussion as they pertain to the accuracy of the self-reported data collection involved in the BPS:04/09 development and the appropriateness of the statistical model used to examine the relationship between college student employment and post-college returns.

Self-reported data. The third limitation relates to the accuracy of the data used to inform this study. While the Beginning Postsecondary Students Longitudinal Study utilized institutional records and national databases for data collection, surveys were also used. This study relied on participant reported information to account for student employment participation, college integration, and post-college labor market characteristics, including salary.

The advantage of self-reported data collection is that it may gather information that may be unobtainable in any other way (e.g., views and opinions)

(Barker, Pistrang, & Elliott, 2005). However, the reliability of self-reported data is commonly questioned due to the potential for subjects' inaccurate recall, non-descript accounts, exaggerations, and deception. This doesn't mean self-reported data are invalid, but it suggests the data collection cannot always be trusted (Ericsson & Simon, 1993). To examine BPS:04/09 data collection reliability, the NCES tested subjects' response consistency (Wine, Cominole, & Caves, 2009). After the BPS:04/09 field test, a subsample of subjects (n=300) was reinterviewed using a subset of initial interview items. Reliability assessments were made using subjects' field test and reinterview responses. For discrete variables, reliability was assessed as the percentage of exact matches between the paired responses. For continuous variables, reliability was assessed if the association between subjects' initial interview and reinterview responses were within one standard deviation. The tests of association used (for continuous variables) included Cramer's phi (estimates the strength between two nominal variables), Kendall's tau-*b* (assesses the strength between three or more ranked items), and Pearson's *r* (estimates the correlation between two interval/ratio variables). Through the reliability assessments, NCES found that the BPS:04/09 produced high quality data and consistently reliable results (Wine, Cominole, & Caves, 2009).

Model specification. While human capital theory (Becker, 1964; 1975; 1993; Mincer, 1974) suggests individuals are monetarily rewarded for the developing marketable skills and knowledge through their education and work activities, the supporting literature also suggests many additional factors predict earnings. The research examining earnings suggests, that in addition to education and employment,

incomes are also influenced by subjects' health (e.g., Halla & Zweimüller, 2013; McLean & Moon, 1980), personality (e.g., Borghans, Duckworth, Heckman, & Baster, 2008; Bowles, Gintis, & Osborne, 2001; Robins, Homer, & French, 2011), self-confidence (e.g., Judge, Hurst, & Simon, 2009; Santos-Pinto, 2012), IQ (e.g., Heineck & Anger, 2010; Zax & Rees, 2002), academic achievement/performance (e.g., Jones & Jackson, 1990; Rumberger & Thomas, 1993; Thomas, 2000; 2003), academic major (e.g., Arcidiacono, 2004; Rumberger & Thomas, 1993; Thomas, 2000), institutional (i.e., college) quality (e.g., Black, Daniel, & Smith, 2005; Black & Smith, 2003; Dale & Krueger, 2002; Zhang, 2005), institutional type (e.g., Brewer, Eide, & Ehrenberg, 1999; Light & Strayer, 2004; Monks, 2000; Monk-Turner, 1994), occupational aspirations (e.g., Marini & Pi-Ling, 1997), self-efficacy (e.g., Murray, 2000), labor market information (e.g., Hofler & Murphy, 1994; Ogloblin & Brock, 2005; Polachek & Robst, 1998; Polachek & Xiang, 2006), union membership (e.g., Cho & Cho, 2011; Volscho & Fullerton, 2005), and residency (i.e., rural, urban, suburban) (e.g., Roback, 1988; Vera-Toscano, Iphimiister, & Weersink, 2004). Accounting for these predictors in a statistical model is dependent on the availability of the information captured within a single dataset.

The BPS:04/09 was specifically developed to collect data relevant to labor market outcomes. However, many of the known predictors of earnings (previously noted) are not captured within the BPS:04/09 dataset. Consequently, the omission of one or more potentially relevant variables relating to earnings is possible. The omission of predictive variables may cause incomplete model specification. To appropriately specify the statistical model, this study used human capital theory and

prior returns to college student employment research to guide the selection of variables. However, as the data become available, the relevant predictors precluded from this study should be involved in future examinations exploring the direct effect on income, as well as any mediating or moderating influence they possess, potentially altering the relationship between college student employment and post-college earnings. Although beyond the scope of this investigation, future research should also investigate how group differences (e.g., gender, race/ethnicity, socioeconomic status, geography, educational settings, post-college work setting, and the congruence between college and post-college employment) are manifested within the relationship between college student employment and post-college earnings.

Summary

This chapter defined the data, analytic samples, variables, analytic strategy and statistical techniques used in the examination of factors associated with bachelor's degree completion and returns to college student employment. Conducted in separate analytic phases, this study involved a secondary analysis of BPS:04/09 data using propensity score matching and fixed-effects regression. To address the first research question, a sample of 2003-2004 four-year college entrants, who did not complete a bachelor's degree or completed a bachelor's degree at their first higher education institution was used to identify important constructs, from Bean's (1990) model of student attrition, associated with bachelor's degree completion. The second analytic phase, examining returns to college student employment, was grounded in human capital theory (Becker, 1964; 1975; 1993; Mincer, 1974) and prior research using a sample of 2003-2004 four-year college entrants with statistically equivalent

propensities for college completion was further restricted to subjects who, six years after initial college enrollment, are participating in the labor market and not pursuing graduate level education. Variables identified for use in each investigation were selected based on guiding frameworks and prior research usage. This study contributes to the existing literature by controlling for selection bias using propensity scores to develop a homogenous sample for analysis.

CHAPTER IV: RESULTS

Chapter Overview

Pursuant to the study method, this chapter presents the results developed using the STATA 13 statistical package. The findings are presented in three sections. Addressing students' chances of bachelor's degree completion (i.e., research question one), the first section reviews the analytic sample, variables, and techniques used prior to presenting the results and diagnostics of the analysis. Transitioning to the second stage, the subsequent section examines the success propensity score matching has had on reducing selection bias in the development of the second stage analytic sample. The third section reviews the propensity score matched sample, variables, and analytic techniques used to address the returns to college student employment (i.e., research question two) before presenting the results and diagnostics from the analysis. For comparative purposes, the results produced using the unmatched (i.e., pre-propensity score matched) subsample are also discussed.

Table 4

Descriptive Statistics of Variables Used in the Phase I Analysis (n=6,094)

<i>Variable</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min</i>	<i>Max</i>
<i>Bachelor's degree completion (2009)</i>				
Non-completer	0.37	0.48	0	1
Completer	0.63	0.48	0	1
<i>Hours worked per week (2006)</i>				
0	0.32	0.46	0	1
1-10 hrs	0.18	0.38	0	1
11-20 hrs	0.25	0.43	0	1
21-30 hrs	0.15	0.35	0	1
31+ hrs	0.11	0.32	0	1
<i>Gender</i>				
Male	0.45	0.50	0	1
Female	0.55	0.50	0	1

Table 4 (conti.)

Descriptive Statistics of Variables Used in the Phase I Analysis (n=6,094)

<i>Variable</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min</i>	<i>Max</i>
<i>Student race/ethnicity</i>				
White	0.75	0.43	0	1
Hispanic or Latino	0.10	0.30	0	1
Black or African American	0.09	0.29	0	1
Asian	0.06	0.24	0	1
<i>Parents' educational background</i>				
High school or less	0.19	0.39	0	1
Some college	0.23	0.42	0	1
Bachelor's degree	0.28	0.45	0	1
Master's degree	0.20	0.40	0	1
Doctoral degree	0.10	0.30	0	1
<i>Parents' income level (2002)</i>				
1st Quartile	0.27	0.45	0	1
2nd Quartile	0.26	0.44	0	1
3rd Quartile	0.24	0.43	0	1
4th Quartile	0.23	0.42	0	1
<i>Subjects' college admission score</i>				
1st Quartile	0.30	0.46	0	1
2nd Quartile	0.25	0.43	0	1
3rd Quartile	0.25	0.43	0	1
4th Quartile	0.20	0.40	0	1
<i>Subjects' residency during college (2004)</i>				
Lived off-campus	0.31	0.46	0	1
Lived on-campus	0.69	0.46	0	1
<i>Students' unmet need (2004)</i>				
1st Quartile	0.52	0.50	0	1
3rd Quartile	0.22	0.41	0	1
4th Quartile	0.26	0.44	0	1
<i>Students' grade point average (2004)</i>				
Ds or mostly Ds	0.04	0.20	0	1
Cs or mostly Cs	0.13	0.34	0	1
Bs or mostly Bs	0.43	0.50	0	1
As or mostly As	0.39	0.49	0	1
<i>Frequency of social interaction with faculty (2004)</i>				
Never	0.52	0.50	0	1
Sometimes	0.40	0.49	0	1
Often	0.07	0.26	0	1
<i>Frequency of participation in fine arts activities (2004)</i>				
Never	0.46	0.50	0	1
Sometimes	0.40	0.49	0	1
Often	0.14	0.35	0	1
<i>Frequency of participation in student clubs (2004)</i>				
Never	0.51	0.50	0	1
Sometimes	0.32	0.46	0	1
Often	0.17	0.38	0	1

Table 4 (conti.)

Descriptive Statistics of Variables Used in the Phase I Analysis (n=6,094)

<i>Variable</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min</i>	<i>Max</i>
<i>Frequency of participation in school athletic activities (2004)</i>				
Never	0.58	0.49	0	1
Sometimes	0.21	0.41	0	1
Often	0.21	0.41	0	1
<i>Frequency of academic interaction with faculty (2004)</i>				
Never	0.14	0.34	0	1
Sometimes	0.69	0.46	0	1
Often	0.18	0.38	0	1
<i>Frequency of interaction with an academic advisor (2004)</i>				
Never	0.15	0.36	0	1
Sometimes	0.62	0.49	0	1
Often	0.23	0.42	0	1
<i>Frequency of participation in study groups (2004)</i>				
Never	0.29	0.45	0	1
Sometimes	0.57	0.50	0	1
Often	0.15	0.35	0	1

Note: Estimates have been adjusted using weights and variance estimation procedures to account for the BPS:04/09 two-stage stratified sampling design.

Source: BPS:04/09

Stage 1: Chances of Bachelor's Degree Completion

The exploration into the factors predicting bachelor's degree completion involved Beginning Postsecondary Students Longitudinal Study (BPS:04/09) data from 2004 (i.e., subjects' initial college enrollment year), 2006 (i.e., third year in college) and 2009 (i.e., six years after initial college enrollment). The first phase of investigation involved an analytic sample limited to 2003-2004 four-year college entrants, who did not complete a bachelor's degree or completed a bachelor's degree at their first higher education institution. In terms of the sample's demographic characteristics (see Table 4), subjects were predominantly white (75%), female (55%), and over half came from households possessing at least one parent who completed, at a minimum, a bachelor's degree (58%). During their first year in

college (i.e., 2004), the majority lived on-campus (69%) and earned B's or greater in their coursework (82%). Socially in 2004, the majority of students never interacted with faculty (52%), nor participated in fine arts (46%), student clubs (51%), and school athletic (58%) activities. Academically in 2004, the majority of these students sometimes interacted with faculty (69%), an academic advisor (62%), and participated in study groups (57%).

Statistical analysis. The BPS:04/09 data were analyzed using a logistic regression model. The dependent variable, bachelor's degree completion status, was based on data collected during the second follow-up in 2009. The independent variables were based on data from students' first and third year of college enrollment and reflect concepts from Bean's (1990) model of student attrition. To accurately calculate beta coefficients and/or standard errors, the NPSAS:04 (and by extension, the BPS:04/09) violation of simple random sampling was taken into account using variance estimation. The logistic regression analysis utilized NCES specified (Cominole, et al., 2007; Wine, et al., 2009) balanced repeated replication that involved sampling and replicate weights. Table 4 provides the descriptive statistics for the variables used in the first analysis.

Table 5

Likelihood of Completing a Bachelor's Degree by 2009 Among Students Who First Enrolled in Fall 2004 at Four-Year Colleges and Universities (n=6,094)

	<i>Beta Coefficient</i>	<i>Standard Error</i>	<i>Odds Ratio</i>
Hours worked per week (2006)			
0 hrs (reference group)			
1-10 hrs	0.596	0.128	1.814***
11-20 hrs	0.353	0.123	1.424**
21-30 hrs	0.017	0.128	1.017
31+ hrs	-0.733	0.142	0.480***

Table 5 (conti.)

Likelihood of Completing a Bachelor's Degree by 2009 Among Students Who First Enrolled in Fall 2004 at Four-Year Colleges and Universities (n=6,094)

	<i>Beta Coefficient</i>	<i>Standard Error</i>	<i>Odds Ratio</i>
Gender			
<i>Male (reference group)</i>			
Female	0.305	0.084	1.357***
Student race/ethnicity			
<i>White (reference group)</i>			
Hispanic or Latino	-0.100	0.177	0.905
Black or African American	-0.055	0.164	0.946
Asian	0.327	0.192	1.387
Parents' educational background			
<i>High school or less (reference group)</i>			
Some college	-0.116	0.133	0.890
Bachelor's degree	0.136	0.142	1.145
Master's degree	0.289	0.147	1.335
Doctoral degree	0.046	0.195	1.047
Parents' income level (2002)			
<i>1st Quartile (reference group)</i>			
2nd Quartile	0.085	0.147	1.088
3rd Quartile	0.212	0.155	1.237
4th Quartile	0.537	0.167	1.710**
Subjects' college admission score			
<i>1st Quartile (reference group)</i>			
2nd Quartile	0.657	0.125	1.928***
3rd Quartile	0.678	0.145	1.970***
4th Quartile	1.033	0.141	2.810***
Subjects' residency during college (2004)			
<i>Lived off-campus (reference group)</i>			
Lived on-campus	0.476	0.112	1.609***
Students' unmet need (2004)			
<i>1st Quartile (reference group)</i>			
3rd Quartile	0.027	0.125	1.027
4th Quartile	0.099	0.128	1.104
Students' grade point average (2004)			
<i>Ds or mostly Ds (reference group)</i>			
Cs or mostly Cs	1.409	0.238	4.093***
Bs or mostly Bs	2.395	0.236	10.964***
As or mostly As	3.023	0.238	20.552***
Frequency of social interaction with faculty (2004)			
<i>Never (reference group)</i>			
Sometimes	-0.013	0.101	0.987
Often	-0.042	0.196	0.958
Frequency of participation in fine arts activities (2004)			
<i>Never (reference group)</i>			
Sometimes	-0.003	0.108	0.997
Often	-0.222	0.142	0.801

Table 5 (conti.)

Likelihood of Completing a Bachelor's Degree by 2009 Among Students Who First Enrolled in Fall 2004 at Four-Year Colleges and Universities (n=6,094)

	<i>Beta Coefficient</i>	<i>Standard Error</i>	<i>Odds Ratio</i>
Frequency of participation in student clubs (2004)			
<i>Never (reference group)</i>			
Sometimes	0.109	0.110	1.115
Often	0.390	0.132	1.478**
Frequency of participation in school sports (2004)			
<i>Never (reference group)</i>			
Sometimes	-0.016	0.146	0.985
Often	0.017	0.126	1.017
Frequency of academic interaction with faculty (2004)			
<i>Never (reference group)</i>			
Sometimes	0.402	0.146	1.495**
Often	0.382	0.173	1.466*
Frequency of interaction with an academic advisor (2004)			
<i>Never (reference group)</i>			
Sometimes	0.159	0.135	1.173
Often	0.019	0.169	1.020
Frequency of participation in study groups (2004)			
<i>Never (reference group)</i>			
Sometimes	0.388	0.114	1.474**
Often	0.515	0.173	1.673**
Constant	-3.994		

Note: Standard errors have been adjusted using variance estimation procedures to account for the BPS:04/09 two-stage stratified sampling design. The analysis is based on data weighted by the NCE- provided weight (WTB000) and replicate weights (WTB001-WTB200).

* $p < .05$, ** $p < .01$, *** $p < .001$

Source: BPS:04/09

Results. Table 5 presents the results of the logistic regression analysis. Using an alpha level of 0.05, the Wald test found the overall logistic regression model was statistically significant, ($F(38, 162) = 21.42$, $p < 0.001$) and 17 variables were found to be significantly related to bachelor's degree completion.

The results from the regression model indicate a nonlinear relationship exists between students' chances of bachelor's degree completion and their employment

intensity in 2006. Compared to students who did not work in their third year of college, limited levels of work experience improved students' likelihood of completing a bachelor's degree. However, as their employment intensity rose, these benefits diminished and ultimately reversed, reducing students' chances of degree completion. Compared to the odds of students who were not working in their third year of college, the odds of completing a bachelor's degree were over one and three-quarters (Odds-ratio =1.814, $p < 0.001$) times the odds for students who worked a maximum of 10 hours a week and one and a half (OR=1.424, $p < 0.01$) times the odds for students who worked between 11 and 20 hours per week. However, the odds of graduating if working over 30 hours per week were approximately half (OR=0.480, $p < 0.001$) the odds of graduating if not working in 2006.

In regard to students' background characteristics, the odds of female students' completing a bachelor's degree were roughly one and a third (OR=1.357, $p < 0.001$) times the odds of their male counterparts. The odds of earning a bachelor's degree for students' with parental incomes in the highest quartile (in 2002) were about one and three-quarters (OR=1.710, $p < 0.01$) times the odds of students from the lowest quartile. Compared to the odds of students' with college admission scores in the lowest quartile, the odds of exiting college with a bachelor's degree were about two times the odds of students in the second (OR=1.928, $p < 0.001$) and third (OR=1.970, $p < 0.001$) quartiles, and three times the odds of students in the fourth (OR=2.810, $p < 0.001$) quartile. Students' first year (i.e., 2004) residency also proved to be a significant bachelor's degree completion predictor. The odds of college degree completion for students who lived on-campus during their first year in college were

roughly one and a half (OR=1.609, $p < 0.001$) times the odds of students who lived off-campus.

The greater college students perform academically, the more likely they were to complete a bachelor's degree. The odds of completing a degree for students who maintained an A, B, or C grade point average (in 2004) were 21 (OR=20.552, $p < 0.001$), 11 (OR=10.964, $p < 0.001$), and 4 (OR=4.093, $p < 0.001$) times greater, compared to students who earned a D average or below. Student levels of college integration were also related to degree completion. The odds of completing a degree were about one and a half (OR=1.478, $p < 0.01$) times higher for students who participate in clubs, compared to students who did not. Compared to the odds of students who did not academically engage with their faculty, the odds were approximately one and a half times higher for students who did so sometimes (OR=1.495, $p < 0.01$) or often (OR=1.466, $p < 0.05$). Similarly, the odds of degree completion for students who sometimes (OR=1.474, $p < 0.01$) or often (OR=1.673, $p < 0.01$) participated in study groups were roughly one and a half times greater, compared to the odds of students who did not.

Diagnostics. Diagnostic testing for goodness of fit and multicollinearity were conducted on the logistic regression model. To confirm goodness of fit, a link test was performed. The results from the link test ($\hat{p} < 0.001$, $\hat{q} p = 0.437$) show that the model was appropriately specified. To test for multicollinearity, variance inflation factors (VIF) were calculated. Variables with a VIF greater than 5 are considered to have a high level of multicollinearity (O'Brien, 2007). The VIF analysis indicated that the variance inflation factors associated with each variable

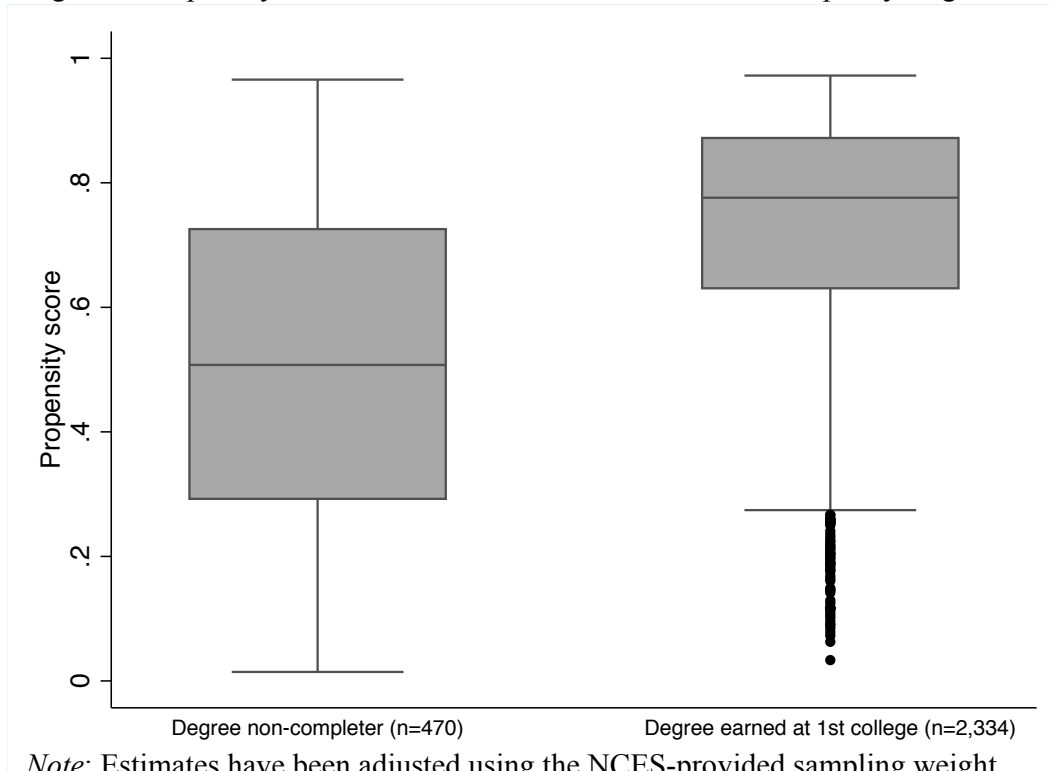
were no greater than 1.56, demonstrating that multicollinearity was not present.

Stage 2 Sample Development

The goal in the second analytic stage is to estimate the return to college student employment, with mitigated levels of selection bias. Propensity score matching was used to directly address selection bias by developing a sample of degree completers and non-completers who are as equivalent as possible in terms of their propensity for degree completion. Generated as part of the first stage analysis, students' predicted probabilities of degree completion were the basis for the development of the second stage analytic sample. The process of developing the second stage sample began by further restricting the initial sample to subjects who, six years after initial college enrollment, were participating in the labor market, but not pursuing graduate level education. This restricted sample was found to meet the pre-matching Neyman-Rubin counterfactual framework's stable unit treatment value assumption (SUTVA) and common support requirements.

Stable Unit Treatment Value Assumption. The stable unit treatment value assumption (SUTVA) states all known treatment levels must be accounted for and treatment must be uniform within each level (Guo & Fraser, 2010). The SUTVA has been satisfied as the treatment variable (within this study), bachelor's degree completion, is observed as a binary condition. In that, bachelor's degree completion can only exist in one of two states, either an institution has or has not conferred a bachelor's degree, based on students' completion of all degree requirements and institutional processes. Identifying matched pairs of subjects across these groups requires the original data to satisfy the assumption of common support.

Figure 6. Propensity Score Distribution for the Pre-matched Sample by Degree Status



Note: Estimates have been adjusted using the NCES-provided sampling weight (WTB000).

Source: BPS:04/09

Common Support Assumption. The common support assumption ensures subjects in both groups share highly similar or equivalent propensity scores (conditioned on observed characteristics). The pre-matching assumptional evaluation of the common support assumption involved an examination of box plots and the overlap in propensity scores across the conditional states. Figure 6, shows that when comparing the propensity scores distributions across conditional states, the box plot suggests the pre-matched comparison groups' propensity scores overlap considerably.

Matching Algorithm and Subsample Selection

Using the restricted samples' logistic regression generated predicted probabilities, matched subsamples were developed using nearest neighbor one-to-one within caliper (non-replacement), kernel, and local linear matching techniques. The

median absolute standardized bias (MASB) was calculated for each subsample to determine which matching technique (and associated subsample) would be most appropriate for this investigation. The MASB results found nearest neighbor one-to-one within caliper (non-replacement) matching produced the greatest level of bias reduction. Compared to the restricted sample's MASB of 22%, the subsamples produced using nearest neighbor one-to one within caliper (non-replacement), kernel, and local linear matching techniques were observed to possess MASBs of 4.2%, 6.1%, and 6.6%, respectively. Stated differently, nearest neighbor one-to-one within caliper (non-replacement) improved the balance of pretreatment characteristics by approximately 81%, 9% more than kernel, and 11% beyond local linear matching techniques. What follows is a post-matching evaluation of the nearest neighbor one-to-one within caliper (non-replacement) subsample against the Neyman-Rubin counterfactual framework's common support and ignorable treatment assignment assumptions (Neyman, 1923; Rubin, 1974; 1978; 1980; 1986).

Common Support Assumption. The post-matching assumptional evaluation of the common support assumption involved the two-sample Kolmogorov-Smirnov test for equality of distribution, using an alpha level of 0.05. This normality assessment returned a p-value of 0.291, indicating the comparison groups within the matched sample exhibit equality in propensity score distributions.

Ignorable Treatment Assignment Assumption. The ignorable treatment assignment assumption (ITAA) states that conditioned on the predictors of receiving treatment, subjects assignment to treatment or a comparison group is independent of the outcome and that unobserved bias is ignorable (Thoemmes & Kim, 2011). That

is, regardless of subjects observed conditional assignment, matched subjects must not display an observed and unobserved bias toward assignment to a specific condition. The ITAA requires a subject and their matched pair to have statistically equivalent probabilities for assignment into both conditional states.

Table 6

Pre- and Post-matching Chi-square Tests for Variables Predicting Propensity Scores

Variable	df	χ^2	
		Pre-Matched (n=2,804)	Post-Matched (n=844)
Hours worked per week (2006)	4	92.226***	1.200
Gender	1	3.950*	0.916
Student race/ethnicity	3	68.709***	4.712
Parents' educational background	4	53.153***	1.065
Parents' income level (2002)	3	45.734***	1.069
Subjects' college admission score	3	156.029***	2.210
Subjects' residency during college (2004)	1	41.173***	1.072
Students' unmet need (2004)	2	6.827*	0.312
Students' grade point average (2004)	3	255.961***	1.268
Frequency of social interaction with faculty (2004)	2	2.837	1.329
Frequency of participation in fine arts activities (2004)	2	19.413***	0.125
Frequency of participation in student clubs (2004)	2	51.437***	4.171
Frequency of participation in school athletic activities (2004)	2	3.742	3.571
Frequency of academic interaction with faculty (2004)	2	2.316	1.870
Frequency of interaction with an academic advisor (2004)	2	6.714*	0.430
Frequency of participation in study groups (2004)	2	13.524**	3.877

* p < .05, ** p < .01, *** p < .001

Source: BPS:04/09

Observed bias. Observed in Table 6, the chi-square analyses (i.e., tests of independence) reveal a marked improvement in the covariate balance (i.e., observed bias) between pre- and post-matched subsamples on each predictor of bachelor's degree completion. Using an alpha level of 0.05, the chi-square test results for the unmatched (i.e., pre-propensity score matched) sample suggests the comparison groups differ in manner meaningful to conditional assignment, violating ITAA on 13 of 16 variables. However, nearest neighbor one-to-one within caliper (non-replacement) matching improved upon these initial violations. The chi-square tests

results, which examined the matched subsample’s covariate balance, indicate (at an alpha level of 0.05) the comparison groups do not display an observed bias toward assignment to a specific outcome for each propensity score predictor. While chi-square analyses are used to test the degree to which comparison groups possess an observed bias to a conditional assignment, the influence of unobserved bias can only be hypothetically tested using Rosenbaum’s bound analysis.

Unobserved bias. The Rosenbaum bound sensitivity analysis determines how influential an unmeasured confounding variable must be to affect the selection process and alter conclusions drawn from analyses involving the propensity score matched subsample (DiPrete & Gangl, 2004; Rosenbaum, 2002). The Rosenbaum’s bounds analysis results ($\Gamma=1.48$, $p = 0.055$) suggest the selection process may be mildly robust to hidden bias. Stated differently, the selection process and subsequent research findings developed using the matched sample would be challenged if an unobserved variable increased the likelihood of completing a bachelor’s degree by 48%, relative to students who did not earn a bachelors degree.

Table 7

Descriptive Statistics of Variables Used in the Phase 2 Analysis (n=844)

<i>Variable</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min</i>	<i>Max</i>
<i>Post-college salary</i>				
Annual salary in 2009 (natural log)	10.24	0.53	6.91	11.96
<i>Hours worked per week (2006)</i>				
0	0.27	0.44	0	1
1-10 hrs	0.13	0.34	0	1
11-20 hrs	0.26	0.44	0	1
21-30 hrs	0.18	0.38	0	1
31+ hrs	0.17	0.37	0	1

Table 7 (conti.)

Descriptive Statistics of Variables Used in the Phase 2 Analysis (n=844)

<i>Variable</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min</i>	<i>Max</i>
<i>Gender</i>				
Male	0.47	0.50	0	1
Female	0.53	0.50	0	1
<i>Student race/ethnicity</i>				
White	0.71	0.46	0	1
Hispanic or Latino	0.12	0.33	0	1
Black or African American	0.12	0.33	0	1
Asian	0.05	0.21	0	1
<i>Parents' educational background</i>				
High school or less	0.22	0.41	0	1
Some college	0.29	0.45	0	1
Bachelor's degree	0.29	0.45	0	1
Master's degree	0.14	0.34	0	1
Doctoral degree	0.07	0.25	0	1
<i>Parents' income level (2002)</i>				
1st Quartile	0.29	0.46	0	1
2nd Quartile	0.24	0.43	0	1
3rd Quartile	0.27	0.44	0	1
4th Quartile	0.24	0.43	0	1
<i>Student grade point average (2006)</i>				
Cs and below	0.05	0.21	0	1
Bs or mostly Bs	0.45	0.50	0	1
As or mostly As	0.50	0.50	0	1
<i>Degree major (2009)</i>				
Education	0.08	0.26	0	1
Technical/professional/vocational	0.17	0.38	0	1
Engineering	0.06	0.25	0	1
Computer Science	0.03	0.17	0	1
Math	0.01	0.09	0	1
Physical science	0.02	0.13	0	1
Life sciences/health	0.15	0.36	0	1
Social or behavioral sciences	0.12	0.33	0	1
Humanities	0.13	0.33	0	1
Business	0.23	0.42	0	1
<i>Institutional admissions selectivity</i>				
Minimum	0.19	0.39	0	1
Moderate	0.60	0.49	0	1
High	0.21	0.41	0	1
<i>Carnegie institutional classification</i>				
Research & doctoral	0.39	0.49	0	1
Masters	0.44	0.50	0	1
Baccalaureate	0.17	0.38	0	1

Table 7 (conti.)

Descriptive Statistics of Variables Used in the Phase 2 Analysis (n=844)

<i>Variable</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min</i>	<i>Max</i>
<i>Institutional control</i>				
Public institution	0.69	0.46	0	1
Private institution	0.31	0.46	0	1
<i>Bachelor's degree completion (2009)</i>				
Non-completer	0.52	0.50	0	1
Completer	0.48	0.50	0	1
<i>Employment intensity (2009)</i>				
Part-time	0.18	0.39	0	1
Full-time	0.82	0.39	0	1
<i>Job's need for a college degree (2009)</i>				
Degree not required	0.60	0.49	0	1
Degree required	0.40	0.49	0	1
<i>Job related to major (2009)</i>				
Job does not relate to major	0.44	0.50	0	1
Job relates to major	0.56	0.50	0	1
<i>Post-college job tenure (2009)</i>				
Months employed in current or similar job	30.32	26.57	1	120

Note: Estimates have been adjusted using the NCES-provided sampling weight (WTB000).

Source: BPS:04/09

Stage 2: Returns to College Student Employment

The matched subsample, developed using the nearest neighbor one-to-one within caliper (non-replacement) algorithm, was used to examine the relationship between post-college salary outcomes and hours worked during college. In terms of the matched sample's demographic characteristics (see Table 7), subjects were predominantly white (71%), female (53%), and half (50%) came from households possessing at least one parent who completed, at a minimum, a bachelor's degree. During the subjects third year in college (i.e., 2006), half (50%) earned A's or greater in their coursework.

Statistical Analysis. The propensity score matched subsample was analyzed

using an ordinary least squares regression model, which included industry and occupational fixed-effects. The dependent variable, the natural log of annual salary, is based on data collected during the second follow-up in 2009. The independent variables were based on data from students' first and third year of college enrollment and reflect human capital theory (Becker, 1964; 1975; 1993; Mincer, 1974) concepts. Table 7 provides the descriptive statistics for the variables used in the second analytic phase. The fixed-effects regression analysis was weighted using the NCES-provided sample weight and the standard errors were adjusted for institutional clustering.

Table 8

Analysis of Annual Salary (natural log) in 2009 Among Students Who Enrolled in 2004 at Four-Year Colleges and Universities Using Matched (n=844) and Pre-matched (n=2,804) Samples

	<u>Matched</u>		<u>Pre-matched</u>	
	<i>b</i>	<i>robust s.e.</i>	<i>b</i>	<i>robust s.e.</i>
Hours worked per week (2006)				
0 (reference group)				
1-10 hrs	-0.011	(0.053)	0.011	(0.030)
11-20 hrs	0.059	(0.050)	-0.026	(0.030)
21-30 hrs	-0.044	(0.059)	-0.039	(0.034)
31+ hrs	0.109*	(0.052)	0.061	(0.034)
Gender				
Male (reference group)				
Female	-0.017	(0.043)	0.012	(0.022)
Student race/ethnicity				
White (reference group)				
Hispanic or Latino	-0.030	(0.061)	-0.011	(0.043)
Black or African American	-0.011	(0.061)	0.008	(0.040)
Asian	0.020	(0.082)	0.039	(0.038)
Parents' educational background				
High school or less (reference group)				
Some college	-0.022	(0.050)	-0.028	(0.031)
Bachelor's degree	0.028	(0.053)	0.001	(0.033)
Master's degree	0.032	(0.062)	-0.027	(0.031)
Doctoral degree	-0.066	(0.070)	-0.059	(0.041)
Parents' income level (2002)				
1st Quartile (reference group)				
2nd Quartile	-0.060	(0.062)	0.010	(0.032)
3rd Quartile	-0.038	(0.049)	0.034	(0.030)
4th Quartile	0.008	(0.059)	0.091**	(0.029)

Table 8 (conti.)

Analysis of Annual Salary (natural log) in 2009 Among Students Who Enrolled in 2004 at Four-Year Colleges and Universities Using Matched (n=844) and Pre-matched (n=2,804) Samples

	<u>Matched</u>		<u>Pre-matched</u>	
	<i>b</i>	<i>robust s.e.</i>	<i>b</i>	<i>robust s.e.</i>
Student grade point average (2006)				
<i>Cs and below (reference group)</i>				
Bs or mostly Bs	0.137	(0.147)	0.080	(0.109)
As or mostly As	0.151	(0.156)	0.125	(0.110)
Degree major (2009)				
<i>Education (reference group)</i>				
Technical/professional/vocational	0.228*	(0.108)	0.024	(0.058)
Engineering	0.301*	(0.127)	0.178*	(0.071)
Computer Science	0.090	(0.246)	0.028	(0.099)
Math	0.244	(0.204)	0.129	(0.102)
Physical science	0.179	(0.142)	-0.164	(0.151)
Life sciences/health	0.124	(0.103)	0.017	(0.057)
Social or behavioral sciences	0.173	(0.100)	0.040	(0.056)
Humanities	0.164	(0.101)	-0.017	(0.063)
Business	0.207*	(0.096)	0.069	(0.062)
Institutional admissions selectivity				
<i>Minimum (reference group)</i>				
Moderate	0.126*	(0.061)	0.106**	(0.036)
High	0.169*	(0.065)	0.178***	(0.037)
Carnegie institutional classification				
<i>Research & doctoral (reference group)</i>				
Masters	-0.038	(0.044)	-0.033	(0.024)
Baccalaureate	-0.060	(0.061)	0.006	(0.043)
Institutional control				
<i>Public institution (reference group)</i>				
Private institution	-0.013	(0.042)	-0.001	(0.026)
Bachelor's degree completion (2009)				
<i>Non-completer (reference group)</i>				
Completer	-0.038	(0.040)	-0.046	(0.028)
Employment intensity (2009)				
<i>Part-time (reference group)</i>				
Full-time	0.312***	(0.057)	0.334***	(0.046)
Job's need for a college degree (2009)				
<i>Degree not required (reference group)</i>				
Degree required	0.159**	(0.049)	0.231***	(0.027)
Job related to major (2009)				
<i>Job does not relate to major (reference group)</i>				
Job relates to major	0.161**	(0.047)	0.114***	(0.026)
Post-college job tenure (2009)				
Months employed in current or similar job	0.001	(0.001)	0.001*	(0.000)

Table 8 (conti.)

Analysis of Annual Salary (natural log) in 2009 Among Students Who Enrolled in 2004 at Four-Year Colleges and Universities Using Matched (n=844) and Pre-matched (n=2,804) Samples

	<u>Matched</u>		<u>Pre-matched</u>	
	<i>b</i>	<i>robust s.e.</i>	<i>b</i>	<i>robust s.e.</i>
Industry (2009) fixed effects	Yes		Yes	
Occupational (2009) fixed effects	Yes		Yes	
Constant	9.595		9.619	

Note: Standard errors have been adjusted for institutional clustering. The analysis is based on data weighted by the NCES-provided weight (WTB000).

* $p < .05$, ** $p < .01$, *** $p < .001$

Source: BPS:04/09

Results. Table 8 presents the results of the fixed-effects regression analysis.

Using an alpha level of 0.05, the overall multiple regression model was statistically significant ($R^2 = 0.380$, $F(81, 466) = 10.02$, $p < 0.001$) and 9 predictors were found to possess a significant relationship with post-college annual salary (\ln).

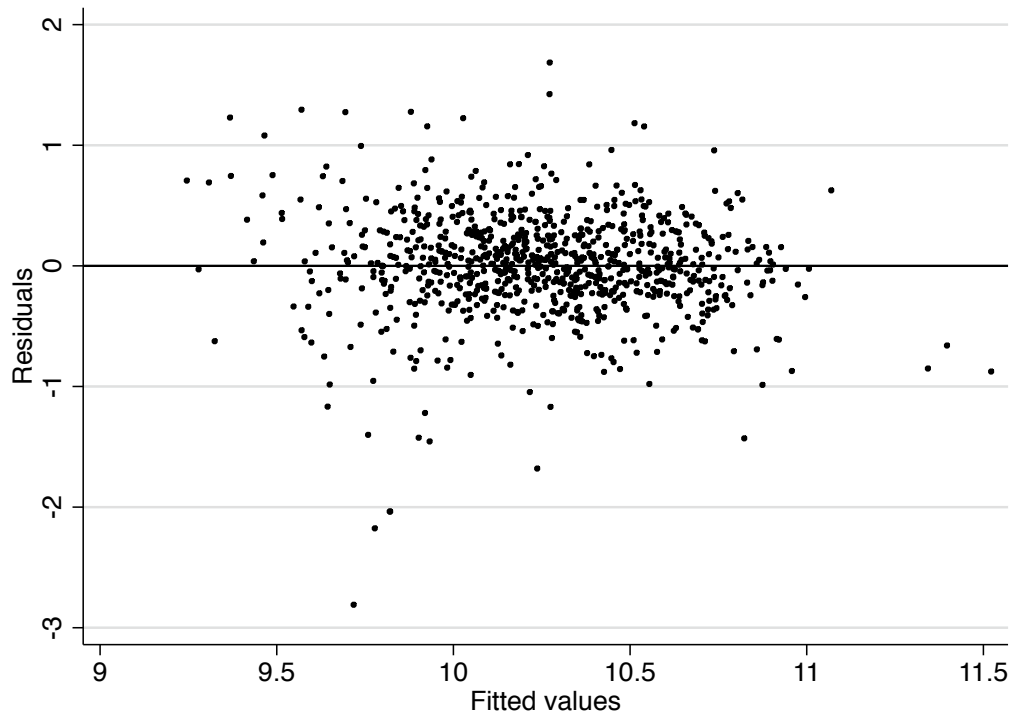
The results indicate a nonlinear relationship exists between students' 2009 post-college annual salary (\ln) and their employment intensity in 2006. Compared to individuals who reported working no hours for pay, only relatively high levels of work experience during college were found to possess a significant relationship with post-college salary. As reported in Table 8, students who worked over 30 hours per week earned 12% (i.e., $\exp(0.109)-1$, $p < 0.05$) more in 2009, compared to individuals who did not work in their third year of college.

In regard to academic characteristics, compared to education majors, those who majored in technical/professional/vocational, engineering, and business disciplines earned 26% (i.e., $\exp(0.228)-1$, $p < 0.05$), 35% (i.e., $\exp(0.301)-1$, $p < 0.05$), and 23% (i.e., $\exp(0.207)-1$, $p < 0.05$) more, respectively. In terms of institutional characteristics, students earned 13% (i.e., $\exp(0.126)-1$, $p < 0.05$) more if

they enrolled at a moderate admissions selective institution and 18% (i.e., $\exp(0.169)-1$, $p < 0.05$) more at highly selective institutions, compared to enrollment at minimally selective institutions. In terms of labor market characteristics, individuals' working full-time (i.e., at least 35 hours per week) earned 37% (i.e., $\exp(0.312)-1$, $p < 0.001$) more, compared to part-time employees. Compared to employment that did not require a college degree, individuals in positions with a degree requirement earned 17% (i.e., $\exp(0.159)-1$, $p < 0.01$) more. When an individual's academic major was related to their job, they earned 17% (i.e., $\exp(0.161)-1$, $p < 0.01$) more, compared to those with a job-major mismatch.

Diagnostics. Diagnostic testing for goodness of fit, multicollinearity, and heteroskedasticity were conducted on the fixed-effects regression model. To confirm goodness of fit, a link test was performed. The results from the link test ($\hat{p} < 0.108$, $\hat{p} = 0.221$) show that the model was appropriately specified. To test for multicollinearity, variance inflation factors (VIF) were calculated. Variables with a VIF greater than 5 are considered to have a high level of multicollinearity (O'Brien, 2007). The VIF analysis indicates that the variance inflation factors associated with each variable were no greater than 1.66, demonstrating that multicollinearity was not present. The post-regression inspection of heteroskedasticity (Figure 7), using a residual diagnostic (i.e., plotting residual-versus-fitted values), suggests the possible presence of heteroskedasticity in the model. However, accounting for clustering within the fixed-effects regression model produced heteroskedasticity-robust parameter estimates (Moulton, 1986).

Figure 7. Post-regression Heteroskedasticity Inspection: Residual-Versus-Fitted Plot



Source: BPS:04/09

Comparison of Matched and Unmatched Regression Results

A comparison of results generated using matched and unmatched subsamples revealed several substantive differences, beyond differing statistically significant variable coefficient values (Table 8). The results generated using the unmatched subsample deviate from those previously discussed in several ways. First, the unmatched results suggest that students do not benefit from working during college. Second, parental income is a significant predictor of post-college earnings. Third, accumulation of time employed is the same (or similar) job predicts future earnings. Comparing these results, produced using matched and unmatched samples, would lead to different research conclusions.

Summary

This chapter presented the study results for the two guiding research questions. The examination into the factors predicting bachelor's degree completion was investigated using a logistic regression model. The findings suggest students' work intensity during college, their college admission scores, grade point averages, club involvement, and academic integration were statistically significant predictors of bachelor's degree completion. Addressing the second research question, propensity score matching and ordinary least squares regression model (with industry and occupational fixed-effects) were combined to estimate the return to college student employment, with mitigated levels of selection bias with regard to college completion. The results suggest high levels of work intensity during college are associated with higher post-college earnings. Additionally, students' majors, post-college employment intensity, their job's requirement of a degree, their job-major relationship and their college's admission selectivity were found to predict post-college earnings. The next chapter discusses the results within the context of the literature.

CHAPTER V: DISCUSSION

Introduction

This chapter examines the study's findings within the context of college student retention and returns to college student employment literature. First, the chapter begins by contrasting the study's results, associated with each research question, against the related literature and offers hypotheses explaining research conclusions. The chapter then continues by discussing the conclusions, practical implications for higher education, and opportunities for future research. The chapter concludes by exploring the educational research implications associated with this study.

Discussion of the findings

The purpose of this investigation was to examine the relationships between working while in college, bachelor's degree completion, and post-college salary outcomes. Drawing from Bean's (1990) student attrition model and human capital theory (Becker, 1993; Mincer, 1974), this study assumed an industrial perspective for the investigation. This section discusses the study's findings by research question.

Research Question 1: Chance of College Completion. The first research phase investigated students' chance of college completion. This examination was guided by the question, after accounting for the number of hours college students worked for pay, as well as their background characteristics, financial characteristics, academic characteristics, and academic and social integration, what contributes to the chance of bachelor's degree completion? As the results indicate in chapter four, many

of the variables included in the phase one analysis are associated with degree completion; most notably among them are the students' residency during college, their level of college engagement, college academic performance, and work activities while in college. The results suggest that living on-campus, active engagement in clubs, study groups, and interaction with faculty are positively associated with degree completion. The results also indicate that working during college, up to 20 hours per week, is positively related to degree completion. Conversely, working in excess of 30 hours per week is negatively associated with completing a college degree. This section will discuss these results within the context of college persistence research.

This study addressed students' chance of college completion using Bean's (1990) model of student attrition. Bean's (1990) model of student attrition postulates that student decisions to leave college are the result of satisfaction and institutional fit. Over time, the more an institution is able to meet the needs of a student, the greater their satisfaction and likelihood of persistence. Through organizational, academic, and social interactions (i.e., experiences) with their institutions, students develop attitudes reflective of perceived measures of institutional fit and loyalty. Students' institutional fit and loyalty influence their intent to leave and ultimately, departure decisions. Within Bean's (1990) framework, it is presumed adequate college integration and academic performance directly support students' decisions to persist. The study's findings support Bean's (1990) student integration and performance hypotheses.

The study's findings suggest circumstances that give students the opportunity to integrate into their campus improve their likelihood of degree completion. This

relationship was found to be specific to students' residency during college, their levels of engagement in clubs, study groups, and (academically) with faculty. Similar to the conclusions of Astin (1993), Canabal (1995), Christie and Dinham (1991), King (2002), and Wolfe (1993), the study's findings indicate living on-campus increases student likelihood of degree completion. The results indicate the odds of college degree completion for students who lived on-campus during their first year in college were roughly one and a half times the odds of students who lived off-campus. Like Bean (1990), Blimling (1993) and Pascarella and Terenzini (1991; 2005) hypothesized that students' proximity to campus encourages integration, primarily through the increased opportunities for organizational, academic, and social interactions that living on-campus provides. Indeed, Blimling (1993) found that compared to commuting students, residential students participate in more extracurricular activities, engage more frequently with peers and faculty members, and are more satisfied with their college experience. Viewed through Bean's (1990) model, increasing students' levels of college engagement improves their integration, satisfaction, and ultimately their likelihoods for persistence and degree completion.

Consistent with Bean's (1990) model, the study's results suggest college engagement is related to degree completion. The findings indicate the odds of completing a degree were about one and a half times higher for students who participate in clubs, compared to students who did not. Similarly, the odds of completing a degree for students who sometimes or often participated in study groups or who academically engaged with their faculty were roughly one and a half times greater, compared to the odds of students who did not. In alignment with Bean's

(1990) model of student attrition, Pascarella and Terenzini hypothesize that these activities (i.e., participation in clubs, study groups, and academic interactions with faculty) improve students' chances for degree attainment through the increases in academic and social integration each activity fosters. To a degree, each of these activities supports social integration, but their major function is to bolster students' academic pursuits.

Activities that support student academic pursuits, especially performance, are critical to student persistence as Bean's (1990) model suggests and prior research (Pascarella & Terenzini, 1991; 2005) has noted, a direct and significant association exists between performance and persistence. From among the factors included within the study's analysis, student academic performance was found to be the best predictor for degree completion. The study's results indicate the better students perform, the more likely they are to complete a college degree. Compared to students who earned Ds or mostly Ds in their first year in college, students performing at higher academic levels have much higher likelihoods of degree completion. The results indicate the odds of completing a degree for students who maintained C, B, or A grade point averages (during their first year in college) were 4, 11, and 21 times greater (respectively), compared to students who earned a D average or below.

While Bean (1990) hypothesized student integration and academic performance would support student persistence, his student attrition model also predicts environmental pull factors, particularly high levels of student employment, would have a negative influence on students' academic performance and integration, and ultimately, degree completion. Prior research (Pascarella & Terenzini, 2005) and

this study's findings are consistent with Bean's (1990) hypothesis regarding the effects of working during college.

Prior research findings (i.e., Bella & Huba, 1982; Bradley, 2006; Curtis & Nimmer, 1991; Dallam & Hoyt, 1981; Ehrenberg & Sherman, 1987; Furr & Elling, 2000; Gleason, 1993; Goldstein & High, 1992; Hammes & Haller, 1983; Hood, Craig, & Ferguson, 1992; King, 2003; Pascarella & Terenzini, 1991; 2005; Pike, Kuh, & Mass-McKinley, 2008) suggest a non-linear relationship exists between work intensity, academic performance, and integration. This study found a similar non-linear relationship exists between work intensity during college and students' chance of degree completion. The study's finding support Choy and Berker's (2003) conclusion that working in moderation (up to 20 hours per week) encourages degree completion, compared to not working at all. At lower levels of work intensity, this may speak to Ziskin, Torres, Hossler, and Gross' (2010) conclusion that employment strengthens students' institutional fit (which encourages persistence) through the social integrative support working students receive from within their work environments.

Conversely, the results are also in agreement with Beeson & Wessel (2002), Cuccaro-Alamin and Choy (1998), Ehrenberg and Sherman (1987), King (2002), Kulm and Cramer (2006), Pascarella and Terenzini (2005), and St. John's (2003) previous conclusions and indicate high employment levels encourage degree non-completion. Reflecting on Henke, Lyons, and Krachenberg's (1993) conclusions, the study's findings suggest that when working 31 hours per week or more, students may lose the ability to successfully manage the number of college credits based on their

perceived course difficulty and performance goals. Examined through the student attrition model (Bean, 1990), working near full-time (i.e., working 31 hours or more per week) during college negatively affects students' academic performance, integration, and persistence behaviors. But it is important to note that the scope of this research only examined degree completion up to six years after initial college enrollment. And while near full-time employment and degree non-completion behaviors are negatively related, working in general may extend student's time-to-degree. Perhaps King (2002), and Stern and Nakata (1991) are correct in their assessment that working college students may not be dropping out of college but perhaps require more time to complete their degrees.

Research Question 2: Returns to College Student Employment. The second phase of research examined the returns to working while in college. This investigation was guided by the research question, after controlling for the chance of degree completion and other variables, how are post-college salary outcomes related to hours worked during college, over and beyond other predictors of salary? The chapter four results indicate several variables in the phase two analysis are associated with college students' future salaries, and include students' work activities during college, their institution's admissions selectivity, college degree major, and the relationship student's degree major has with their post-college job. The results indicate that working in excess of 30 hours per week while in college is positively associated with students' future earnings. The results also indicate that attending institutions with higher levels of admissions selectivity is positively related with post-college earnings. Student degree major and the relationship of students' college

majors to their future jobs were also positively related to their post-college salary. This section will discuss these results within the context of the returns to college student work literature.

This study examined how post-college salary outcomes are related to the number of hours students worked during college using a conceptual model reflecting concepts from human capital theory (Becker, 1964; 1975; 1993) and Mincer's (1974) model of labor market returns. The conceptual framework describes post-college salary as a product of the combined influence of students' employment participation during college, their education, and post-college labor market characteristics, as well as, their background, academic, and institutional features. This model focuses on individuals' major human capital developing activities (i.e., education, work experience gained during college and post-college labor market experiences), while accounting for factors (i.e., students' background, academic, and institutional characteristics) identified within the literature as also influencing post-college salary.

The prior work of Gleason (1993), Molitor and Leigh (2005), and Titus' (2010) research findings support the notion that working while in college is rewarded in the post-college labor market. Consistent with prior research (i.e., Gleason, 1993; Molitor & Leigh, 2005; Titus, 2010), this study's results suggest that college students' are financially rewarded (six years after initial college enrollment) for working 31 hours per week or more during their third year in college. Compared to non-working students, students working in excess of 30 hours per week were found to earn 12% more, six years after initial college enrollment. Examined through Mincer's (1974) model of labor market returns, the research conclusions suggests

college students' work behaviors are rewarded in the post-college labor market for the simultaneous development marketable skills and knowledge through their educational and work activities. Prior research (Casella & Brougham, 1995; Ehrenberg & Sherman, 1987; Gleason, 1993; Hotz et al., 2002; Light, 1999; 2001; Reardon, Lenz, & Folsom, 1998; Ruhm, 1997; Stephenson, 1982) suggests that increased salaries are rewards for the development of (work place) knowledge and skills beyond those gained in school alone (e.g., the development of individual's work quality, their willingness to accept supervision and direction, time management, and interpersonal skills).

Compared to working 31 hours or more per week while in college, students' institutional features (i.e., institutional admissions selectivity), educational characteristics (i.e., degree major), and post-college labor market characteristics (e.g., job's relationship to degree major) were individually found to possess stronger positive relationships with post-college salary. Consistent with prior research (e.g., Black & Smith, 2004; Brewer & Ehrenberg, 1996; Hoekstra, 2008; Monks, 2000), this study found that individuals who attended institutions with moderate or highly selective admissions earned 13% and 18% more (respectively) than minimally selective college entrants.

In addition to admissions selectivity levels, prior research (e.g., Bowen & Bok, 1998; Dowd, 1999; Eide & Waehrer, 1998; Stoecker & Pascarella, 1991; Titus, 2010) has also found college majors to impact students' future earnings. Particular to this study, students who majored in technical/professional/vocational, engineering, and business disciplines earned 26%, 35% and 23% more (respectively), six years

after initial college enrollment, compared to students majoring in education.

Research (e.g., Callaway, Fuller, & Schoenberger 1996; Dutt, 1997; Fricko & Beehr, 1992; Fuller & Schoenberger, 1991; Grubb, 1997) has also found that earnings increase when individuals' college major are related, or congruent, with their jobs. The study's findings support the prior research conclusions and indicate that job major congruence enhances individuals' future salaries by 17%, compared to those with a job-major mismatch.

Human capital theory (Becker, 1993; Mincer, 1974) suggests the earnings differences reflected in the results, pertaining to college major and job-major congruence, may speak to the demand for or the limited availability of individuals in the labor force who possess particular sets of knowledge and skills. Increased earnings can be viewed as a method for employers to attract uniquely knowledgeable and skilled individuals into work positions within industries that have limited availability of persons with the necessary qualifications needed to be employed in particular jobs. It is important to note, while the increased salaries are offered as rewards for individuals' private investment in education and training, earnings are determined by the current demand and availability of uniquely skilled labor. Any variation in results across studies examining the role college majors and job-major congruence has on earnings may be the result of supply of and demand for particular sets of knowledge and skills at the time the data was collected.

Implications for Practice

In tandem, these findings reveal the duality of college student employment and the implications it holds for students' college success and post-college financial

outcomes. While the results suggest low employment intensity (i.e., working 20 hours per week or less) increases student likelihood of degree completion, moderate student work intensity (i.e., working between 21-30 hours per week) possesses no statistical relationship with post-college income. Conversely, near full-time employment (i.e., working 31 hours per week or more) diminishes students' chances of degree completion, but it is only at this level that college student work activities are associated with post-college monetary rewards. However, college student participation in higher education and their work activities are not entirely antithetical. College and universities can support students' ambitions (of increasing future earnings) by establishing concerted efforts between offices to jointly support college student's educational and work decisions. By concentrating on departments designated for informed student guidance, institutions can assist students through information dissemination regarding the educational and cumulative work experiences needed for post-college success in specific industries, occupations or further educational pursuits. Departmental academic advising and college career center personnel can be placed at the forefront of supporting student's career development needs.

In order for institutions to establish better support systems for students' financial ambitions (i.e., the attainment of their occupational goals), a point of understanding must be developed between academic advisors and career counselors (as well as their respective departments). Each has a unique area of erudition: academic advisors provide student guidance regarding the requirements, challenges, and available opportunities students have as they pursue degree completion; career

counselors proactively address post-college pre-employment experiential requirements and encourage approaches to remedy deficiencies before students exit college. In isolation, academic advisors and career counselors, and their respective department, may have a monolithic understanding of students labor market entrance requirements. But the integration of academic advising and career center office knowledge will reveal the complexity students face in order to enter the post-college labor market as they strive to attain their aspirational work positions. The goal of linking academic advising offices and college career centers is to garner a deeper understanding of the additional post-college pre-employment requirements industries, occupations, and graduate programs place on students. The combined information exceeds the scope of each individual department's expertise (i.e., educational or work requirements), but forms the basis for institutions to guide students toward more effective and efficient paths of investing in their knowledge and skills through simultaneous participation in education and employment.

In light of the study's findings, institutions (that have not already) should consider encouraging the development of interdepartmental committees involving career center and advising office personnel for bilateral information dissemination pertaining to the particulars of (college major specific) degree completion and occupation/industry specific labor market entrance requirements. This type of engagement between offices may increase departmental awareness of the additional occupation/industry requirements beyond those within the individual departments' purview in order to design for each student a college completion plan which accommodates the additional labor market requirements beyond academics alone.

The engagement may also lead departments to understand the limits of their expertise while developing comfort and interdependence with other offices promoting student success during college and into the labor market. The study's results also suggest the individual departments can take proactive steps to support college students educational and employment decisions.

Academic Advising. To promote student academic success and increase the likelihood of degree completion, academic advising offices should work with academic support units and faculty directly to identify major impediments toward degree progress (e.g., coursework and procedural requirements) to develop supplemental academic help to aid student performance either through study group formation or through academic engagement with university officials (e.g., faculty). Further, academic advising offices may consider recommending that students live as close as possible to campus or on-campus allowing students to more readily integrate into the institution by participating in student clubs and tutoring, as well as the opportunity to take advantage of increased access to faculty, staff, additional support units, and the career center. Students' access to the career center should lead to an enhanced experience that further integrates students into the institution while providing in-depth exposure/orientation toward their aspirational goals.

Career Centers. Career centers possess the potential to serve as an integral institutional feature for student integration, support, and guidance primarily through the dissemination of up-to-date career information, access to meaningful and enriching work experiences, and on-going career related training/learning opportunities. Should career centers choose to capitalize on their potential, career

center officials should consider evaluating cumulative career specific work experience requirements, as well as the level of performance considered beneficial whether students pursue graduate/professional education or seek entrance into a specific industrial/occupational field. This information should be communicated to faculty, academic advisors, and students through industry/occupational specific workshops and through the maintenance of up-to-date referral websites to make information more readily available for consideration when developing student's collegiate plans for smooth entrance into the labor market. Student participation in career learning activities should be further supported beyond career workshops and extend into real-world work experiences through internships. Again, the career center would do well to reach out to local enterprises (e.g., business, medicine, government, and education) to develop internship opportunities well in advance of students need for such an experience. Coordinating internships or developing internship programs to offer enhanced work experiences germane to students' aspirational occupations would increase students' campus integration, especially if those experiences were located on-campus. And finally, career centers should publicize its' scheduled activities through standard methods of communication (e.g., physical and virtual message boards, direct e-mail to students, faculty, academic advising personnel), social media, departmental websites, and on-line calendars. These types of activities would offer students access to institutional career development opportunities and encourage students to engage within the university while actively participating in career development activities in pursuit of their college degrees and occupational goals.

Recommendations for Future Research

To further develop accurate information, more research is needed pertaining to students post-college pre-employment requirements. It would be prudent for future research to address questions that examine differences that may exist within the association between post-college earnings and working during college, specific to student characteristics and occupation/industry aspirations. These potential research questions include:

- Does the relationship between post-college earnings and college student employment differ by gender and race/ethnicity?
- Does the association between post-college earnings and college student employment differ across majors?
- Does the association between post-college earnings and college student employment differ by occupation or industry?

Answering these or similar questions would permit college career centers to provide more accurate information to students relative to their unique characteristics.

Implications for Educational Research

Using existing statistical software, this study demonstrated the combined use of advanced statistical techniques and appropriate data to address some of the most serious issues that plague most of higher education research, endogeneity bias (Titus, 2007). The presence of endogeneity bias suggests any observed relationship between the dependent and endogenous independent variables may be spurious. Endogeneity can result from measurement error, omitted variables, and sample selection bias.

Using propensity score matching, this research showed how these problems can be

addressed when examining the topic of post-college earnings. Additional advanced methods exist that can be employed to investigate related working college student questions. For example, future studies could introduce event history or hazard analysis to exam the relationship between working during college and students time-to-degree. Alternatively, stochastic frontier analysis could be used to explore how working while in college influences the “reservation” earnings (i.e., the difference between the highest potential earnings and actual earnings) students receive after graduating from college. Building upon this study, subsequent investigations could utilize treatment effect models (e.g., instrumental-variable, selection on “unobservables”) to examine how different levels of work intensity while in college influence college student completion and labor market outcomes. However, to conduct these studies, the use of appropriate data cannot be overlooked.

This study utilized the recently available and most relevant data to study post-college earnings. The investigation used information from the second (2009) follow-up to the 2004 Beginning Postsecondary Student Longitudinal Study (BPS:04/09), a restricted nationally representative database sponsored by the National Center for Education Statistics (NCES). The NCES-developed dataset would be appropriate for use in studies examining many different topics for at least three reasons. First, the BPS:04/09 followed first-time, beginning undergraduate students capturing detailed information pertaining to student characteristics including background/demographics, physical/mental health, temporal changes to individuals and their family formation, finances, college financing, academic progress, persistence, bachelor’s degree completion, as well as educational experiences (i.e., academic, social, and

institutional interactions), workforce participation, and societal/personal outcomes related to postsecondary education participation (Cominole et al., 2007). Second, the information included in the BPS:04/09 was derived from institutional records, national databases, and student surveys. Third, the BPS:04/09 dataset contains a myriad of statistical weights and variance estimation procedures, developed by the National Center for Education Statistics, to aid in the calculation of correct representative point estimates, standard errors, and statistical tests. Given these points, it would behoove researchers (who investigate college student related issues) to become, at a minimum, acquainted with the general scope of the Beginning Postsecondary Student Longitudinal Study (BPS:04/09) dataset. The information available within the BPS:04/09 may inform studies that examine relationships between the wide variety of factors (previously listed) and college student outcomes. However, the BPS:04/09 could be improved through the inclusion of additional variables to help predict college completion and labor market outcomes.

Though minimally available in the BPS:04/09, socio-psychological factors are included in many frameworks that have been used to study college student retention (e.g., Astin, 1977; 1985; Bandura, 1977; Bean, 1980; Bean & Eaton, 2000; Bean & Metzner, 1985; Bean, 1990; Braxton, 1999; Duncan & Blau, 1967; Fishbein & Ajzen, 1975; Spady, 1970). Within Bean's (1990) model of student attrition, socio-psychological (attitudinal) variables such as student's personality, self-confidence, self-efficacy, and occupational aspirations are predicted to be influential to college student dropout decisions. Further, research examining earnings suggests incomes are also influenced by personality (e.g., Borghans, Duckworth, Heckman, & Baster,

2008; Bowles, Gintis, & Osborne, 2001; Robins, Homer, & French, 2011), self-confidence (e.g., Judge, Hurst, & Simon, 2009; Santos-Pinto, 2012), self-efficacy (e.g., Murray, 2000), and occupational aspirations (e.g., Marini & Pi-Ling, 1997). Including these and additional socio-psychological variables within the BPS:04/09 would enrich future studies that examine college completion and labor market outcomes.

Summary

The purpose of this study was to examine the relationships between college student employment, bachelor's degree completion, and post-college salary outcomes. This study also incorporated a relatively new statistical technique to address selection bias, propensity score matching. Overall, the findings from this study suggest working during college may benefit students' educational pursuits. At the same time, working during college may develop knowledge, skills, and abilities directly applicable and financially beneficial to students' post-college careers, beyond what higher education can provide alone. However, the aggressive pursuit of developing these knowledge, skills, and abilities through high work intensity are related to higher probabilities of degree non-completion or perhaps, extended time-to-degree. While the growing trend of working while in college shows no signs of abatement, institutions can support student educational and work decisions in strategic ways. Building on this investigation, more research is needed to understand the role working during college has for differing student career trajectories.

APPENDIX

IRB Approval Notification



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DATE: March 25, 2014

TO: Richard Medellin
FROM: University of Maryland College Park (UMCP) IRB

PROJECT TITLE: [541107-1] Predictors of Bachelor's Degree Completion and the Returns to College Student Employment: An Application of Propensity Score Matching

REFERENCE #:
SUBMISSION TYPE: New Project

ACTION: APPROVED
APPROVAL DATE: March 25, 2014
EXPIRATION DATE: March 24, 2015
REVIEW TYPE: Expedited Review

REVIEW CATEGORY: Expedited review category # 7

Thank you for your submission of New Project materials for this project. The University of Maryland College Park (UMCP) IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a project design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require each participant receive a copy of the signed consent document.

Please note that any revision to previously approved materials must be approved by this committee prior to initiation. Please use the appropriate revision forms for this procedure which are found on the IRBNet Forms and Templates Page.

All UNANTICIPATED PROBLEMS involving risks to subjects or others (UPIRSOs) and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office. Please use the appropriate reporting forms for this procedure. All FDA and sponsor reporting requirements should also be followed.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to this office.

This project has been determined to be a Minimal Risk project. Based on the risks, this project requires continuing review by this committee on an annual basis. Please use the appropriate forms for this procedure. Your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date of March 24, 2015.

Please note that all research records must be retained for a minimum of three years after the completion of the project.

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