ABSTRACT

ENGLISH, DAVID JUDSON. Graduate School Choice: An Examination of Individual and Institutional Effects. (Under the direction of Paul D. Umbach).

While significant scholarly attention focuses on the development and testing of theoretically grounded models of the college choice process at the undergraduate level, far less research explores the area of graduate school enrollments. Graduate school choice, which is defined for the purposes of this paper as the decision to pursue any post-baccalaureate degree program at the masters, doctoral-research, or doctoral-professional practice level, is shaped and determined by a number of individual and organizational level characteristics. The relative influence and predictive power of these variables in modeling graduate school choice behaviors is of significant theoretical and practical interest, given the role graduate education plays in access to certain career paths, career levels, and lifetime earnings. This paper addresses a gap in the literature by advancing a conceptual framework of graduate school choice derived from the work of Perna (2006), drawing significantly from human capital theory and incorporating the salient concepts of cultural and social capital. The methodology employed is a set of generalized hierarchical linear models in which students are nested within undergraduate institutions. The dependent variables of interest were graduate school aspiration, application, and enrollment. The dataset analyzed was the 2000/01 Baccalaureate & Beyond Longitudinal Study (B&B:00/01). The nationally representative B&B:00/01 study is comprised of approximately 10,000 students who received a baccalaureate degree from one of the over 1,000 institutions sampled between July 1, 1999 and June 30, 2001.

In this study, individuals most likely to aspire to, apply for, and enroll in graduate school were dependent students who obtained high undergraduate grade point averages, majored in

the humanities, social or behavioral sciences, mathematics, or life and physical sciences, and attended a master's or doctoral institution. This study also found that, when controlling for all other variables in the models, African-America and Hispanic students are more likely to engage in the graduate school choice process than white students. A key variable of interest, undergraduate indebtedness, does not affect graduate school choice, when accounting for all other variables in the model.

Graduate School Choice: An Examination of Individual and Institutional Effects

by
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DEDICATION

This work is dedicated to my parents, Jack and Chris English, to my brother, Robert English, and to my wife, Shannon English.

BIOGRAPHY

David J. English was born in Atlanta, Georgia, but has lived exclusively in North Carolina for over twenty-five years. He earned a Bachelor of Science in Business Administration degree with majors in Business Management and Computer Information Systems, and a Bachelor of Science degree in Industrial Technology with a concentration in Furniture Industry Studies from Appalachian State University, in Boone, NC. He also earned a Master of Arts in Higher Education Administration from Appalachian State.

A profound believer of the critical role that higher education plays in American society, David has spent the past eight years working in higher education. His career began at Appalachian State University as an Assistant Director of Admissions. He then moved to Chapel Hill, NC where he spent four years working at the General Administration office of the multi-campus University of North Carolina. At UNC General Administration, he worked closely with issues of enrollment, admissions, and student access, most recently as Director of CFNC Technology and Internet Services. David currently serves as Associate Provost at the University of North Carolina School of the Arts, in Winston-Salem, NC. UNC School of the Arts is the nation's first and only stand alone public arts conservatory. In this role, he oversees graduate programs, for-credit summer offerings, and enrollment management.

In his spare time, David enjoys the outdoors and getting back to the Blue Ridge Mountains of North Carolina. He also takes pleasure in traveling and exploring new places whenever possible.

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The process of writing the dissertation has been arduous at times, but incredibly rewarding. It is impossible that I would have completed this work without the support and assistance of a number of individuals who I would like to acknowledge.

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Finally, I thank my wonderful wife Shannon for all that she has done in this process. She has lived with a husband largely in absentia for the better part of a semester while I balanced working and writing. She has been a constant source of support and encouragement throughout this process, and I would not have been able to complete this project without her. She has reviewed, edited, read, and re-edited this dissertation more times than I can count. I owe more to her than I can possibly express, and am so thankful to be her husband.

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CHAPTER ONE: INTRODUCTION

Every year, thousands of students across the United States make the decision to pursue graduate study upon completion of their baccalaureate degrees. Research has shown that the successful pursuit of a graduate degree is correlated with increased lifetime earnings and an increased quality of life (Baum, Ma, & Payea, 2010). Multiple professions, including medical doctors, lawyers, college professors, dentists, pharmacists, principals, surgeons, veterinarians, school superintendents, and various members of the clergy are all careers open only to those who have successfully completed either the masters or doctors degree (Morelon-Quainoo, 2009). Moreover, from a public-good perspective, there are a number of reasons why graduate education is a desirable social objective. For example, individuals possessing graduate degrees contribute more to the local, state, and federal governments in the form of higher tax payments. They have also been shown to exhibit characteristics that lead to improved health, and tend to have children who are better prepared for primary education, and who subsequently attain higher levels of education over their lifetimes (Baum et al., 2010).

While the United States has been the world leader of graduate education since the conclusion of World War II, there are a number of trends that threaten that position. First, the availability of quality graduate education in other countries is continually improving, challenging the previously strong and reliable pipeline of new students from abroad (Wendler et al., 2010). Second, and of greater concern, is the continued inequality regarding graduate

school attainment for historically underrepresented populations (Perna, 2004). While strides have been made in improving baccalaureate and graduate attainment rates for first-generation, low-income, and minority student populations, unfortunately large gaps still exist when comparing those subsets of students to their peers (Morelon-Quainoo, 2009). These concerns are magnified by long-term demographic trends that show a projected flattening of the traditional cohort of students who pursue graduate education, and an increase of those groups of students who have been historically underrepresented. Without significant and continued improvements in graduate attainment rates for underrepresented populations, it is doubtful that the U.S. will maintain its status as a leader in the global economy (Wendler et al., 2010). Therefore, it is necessary to continue and expand empirical studies of the factors that influence an individual's decision to pursue graduate education; particularly pertinent is the existing vein of research exploring college choice at the undergraduate level (Perna, 2004).

College choice, defined as the theoretical approach to modeling the factors that impact if and where any given student will enroll in post-secondary education, has received considerable attention and research in the past thirty-five years (Perna, 2006). Interest in college choice arose from several distinct sources: colleges hoping to shape and maximize the competitiveness of their freshman class, state governments looking to improve access for underrepresented populations, and researchers attempting to model and understand the college attendance decision process (Kinzie et al, 2004). Research on college choice has been truly interdisciplinary, drawing from the discreet fields of economics, sociology, psychology, and education. Researchers proposed a number of combined frameworks in the 1980's and

1990's that synthesized the leading principles and hypothesized variables found in the somewhat disparate disciplinary models of the 1970's (Vrontis, Thrassou, & Melanthiou, 2007).

While considerable research has been devoted to the development and testing of college choice models at the undergraduate level, the concept of college choice for graduate school is less prevalent and somewhat less refined. Research of graduate school enrollment processes has evolved through multiple iterations and approaches. Early research was largely descriptive, providing foundational knowledge about who actually pursued graduate study in America (Kallio, 1995). Later works explored the concept of persistence into graduate study, primarily through the lens of a causal model derived from the work of Pascarella & Terenzini, Tinto, and others (Ethington & Smart, 1986).

Recent research has begun to situate graduate enrollment choice processes within theoretical models adapted from the established literature on undergraduate college choice. This more recent research explores a number of different variables associated with graduate education, including background characteristics inherent to the student, various aspects of the student's undergraduate institution, the student's undergraduate major, and the total amount of debt the student accumulated while pursuing the baccalaureate degree. Drawing from each of these research threads, this study continues the exploration of the graduate school attendance decision within a model derived from the research on undergraduate college choice. Building from established college choice conceptual models allows current research to frame the student's process of electing to pursue graduate study as a distinct and new

choice among many possible post-graduation options. In sum, this research helps advance the overall body of knowledge related to graduate school choice processes.

Importance of the Study

The economic upheaval of the late 2000's provided perhaps the single most dramatic restructuring of the U.S. economy since the conclusion of World War II. While the meltdown originated on Wall Street and other major financial centers, its effects are still felt within the ivory towers of higher education. The impact on graduate education has been twofold: first, as the negative economy has primarily impacted employment openings, advanced degrees have become increasingly beneficial in the domestic job market; and second, as the world market continues to shrink, possession of a post-baccalaureate degree is advantageous when competing with individuals from around the globe (Wendler et al., 2010). These economic factors have helped transform graduate education from something benefiting only the elite to a required credential for entry into a multitude of career paths.

Additionally, there are many practical and theoretical benefits to more fully understanding the process by which students elect to pursue graduate education, including those intrinsic and extrinsic factors that impact the decision. From a practical standpoint, graduate education is a costly and time-consuming activity for both the institution providing the education as well as the individual receiving it (Hardgrave, Wilson, & Walstrom, 1994). Significantly high attrition rates and significantly low completion rates compound the time and cost factors, with estimated attrition at the doctoral level approaching the 50% mark (Ampaw & Jaeger, 2011; Wendler et al., 2010). A better understanding of the graduate choice process, and, specifically, the various risk factors inherent to different subsets of

students, could have a noteworthy impact on both program efficiency and equity (Perna, 2006).

Efficiency of the educational pipeline includes the rate at which various categories of undergraduate institutions produce baccalaureate recipients who continue on to graduate education; measurements of equity of the pipeline focus on the extent to which various groups of students are advantaged or disadvantaged in the process (Lockheed, 1988). Improved knowledge of educational efficiency is important given the increasing costs of undergraduate education. For instance, if the throughput of baccalaureate recipients into graduate education is higher at certain types of institutions, perhaps policy levers can be applied to shrink the disparity in outcomes. Similarly, a better understanding of equity within the graduate education environment could help address the gaps in attainment exhibited by various underrepresented populations. Graduate school also serves as both the entry gate and training grounds for many professions. Medical doctors, professors, lawyers, dentists, pharmacists, educational administrators, and a host of other careers require the graduate degree for admission; in countless other fields, the graduate degree provides access to career advancement and the upper levels of management (Zhang, 2005).

While research began in earnest on the subject nearly thirty years ago (Mullen, Goyette, & Soares, 2003), the theoretical understandings of graduate choice processes are underdeveloped. Given the myriad of practical outcomes of graduate education, it is imperative that additional research continue to clarify the choice and enrollment processes. This study advances the overall body of knowledge related to graduate school choice, building from currently accepted research. Specifically, the framework of this study is firmly

grounded in the economic theory of human capital development, thus helping to address the fact that much of the previous research sparsely referred to theory or was completely atheoretical in nature (Ethington & Smart, 1986; Hearn, 1987; Kallio, 1995).

Moreover, this study examines the intersection of an individual's background characteristics with the traits inherent to the institution from which the individual received their baccalaureate degree. By doing so, it is one of the first studies to explicitly explore the varying influences that an individual's pre-college attributes and undergraduate institutional characteristics have on the decision to pursue a graduate degree. As such, the independent variables considered in the model have broad applications at both the theoretical and the practical levels. Individual variables include the student's race, ethnicity, gender, undergraduate indebtedness, and undergraduate major; institutional variables include institutional quality and institutional control/type. Exploring the graduate school choice process in this method helps address whether individuals are accessing post-baccalaureate education in an equitable manner, as well as whether institutions are providing graduate degrees in the most efficient structure. For example, students who attend more selective undergraduate institutions are more likely to continue on to graduate school; but those institutions have historically enrolled significantly fewer students who hail from disadvantaged backgrounds (Perna, 2006; DeAngelo, 2009). For the purposes of this study, graduate school choice will refer to the process by which an individual makes the determination to pursue a post-baccalaureate degree, at either the masters or doctoral (research or professional practice) level.

As the focus of this study is on exploring the impacts of individual and institutional characteristics on graduate education in general, the dependent variable of interest will not be sub-divided into various graduate degree disciplines and types (e.g. non-terminal masters, terminal masters, doctoral-research, doctoral-professional practice). While there are certainly a number of differences that exist between those graduate degrees, a full examination of their manifestations is beyond the scope of this study. In summary, the individual and societal benefits of obtaining a graduate degree are significant; and, it is anticipated that this study will advance the understanding of not only the variables that impact the decision to pursue graduate study, but also the actual choice processes, as they exist in established theoretical frameworks.

Theoretical Framework

This study draws from existing literature on college choice and graduate school enrollment, but is primarily grounded in the economic framework of human capital theory. Human capital theory has been the most widely used approach for exploring choice decisions related to undergraduate and graduate education (Paulsen & Toutkoushian, 2008). While human capital theory provides the primary lens for examining graduate school choice decisions in this paper, I explore additional perspectives through the overlay of the concepts of cultural capital and social capital. Recent work by Perna (2004) proposed and validated that the inclusion of cultural capital and social capital concepts in choice models improves their overall efficacy.

Human capital is an economic theory that posits that an individual's ability to produce economic value is directly related to the knowledge, skill, and ability he or she possesses (Becker, 1962). The theory grew out of economists' conclusion that investments in human capital could

have as equally profound an impact on economic productivity as the more traditional concepts of material and physical capital (Cohn & Geske, 1990). Significant study and analysis of human capital began in the early 1960's, primarily under the scholarly work of Schultz, Mincer, and Becker (Zhang & Thomas, 2005). A consensus-driven operational definition of human capital theory arose during this period, which explained that educational investments made in an individual allow the person to operate with greater levels of productivity in the future, resulting in the individual's award of higher levels of compensation, most often in the form of increased wages (Zhang & Thomas, 2005).

Educational researchers often apply human capital theory as a mechanism for explaining the benefits of obtaining further education, as well as the decision-making process individuals undergo when considering such additional education (Levin, 1989). Within education economics, human capital theory finds broad usage and adoption in studies that explore issues of choice and decision sets. The theory generally suggests that investment in education results in increased employee competencies, allowing them to contribute at a higher level, and subsequently, demand a higher wage (Thomas & Perna, 2004). Thus, within the context of graduate school choice, a potential student weighs the perceived set of knowledge and skills that could be obtained in pursuing an advanced degree against the current price of attendance. The decision is shaped by individual preferences and constrained by the individual's budgetary limitations (Paulsen & Toutkoushian, 2008).

An important component of human capital theory relevant to graduate choice is the topic of consumption and investment benefits. Consumption and investment benefits represent two components of the overall utility an individual expects to receive as a result of making the decision

to pursue graduate education (Paulsen & Toutkoushian, 2008). The consumption benefit refers to the increased utility experienced by the actors within a singular bounded period after their decision to take action. In contrast, an investment benefit drives an individual's decision to take action based on that individual's expectation of receiving positive utility in future periods (Cohn & Geske, 1990). Individuals selecting an undergraduate institution consider a multitude of consumption benefits (institution location, campus amenities, extracurricular opportunities, etc) in addition to the longer-term investment benefits (e.g. academic quality, long-term earnings potential). Students deciding whether to pursue graduate education certainly consider some of these consumption benefits; for example, campus location, facilities and services offered, and the overall anticipated campus experience in their decision to enroll. However, while the consumption benefits play a role, potential graduate students focus primarily on weighing the relevant investment benefits (Hearn, 1987).

This importance of investment benefits supports the idea that the theory of human capital should be especially pertinent for the study of graduate choice. While students select an undergraduate institution for a variety of immediate reasons (perceived quality, location, cost, student life options, friends, etc.), the selection of an institution for graduate study is more closely tied to the benefits students expect to receive upon completion of the graduate degree (Hearn, 1987). Given that economic theory, of which human capital is subset, is predicated upon the assumption that individuals make rational decisions in order to maximize their expected utility, the fact that students consider graduate school choice within the constructs of more narrowly defined expected benefits, as opposed to broader immediate consumption benefits, allows for the development of a more focused model.

However, this concept of student rationality has drawn criticism in the past as being untenable and unrealistic (DesJardins & Toutkoushian, 2005), and is one of the primary challenges human capital investment theory has received. Differences in definitions can explain some of the criticism, however. The economist defines rational behavior as an individual making a decision that maximizes their personal utility (either at the present time or in some future time period); the colloquial definition of rationality is an individual making a decision that makes the most sense to the external observer (DesJardins & Toutkoushian, 2005). The narrowed set of perceived benefits considered in the graduate school choice process reduces and simplifies the impact that rationality plays in both the modeling and testing of the decision process. From a purely theoretical perspective, the subjective nature of rational decision-making allows human capital theory to be flexible enough to conceptualize and model the different choice decisions that individuals from varying backgrounds would make (DesJardins & Toutkoushian, 2005). An economist would not expect a first-generation college graduate from a low-socioeconomic background to make the same graduate school enrollment decisions as an individual whose parents possess advanced degrees and are in the upper quintiles of household income; it is likely that their preferences and utility expectations would differ. From a policy standpoint, simply acknowledging the difference in preferences might not be a tenable solution. In order to more clearly conceptualize the choice decisions, it is useful to explore and integrate other theoretical models into the framework of human capital.

Initial research into college choice commonly used either an econometric or a sociological framework, largely owing to the disciplinary backgrounds of the individual researcher (Hossler, Braxton, & Coopersmith, 1989). Models began to combine the two

approaches rather quickly, as scholars posited that overlaying sociological concepts of human behavior on existing econometric frameworks would better explain the college choice process (Perna, 2006). Research on choice processes at both the undergraduate and graduate level has moved in this direction in recent years, incorporating the sociological framework concepts of cultural capital and social capital theories. Cultural capital is most often defined as the individual attributes (e.g. language, cultural awareness, and characteristics) that one draws from either a parent or guardian. Social capital includes the various networks, connections, and resources to which an individual has access (McDonough, 1997; Perna, 2006).

The theoretical model employed in this study integrates the concepts of cultural and social capital into the established econometric framework of human capital. This integration allows for the use of a rational utility approach while acknowledging and accounting for differences that sociological factors such as gender, race/ethnicity, socioeconomic status, geographic location, etc. have on the graduate school choice process. The inclusion of cultural capital and social capital helps address concerns that have surfaced challenging the validity of human capital theory. Moreover, the inclusion of cultural capital and social capital theories is necessary to address a number of theoretical alternatives that have been advanced to explain the relationship of educational attainment to socioeconomic status, including the theories of screening, signaling, and credentialism (Bills, 2003).

Broadly, these alternative theories question the efficacy of human capital in explaining ties between education and employment, and particularly focus on populations that have been historically marginalized. The three theories of screening, signaling, and credentialism were largely advanced by sociologists who saw failings in the predominant economic theory of human

capital. Those researchers found concern in what they perceived as shortcomings in how the theory of human capital held up when applied to non-majority populations. The theories of screening, signaling, and credentialism were brought forth as a way of explaining differences in the transition from education to employment exhibited by those historically underrepresented populations (Bills, 2003). While the inclusion of social capital and cultural capital theories in the framework does not address every concern brought forth by advocates of the theories of screening, signaling, and credentialism, it does ameliorate a number of the issues by taking into account students' backgrounds, origins, and available resources. Studies at both the undergraduate and graduate level of the choice process have found that the inclusion of cultural and social capital constructs in the traditional econometric framework improves the explanatory power of the model (Perna, 2000; Perna, 2004).

The conceptual model advanced in this paper is adapted from the one developed by Perna (2006) for use in analyzing undergraduate college choice decisions. Perna's model situated the decision of whether to enroll in college as a decision nested inside four discrete contextual layers: social, economic, & policy context (layer 4); higher education context (layer 3); school and community context (layer 2); and habitus (layer 1). Those four layers feed an individual's analysis of expected benefits and costs when determining whether to pursue a baccalaureate degree, and are simultaneously influenced and constrained by demand factors for higher education and availability of resources. The model is adapted in this study to allow for the study of graduate school choice processes. Various components of the habitus are updated to reflect the transition from undergraduate education to graduate education (as opposed to the secondary to post-secondary transition originally posited by Perna). The second layer is modified from a school and

community context to now encapsulate the effects of the undergraduate institution the student attended. Finally, the third layer now focuses on the graduate school context, instead of higher education. The use of this model, appropriately modified to fit graduate school choice processes, facilitates a conceptual structuring and operationlizing of the theories of human, cultural, and social capital (Perna, 2006).

Purpose and Analysis

The purpose of this study was twofold: first, to continue the exploration of the impact of individual biographic factors on the decision to pursue graduate school; and second, to assess how undergraduate institutional characteristics influence the graduate school choice process. The study investigated the efficacy of the proposed model by testing the impact that the theorized independent variables have on the dependent actions of aspiring to, applying for, and ultimately enrolling in graduate education. The conceptual model used in this study was drawn from previous college choice research, integrating concepts of cultural and social capital into the econometric framework of human capital theory. The following research questions guided the study of graduate school choice:

1. To what extent do the following measures of human capital explain graduate school aspiration, application, and enrollment?
    a. What influence does undergraduate major have on graduate school choice processes?
    b. How does undergraduate academic performance impact aspiration, application, and enrollment to graduate education?

   c. To what extent does a student's cumulative undergraduate indebtedness influence components of graduate school choice?

2. To what extent do student demographic and background characteristics and the concepts of cultural capital and social capital influence graduate school aspiration, application, and enrollment?
   a. How do gender and race/ethnicity influence the likelihood of graduate school aspiration, application, and enrollment?
   b. To what extent do indirect measures of cultural capital (parents' education, family income, parental assistance with tuition & fees, language most often spoken in home) impact graduate school choice processes?
   c. How do indirect measures of social capital (type of high school attended; undergraduate institution type and location) interact with other aspects of the model and influence the decision to enroll in graduate school?
3. To what extent do characteristics of the undergraduate institution influence graduate school aspiration, application, and enrollment?
   a. To what extent does the undergraduate institution control (public or private) and classification (Carnegie type) influence components of the graduate school choice process?
   b. How does the graduation rate of the undergraduate institution impact graduate school aspiration, application, and enrollment?
   c. Does attending a Historically Black College or University (HBCU) significantly impact graduate school aspiration, application, and enrollment?

The dataset selected for analysis in this paper was the 2000-01 Baccalaureate and Beyond Longitudinal Study (B&B:2000/01). B&B:2000/01 is a nationally representative study that examines educational and work experiences of individuals a year after receipt of the baccalaureate degree (Charleston, Riccobono, Mosquin, & Link, 2003). The B&B:2000/01 study was the second iteration conducted by the National Center for Education Statistics (NCES), with the previous version conducted in 1993 (B&B:93). This previous incarnation of the Baccalaureate & Beyond study has served as the most widely used dataset for previous explorations of graduate school choice processes (Heller, 2001; Millett, 2003; Mullen et al., 2003; Perna, 2004; Zhang, 2005).

I selected independent variables based upon their interaction with and support of the guiding research questions. The independent variables stem from the following categories: biographical/demographical background information; high school attended; college entrance examinations; parents' educational attainment; family income; undergraduate institution attended; undergraduate academic performance; undergraduate major; and undergraduate indebtedness.

I conducted the data analyses via a generalized linear mixed models (GLMM) approach, as the data are highly nested and the dependant outcome of interest is categorical. GLMM is often referred to as hierarchical linear modeling (HLM) or multi level modeling (MLM), and describes a set of statistical approaches that are similar to ordinary least squares regression, but differ in that they allow for a more accurate modeling of data that exists in nested structures (Bryk & Raudenbush, 1992). Nested data is incredibly prevalent in educational settings, as students are members of individual classrooms, schools, districts, majors, and universities (Heck, Thomas, & Tabata, 2010). A key statistical tenet of ordinary least squares regression is independence of

observation, which requires that knowledge of one individual within a sample provides no knowledge of another individual within the sample. Multilevel models, on the other hand, do not require this independence of observation assumption. As such, a number of other errors associated with ordinary least squares regression exist, including the receipt of standard errors that are too small (Osborne, 2000).

The use of MLM methods was especially pertinent for this study for two primary reasons. First, the B&B:2000/01 dataset was built by initially sampling institutions, and then sampling individuals within those institutions (Charleston et al., 2003). This clustered approach lends itself to analysis via a multilevel approach. Secondly, this research is primarily interested in exploring the differing effects of individual and institutional level characteristics. The methodology advanced is a two-level model, in which students are nested within an undergraduate institution. This modeling strategy allowed for the analysis of whether features of the undergraduate institution affect graduate school aspiration, application, and enrollment, after controlling for other factors. This simultaneous modeling of the variance between individual and institutional-level variables is not feasible in non-multilevel modeling strategies (Agresti, 2007).

Overview of the Study

This study on graduate school choice processes fills a number of key gaps in the literature. First, it not only continues the refinement of a conceptual model of graduate choice that builds upon the established economic theory of human capital investment, but also incorporates the salient concepts of cultural and social capital. Second, it is one of the first studies to examine graduate choice via a nationally representative sample drawn after the substantial changes in college pricing and financing that occurred during the time period of 1994 – 2000. Third, it is one

of the first studies to explore the graduate choice process through the use of multilevel modeling techniques, allowing for a more accurate modeling of the impact of individual-level variables and undergraduate institution characteristics. From a policy perspective, enrollment in graduate level education is tied to multiple private and public goods; thus, developing a stronger understanding of the choice process will spawn both positive practical and theoretical implications.

The second chapter of this paper provides a detailed review of related literature. Organizationally, the review is divided into two major categories. First, I review the previous research conducted on the college choice process at the undergraduate level. I analyze these studies and organize them by the conceptual model employed by the researcher(s). The second component of the literature review is an analysis of those studies that have investigated the graduate choice and enrollment process. Of particular focus are the specific independent variables that have been previously studied and shown to be important in predicting graduate choice processes. The chapter concludes with a presentation of the operative hypotheses, including a discussion of how those hypotheses are derived from prior research.

The third chapter of the paper provides an overview of the methodological approach, including discussion of the data set, the 2000-2001 Baccalaureate and Beyond Longitudinal Study. I next present the steps I undertook in constructing a usable dataset from the 2000/01 Baccalaureate and Beyond Longitudinal Study Electronic Codebook. I discuss the approaches taken to address the high levels of missingness in the data via a complex multiple imputation procedure. The final portion of the methodology section concerns the statistical approach, a generalized hierarchical linear model. In the model, students are nested within undergraduate

institutions, and the dependent variables of interest are graduate school aspiration, application, and enrollment.

The findings of this study are presented in Chapter Four. I first review descriptive statistics that provide an overview of the dataset and its structure. I close by presenting the findings of the various generalized hierarchical linear models within the context of the dependent variables of interest and the research questions.

The paper concludes in Chapter Five with a discussion of significance, limitations, and potential directions for future research. I specifically explore the findings of this study within the context of the established body of research, focusing both on those areas of similarity and difference. I tie the findings of this study back to the literature while providing suggestions for future scholarly inquiry.

CHAPTER TWO: REVIEW OF THE LITERATURE

This study advances a theoretically grounded model for examining graduate school choice process, while simultaneously exploring the impacts that individual and institutional-level variables have on graduate school aspiration, application, and enrollment. For the purposes of this study, the term graduate school choice and graduate enrollment encompasses all post-baccalaureate degree programs. This includes masters level programs that are non-terminal (e.g. master of arts, master of science); terminal masters level programs (e.g. master of business administration, master of fine arts); doctoral programs that prepare an individual for professional practice (e.g. medical doctor, juris doctor); and doctoral programs intended for research (e.g. Ph.D., Ed.D.). As the primary research interest concerns the intersection of individual and institutional level variables, I decided to analyze graduate enrollment via this collapsed categorization. Discrete analyses by graduate program type are beyond the scope of this paper, and may prove a fruitful topic for future research. Enrollment in graduate school and completion of either the master's or doctor's degree (research/scholarship or professional practice) has been shown to lead to significantly higher individual income and lifetime earnings (Baum et al., 2010), and an integrated framework of graduate choice will help understand and explain the process of choosing such enrollment.

This study draws significantly from established college choice literature, while incorporating key aspects of student persistence and graduate enrollment research. I analyze data from the second cohort (2000-2001) of the Baccalaureate and Beyond Longitudinal Study, which

drew its initial sample from the 2000 National Postsecondary Student Aid Study (NPSAS). The nationally representative sample is comprised of approximately 10,000 students and, therefore, allows for broad generalizations. Members of the sample were surveyed again in 2001, allowing for an analysis of graduate enrollments one year following the completion of the baccalaureate degree (Charleston, Riccobono, Mosquin, & Link, 2003)

The purpose of this study was to determine the impact of individual and institutional characteristics on the graduate school choice processes of aspiration, application, and enrollment. To that end, the following research questions guided the study:

1. To what extent do the following measures of human capital explain graduate school aspiration, application, and enrollment?
    a. What influence does undergraduate major have on graduate school choice processes?
    b. How does undergraduate academic performance impact aspiration, application, and enrollment to graduate education?
    c. To what extent does a student's cumulative undergraduate indebtedness influence components of graduate school choice?
2. To what extent do student demographic and background characteristics and the concepts of cultural capital and social capital influence graduate school aspiration, application, and enrollment?
    a. How do gender and race/ethnicity influence the likelihood of graduate school aspiration, application, and enrollment?

   b. To what extent do indirect measures of cultural capital (parents' education, family income, parental assistance with tuition & fees, language most often spoken in home) impact graduate school choice processes?
   c. How do indirect measures of social capital (type of high school attended; undergraduate institution type and location) interact with other aspects of the model and influence the decision to enroll in graduate school?

3. To what extent do characteristics of the undergraduate institution influence graduate school aspiration, application, and enrollment?
   a. To what extent does the undergraduate institution control (public or private) and classification (Carnegie type) influence components of the graduate school choice process?
   b. How does the graduation rate of the undergraduate institution impact graduate school aspiration, application, and enrollment?
   c. Does attending a Historically Black College or University (HBCU) significantly impact graduate school aspiration, application, and enrollment?

The conceptual model advanced in this paper is an adaptation of the one developed by Perna in her analysis of undergraduate college choice processes. Perna (2006) proposed a combined model of college-student choice that is grounded in the theory of human capital and draws heavily from research in the sociological theoretical framework. The model incorporates aspects of human capital, habitus, cultural capital, social capital, and institutional context together in a unified conceptual framework. Specifically, the model

posits that an individual's decision to pursue additional education at the baccalaureate level is derived from a "situated context" shaped by four contextual layers that funnel into college choice: 1) Habitus, 2) School and community context, 3) Higher education context, and 4) Social, economic, and policy context. In the model, the first layer, habitus, includes demographic characteristics, cultural capital, and social capital; the second layer, school and community context, includes availability and types of resources and structural supports and barriers; the third layer, higher education context, includes marketing, recruitment, location, and institutional characteristics; and the fourth layer, social, economic, and policy context, includes demographic, economic, and public policy characteristics.

At its core, Perna's (2006) model focuses on the human capital, cultural capital, and social capital theories. I theorize that these three components of the model, as included in the "habitus" layer, are still in effect in the graduate school context, although the specific variables used to measure those components are necessarily different. For instance, a student's undergraduate major is thought to be a measure of human capital in the graduate school model, and this variable obviously would not have been considered in Perna's original model that focused on the transition from secondary to postsecondary education.

I also modified a number of aspects of the second and third contextual factor layers. In order to accurately reflect the shift towards a graduate level focus, I adapted the model for use in this study by modifying the various components to encompass graduate school processes. Therefore, the second contextual layer, labeled "school and community context" in Perna's model becomes undergraduate institution in my model. The third layer, previously "higher education context," now shifts to the graduate school context. Finally, the fourth

context of “social, economic, and policy” factors remains largely the same as the undergraduate model. Including these modifications of Perna’s four contextual layers, the proposed model for this study is: 1) Habitus, 2) Undergraduate institution context, 3) Graduate school context, and 4) Social, economic, and policy context. A copy of the conceptual model is presented as Figure 2.1.

This conceptual model extends Perna’s (2006) previous work by modifying an approach designed to model undergraduate college choice, and applying it in the study of graduate school choice. I anticipate the model, previously shown to facilitate higher levels of predictive power, will fit well within the graduate school frame. The outlined changes to the model specifically address and account for the differences that exist between graduate school choice and undergraduate college choice decisions. In this study, only the first two contextual layers of the model (habitus and undergraduate institution context) are included in the analysis. This allows for a more direct exploration of the individual and institutional characteristics that influence graduate school choice.

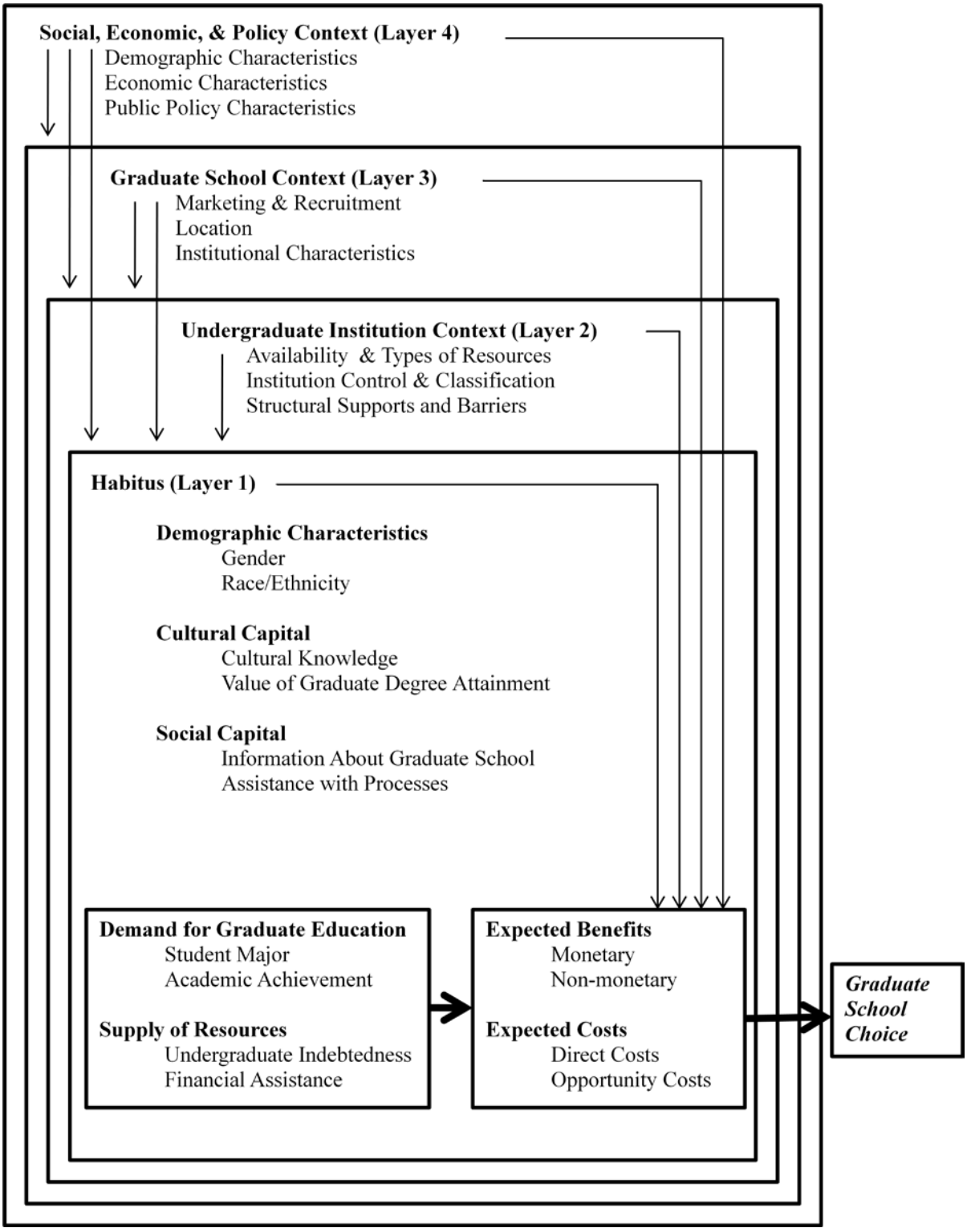

Figure 2.1: Four-layer graduate school choice conceptual model

In order to fully grasp the developmental underpinnings of Perna's (2006) model, and through adaptation, the model advanced in this study, one must first examine the previous literature dedicated to undergraduate college choice decisions. This examination tracks the evolution of undergraduate choice models from their genesis in either the sociological or econometric paradigm through to the combined and integrated models advanced by Perna and others. This will provide a deeper understanding of the various theoretical and conceptual approaches used by researchers in exploring choice decisions. The second step to fully understanding the development of this model requires an exploration of the past research on graduate school choice processes. Prominent in both the undergraduate and graduate choice threads of research are the individual and institutional-level variables that comprise the contextual layers of Perna's four-level model. This second phase of the literature review offers a theoretically grounded approach for determining what modifications should be made, and which variables should be included when adapting the model for graduate school choice analysis. Therefore, the literature review is organized into the following two phases: first, an examination of the literature that informed the proposed model, including studies that advanced the sociological, econometric and combined models of college choice; and, second, a variable-specific review that will provide background for the four proposed contextual layers of the adapted Perna model.

As Perna's (2006) model drew from previous research on undergraduate college choice, the first section of the literature review focuses on those studies and discrete models that informed her work. This research provides the foundation and framework for conceptualizing collegiate enrollment decisions. Undergraduate college choice research

provides the most robust theoretical frameworks for examining choice decisions in general; as such, this first portion of the literature review is organized by conceptual and theoretical model type: sociological, econometric, and combined models. I pay particular attention to the evolution from disciplinary frameworks derived primarily from economic and sociological theory towards the more comprehensive and integrated models that are most prevalent in the literature today. The interdisciplinary approach ultimately posited by Perna is an example of a fully integrated model.

The second section of the literature review examines the previous articles and studies that have explored graduate school choice processes. Whereas the first section of the literature review focuses on the conceptual models developed to explore choice processes generally, the second section focuses on the individual and institutional factors that impact, specifically, graduate school choice decisions. This review of prior research on graduate enrollment decisions informs the composition of variables that are now included in the conceptual model. Therefore, this second section is segmented by the variables that have been previously found to influence graduate school choice processes. Categories of interest fall into the first two of the contextual layers of the proposed model and include demographic characteristics, human capital, cultural capital and social capital (Habitus); institutional quality, and institutional control and classification (Undergraduate institutional context).

This chapter concludes with a presentation of the operative hypotheses explored in this study. Those hypotheses were derived from an analysis of the prior research conducted on graduate school choice, and build from the guiding research questions developed for this study.

Undergraduate College Choice Research

Much of the current research on graduate school choice processes stems from prior research into undergraduate choice processes (Poock & Love, 2001). The conceptual model advanced in this paper is adapted from Perna's framework (2006), which was created to synthesize competing theoretical constructs of undergraduate college choice behaviors. As such, it is important to fully explore and understand the historical origins and developments of college choice research. This section of the literature review begins with an overview of what college choice research seeks to explain, and what historical factors influenced the model's development. As college choice research began primarily as individual disciplinary focused projects, I organize this portion of the review by theoretical construct. Specifically, this section examines the influences that sociological status attainment and economic theory have had in the development of integrated models of college choice.

The process of college choice is an area of the educational spectrum that has received significant scholarly study in recent decades. Historically, the development of the theoretical framework explaining the steps that students undertake while transitioning from high school to college did not begin in earnest until the mid-1970's. This timing was a direct result of the fact that wide-spread access to higher education was limited to a very small portion of the American population prior to the 1960's (Kinzie et al., 2004). Until that point, there was little variation as to which students would consider post-secondary education, as well as in which factors might influence their selection of an institution. As Kinzie et al. discuss, the GI Bill of 1944, *Brown v. Board of Education*, the 1964 Civil Rights Act, and 1965 Higher Education Act all served to expand access to education generally, and higher education specifically,

beyond the contingent comprised primarily of white upper-class male students. This expansion broadened the description of students who might consider furthering their education beyond the high-school level, as well as their options for enrollment. Aside from these massive changes, the need for research concerning college choice was further complicated by the significant decreases in potential student enrollment that occurred in the late 1970's and early 1980's. Researchers, policy analysts, and higher education administrators suddenly found themselves operating in a world where the number of traditional students was declining, non-traditional student numbers were increasing, and there was no clear way to determine which of these students would attend a specific institution, if they attended college at all (Paulsen, 1990).

The thread of research known as college choice grew out of this turbulent environment. While the research on college choice rose from a variety of theoretical frameworks, there are two perspectives that have been most represented in the literature. Initial research into college choice stemmed almost exclusively from either a sociological model of status attainment or an econometric approach (Paulsen, 1990; Perna, 2006; Vrontis et al., 2007). Researchers then modified and merged into a combined theoretical framework that encapsulated both sociological and econometric perspectives. (Hossler, Schmit, & Vesper, 1999; Vrontis et al., 2007). This combined model was eventually further refined to reflect specific components of sociological theory, the concepts of cultural capital and social capital. The primary focuses of the cultural and social capital approaches are to understand the differences in how low-income, first generational and historically underrepresented students progress through the college choice process.

Sociological Status Attainment

Sociological models of status attainment were some of the earliest contributions to the field of college choice. Within the concept of college choice, status attainment refers to the process by which students' life experiences and situational exposures shape their post-secondary education decisions, as a means to improving their quality of life via career advancement. Individuals who have achieved at a higher level academically receive greater levels of support and encouragement that, in turn, manifest in the form of higher levels of aspiration (Perna, 2006).

Sewell and Shah authored two of the seminal works of scholarship in the area of status-attainment in the late 1960's, born out of a seven-year study of 10,318 Wisconsin high school seniors. Their research expanded current knowledge regarding the determinants that shape students choice patterns. They found that socioeconomic status, intelligence, and parental encouragement all significantly impacted the college choice process (Sewell & Shah, 1968a). For females, socioeconomic status had a greater impact than intelligence on college plans, college attendance, and college graduation, while males exhibited the reverse (Sewell & Shah, 1967). Moreover, parental educational attainment was positively and significantly related to students' perception of parental encouragement, college plans, college attendance, and college graduation (Sewell & Shah, 1968b).

Hearn (1991) continued this research on status attainment in the 1980's. He discovered similar findings using the 1980 High School and Beyond Longitudinal Study; specifically, low socioeconomic students were more likely to attend less-selective institutions, regardless of academic ability, achievement, or expectations. These

sociologically-based studies illuminated the fact that while factors related to academic achievement are primarily responsible for determining college choice decisions, individual background factors also play a significant role.

Econometric Models

Research on econometric modeling of the college choice process arose in the late 1970's and early 1980's, primarily as a response to declining enrollments of the college-going population. These models were primarily based on human capital theory, which has been commonly used to explore education investment decisions. In contrast with sociological models, human capital theory assumes that individuals decide to make additional investments in their educational attainment because those additional units of education will allow them to be a more productive and more desirable employee in the future, and, thus, able to demand higher levels of compensation (Zhang & Thomas, 2005). Therefore, the models are predicated upon the concept that students employ a rational cost-benefit analysis to choose between a number of competing opportunities, such as whether or not to enroll in post-secondary education, enter the work force, join the armed forces, etc. (Hossler, Schmitt, and Vesper, 1999). Econometric models assume that students are faced with a set of finite choices, which are considered and then eliminated according to logical processes. Students weigh both indirect and direct costs against potential life-long benefits in order to maximize their potential personal outcomes (Hossler et al., 1999).

A number of studies authored during the 1980's and 1990's used econometric approaches to examine the student college choice process. These studies used data on individuals to determine how students select their decision from a choice set of competing

options (Montgomery, 2002). One of the first large scale studies of this kind was carried out by Manski and Wise (1983). Their research used the National Center for Educational Statistics (NCES) National Longitudinal Study (NLS) of the High School Class of 1972 to explore the probabilities of a specific student enrolling at a specific institution. The study employed a conditional logit model to explore five key factors in college choice: academic aptitude, family income, institutional cost and aid, high school quality, and labor market conditions. They found that students are more likely to enroll in an institution that exhibits an academic profile slightly more competitive than their own, and that low-cost institutions are preferred to high-cost ones (Manski & Wise, 1983).

A common methodology advanced in the econometric research was the use of stochastic utility models. Punj and Staelin (1978) used these models to explore the college choice process of graduate business school applicants; Chapman and Staelin (1982) employed them to further understand rank order choice set data at Carnegie Mellon University. Studies focused on both institutional and individual effects. Institutional cost and perceived academic quality significantly impacted a student's college selection (Chapman, 1979), while a student's academic aptitude and geographic proximity to the potential institution influence his or her decision to pursue and enroll in higher education in general (Leppel, 1993).

One drawback of these developing econometric studies was their lack of an overarching conceptual framework. One of the first econometric phase models to explicitly posit an overarching process for college choice consisted of four steps. The process, as presented by Kotler and Fox (as cited in Hossler et al., 1999, p. 143), hypothesized that

students first make an initial decision to consider post-secondary institutions, next gather information about institutions, subsequently review and eliminate options from the choice set, and finally select an institution for enrollment from the remaining choice set (Kotler & Fox, as cited in Hossler et al., 1999, p. 143). This basic conceptualization of college choice processes would influence the creation of several of the subsequently developed combined models.

Combined Econometric & Sociological Models

While early college choice literature grew out of an econometric or a sociological theoretical framework, many researchers quickly hypothesized that neither adequately explained the decision process (Perna, 2006). Hossler, Schmitt, and Vesper (1999) noted that the combined models developed by Jackson, Chapman, Litten, and Hossler and Gallagher more completely explain the complex steps that students proceed through in the enrollment process.

These combined models share a number of common characteristics. They typically draw from human capital theory, and hypothesize that the student makes a decision regarding college enrollment by examining the interplay of expected benefits and anticipated costs. These models differ from purely econometric approaches, however, in that they recognize that the college choice process was too complex to be explained via one model or framework, and that individuals from different backgrounds clearly approach the college choice process differently (Jackson, 1982). Whereas the actual college choice decision is typically modeled via a human capital approach in these models, the factors that lead up to and affect that

decision are profoundly influenced by sociological theory. One key difference between the various models discussed is whether the focus is student specific or institution specific.

The initial set of combined models explores college choice decisions from the student's individual perspective. The models advanced by Jackson (1982) and Hossler and Gallagher (1987) are built around discrete three-phase designs. The first phase in each of the models focuses on the initial decision to pursue a baccalaureate education in lieu of other alternatives. In the Jackson model, the first phase is known as preference, and draws heavily from the aforementioned sociological studies of status attainment. Jackson (1982) asserted that students' educational aspirations develop in the way suggested by sociological models, and that academic achievement, family background, and social context have the greatest impact on those aspirations. In the model posited by Hossler and Gallagher, the first phase is referred to as predisposition, and also references the decision to pursue post-secondary education in lieu of alternative options including work (1987).

Following the decision to pursue a college degree, both models explain that students next enter a phase in which they begin to identify potential institutions for enrollment. Exclusion, which represents the second phase of Jackson's model, pulls from the econometric line of research. Jackson suggests that students traversing the college choice process enter into a period where they logically eliminate poor fit choices primarily based on cost, academics, and location. Jackson does note, however, that the college choice decision-making process is not nearly as clean or predictable as econometric models might suggest. Hossler and Gallagher (1987) approach the second phase somewhat differently. Their definition of the search phase details the process by which students educate themselves on

their potential institutions, and is focused less on the exclusionary aspects included in the Jackson model.

Upon completing the search/exclusion process, students ultimately select an institution in which to enroll. The final phase of Jackson's model, evaluation, proposes that students develop an internal rating scheme by which they weigh their final decision (1982). The final stage of the Hossler and Gallagher model, choice, occurs when the student has completed all of their admissions applications, and selects an institution from his choice set (Hossler et al., 1999).

Whereas the Jackson model and the Hossler and Gallagher model both explored college choice processes from an individual perspective, Chapman (1981) and Litten (1982) developed combined models that took an institutional approach. Chapman noted that the significant drop in the number of potential college-going students was cause for concern at many colleges and universities. Chapman's model was, therefore, developed to assist admissions officers and administrators in formulating appropriate recruitment strategies. The model is longitudinal in nature, and recommends that the college choice decision is determined by the interaction between a set of student characteristics and a set of external factors. The student characteristics include socioeconomic status, academic aptitude, academic performance, and educational aspirations. The external factors consist of significant persons (such as parents, friends, and high school personnel), fixed college characteristics (academic program, location, cost/aid), and college recruitment strategies (view books, campus tours, etc) (Chapman, 1981).

Litten (1982) expounded upon Chapman's model, outlining a five-stage process of college choice which is affected throughout by both internal and external factors: college aspiration, search process, information gathering, sending applications, and enrolling. College aspirations are affected by student characteristics (race, income, socioeconomic status, sex, religion, parents' education, etc), personal attributes (class rank, academic ability, academic performance, self-image, values, etc), high school characteristics (social composition, quality, curriculum, programs), environment (occupational structure, economic conditions, cultural conditions), and public policy (student aid available.) Information gathering is impacted by college actions (recruitment, admissions policies) and influences/media (parents, counselors, peers, marketing publications, etc). Sending applications is impacted by both college characteristics (price, size, academic programs, and public/private) and influences/media (parents, counselors, peers, marketing publications, etc). Litten also accounts for institutional selection of students by including a college action piece that interacts between the stages of submitting an application and actually enrolling.

A final and more recent contribution to the field is a model advanced by Vrontis, Thrassou, and Melanthiou (2007). Their study drew heavily from the models developed by Jackson, Chapman, and Litten and presents a contemporary higher education college choice model that they envisioned would have applicability in all developed countries. Their model is the first to pull substantially from consumer-choice behavior models, accounting for the concept that higher education marketing and recruiting has more closely resembled for-profit businesses than in years past. As such, their model describes five phases of college choice that reflect this change in paradigm; need recognition, information search, alternative

evaluations, purchase and consumption, and post-consumption evaluation. Vrontis et al also postulated that a variety of internal and external factors influence students passing through the five phases. Internal or individual determinants include customer attributes, such as race, socioeconomic status, and parent's education, as well as personal attributes such as class, personality, educational aspirations, and academic aptitude (2007). External or environmental determinants include general factors consisting of occupational structure and economic and cultural conditions; public policy factors, such as the availability and amount of financial aid; and influences/media, including parents, counselors, peers, and communications. Higher education institutions impact the model through their differentiating characteristics, including cost, size, location, academic programs, and public/private control, as well as through their actions, such as recruiting, admissions policies, financial aid disbursement, and marketing materials. High schools affect the model via their social composition, quality, curriculum, and academic offerings. This combined model is one of the first to conceptualize undergraduate college choice behaviors in a widely-applicable approach.

While the various combined models have taken steps to incorporate both sociological and econometric theoretical constructs in their frameworks, a recent vein of research has advanced the understanding of college choice processes even further. This research refinement has sought to address the fact that human capital theory typically excludes individual preferences that might arise as a result of different family background or social circumstances.

Refinement of Combined Models – Cultural and Social Capital

Cultural and Social Capital models draw heavily from the sociological tradition, and have in recent years, provided a different approach to the traditional combined models. Prior to the late 1990's, most college choice research focused on the generic population, with little focus on the differences between students of various racial, ethnic, and socioeconomic backgrounds. While nearly every model included these factors, little was known on how the factors influence students' progression through the college choice process. Recent research has moved the discussion toward the development of a cohesive conceptual model of college choice that explicitly focuses on the differences exhibited by historically underrepresented populations.

In doing so, a number of these combined model studies now draw from the sociological concepts of cultural capital and social capital. Cultural capital can be conceptualized as the set of attributes related to societal relations that an individual inherits from either a parent or guardian. The way in which these attributes interact with dominant societal norms influences the extent to which individuals are able to navigate and succeed in their environment. Social capital refers to the various networks, connections, and resources to which an individual has access (McDonough, 1997; Perna, 2006). McDonough (1997) pulled heavily from sociological status attainment frameworks, and integrated these frameworks with concepts from literature on school effects. McDonough thus presented a theoretical framework comprised of three assertions: 1) A student's cultural capital will affect the level and quality of college education that the student intends to acquire; 2) A student's choice of college will make sense in the context of that student's friends, family, and outlook, or

habitus; and 3) Students will utilize a process of bounded rationality to limit the number of considered alternatives.

A primary area of study regarding the impacts of cultural capital and social capital concerns the lagging collegiate enrollments for African-American students as compared with their peers of other races. The research has included both qualitative and quantitative studies, helping to clarify the source of the differences exhibited. While research has largely found existing college choice conceptual models to be applicable to underrepresented populations, key gaps do exist. In her qualitative study of 70 African-American high school students from five large cities, Freeman (1999) found that self-imposed pressures of achievement and under-appreciated cultural contextual issues significantly impacted African-American students' decision of whether to pursue post-secondary education. Additional factors influence the differences in how African-American and white students interact with the college choice model, such as lower college aspirations, lower levels of confidence in their high school's academic preparation, and overall lower levels of exhibited academic achievement (Pitre, 2006). Recent research, however, suggests that these differences might be the result of differing preferences and life circumstances. Perna (2000) found that when controlling for all other factors in her model, African-American students are 11% more likely than white students to enroll in a four-year college immediately following high school. She noted, however, that while this finding seems positive, its impact is limited by the small number of African-American and white students that share the same set of characteristics (e.g. parental education, family income).

Studies have also examined the ways in which states and other entities can positively influence college going behaviors for disadvantaged and underrepresented students. Students from low-socioeconomic status (SES) backgrounds are less likely to enroll in any form of post-secondary education than their peers. Those low-SES students who do pursue post-secondary education are more likely to attend an in-state public two-year institution. Those students are, therefore, at a significant disadvantage as compared with students who immediately enroll in a four-year institution following high school graduation and who are more likely to ultimately obtain a bachelor's degree (Perna & Titus, 2004). In order to overcome these disadvantages, researchers have suggested a number of steps to increase the college going rates of disadvantaged student populations. Increasing the levels of current outreach activities available to young students, improving the instructional quality and delivery of outreach programs, expanding opportunities for networking among outreach programs, and linking the outreach programs directly to schools and long-term systemic plans are all proposed measures to help balance access (Cabrera & La Nasa, 2000, pp. 99-100).

Summary – College Choice Research

Theoretical modeling of college choice processes has evolved substantially over the past thirty years. Early disciplinary research was primarily situated within either a sociological or an economic perspective; that research quickly evolved to include combined models that integrated the two approaches. Further refinements of the combined model incorporated the theories of cultural capital and social capital, addressing concerns about the models efficacy when examining historically underrepresented student populations. The

integrated model advanced by Perna (2006) reflects this evolution and serves as the framework for exploring graduate school choice decisions in this study.

Graduate School Choice

Research on graduate school choice processes that was based on a common theoretical framework did not begin in earnest until the early 1980's (Mullen et al., 2003). In the beginning, research on the topic rose from a variety of different objectives, including analyses of the future college faculty pipeline, enrollments in specific professional programs, and graduate enrollment of historically underrepresented populations (Zhang, 2005). Research into graduate school choice decisions has typically built upon established college choice literature or college student persistence scholarship (Kallio, 1995). Perna (2004) noted that this prior researched occurred in a somewhat disjointed nature, with multiple conceptual and theoretical frameworks applied to the various analyses. The breadth and depth of those early studies were also limited by the types of datasets studied, as very few were drawn from large, nationally representative samples.

Following the completion of the initial Baccalaureate and Beyond study (1993/94) and its two follow-up's (1997, 2003), a number of new studies drew from those datasets and greatly advanced academic understandings of graduate school choice processes (Heller, 2001; Millett, 2003; Mullen et al., 2003; Perna, 2004; Zhang, 2005). Those studies began to identify a number of common areas of interest in exploring graduate school choice processes, including the effects of biographical/demographical factors, family characteristics, the type of undergraduate institution the student attended, the student's undergraduate major and general academic performance, and the amount of debt the student accumulated in the process of completing their baccalaureate degree. Perna (2004) advocated for the development and application of a conceptual model

derived from the econometric tradition of human capital theory that simultaneously incorporated cultural and social capital theories. The model of graduate choice employed in this study draws directly from that proposition by adapting Perna's (2006) later work in developing a comprehensive conceptual model for undergraduate college choice and applying it to the study of graduate choice processes. The model is firmly grounded in the tradition of human capital theory, and includes explicit modeling of cultural and social capital concepts.

As a number of common independent variables exist in the current literature, this review will examine those most salient to the theoretical model I adapted from Perna's (2006) analysis of undergraduate college choice processes. Specifically, I look at the first two layers of the current model, the habitus and the undergraduate institution context, and their impact on the human capital investment decision, which is the core of the model. Variables used to measure the influence of the human capital investment include the student's undergraduate academic performance, undergraduate major and potential earned income, and accumulated undergraduate indebtedness. Additionally, there are high school variables such as the student's SAT/ACT score that are believed to influence the graduate school choice process via the intervening level of undergraduate institution type.

The first contextual layer of the adapted Perna model, "habitus", contains the individual-level student demographic variables of race, ethnicity, and gender; approximations of cultural capital such as the parents' highest level of education, parents' income, parents' contributions towards tuition costs, and whether English was the primary language spoken in the home; and finally, the social capital concepts of high school type, and whether the student enrollment at an out-of-state undergraduate institution. The second contextual layer of the model includes variables

related to the undergraduate institution including institutional control, Carnegie classification, graduation rate, and a flag if the institution was a Historically Black College or University (HBCU). These institutional characteristic variables also provide key insights on the influence of social capital in the graduate school choice process (Perna, 2004).

Human Capital Variables

The center of the conceptual model proposed by Perna and adapted for use in exploring graduate school choice processes is the human capital investment decision. Variables such as undergraduate major and academic performance influence the demand an individual student has for graduate education. The total amount of debt the student has accumulated at the undergraduate level and the potential wages the student would forego by enrolling in graduate school moderate that demand. The following variables have featured prominently in the research on graduate school choice.

Undergraduate Academic Performance.

Increased undergraduate grade point averages are consistently found to positively impact graduate enrollment decisions (Fox, 1992; Heller, 2001; Millett, 2003; Zhang, 2005). Hearn (1987) found that undergraduate academic performance directly influenced educational aspiration and indirectly influenced educational plans. However, Ethington & Smart (1986) found that only males' graduate choice decisions were impacted by undergraduate academic performance. Heller concluded that a 15% increase in predicted graduate enrollment likelihood could be attributed to every one-point increase in undergraduate grade point average (2001).

While Heller focused on the differences between each grade point average point, Millett (2003) divided undergraduate academic grade point average (GPA) into four separate categories;

2.74 or lower, 2.75 – 3.24, 3.25 – 3.75, and a reference category of 3.75 or higher. When holding all else constant, Millett found that compared to the reference group that students with a 2.74 or lower GPA were 3.5 times less likely to apply to graduate school. Students with a GPA between 2.75 and 3.24 were 2.1 times less likely to apply, and students with a GPA between 3.25 and 3.74 were 1.5 times less likely to apply to graduate school. However, she found that undergraduate GPA was not significant in predicting graduate school enrollment.

Females have, in recent years, surpassed their male counterparts in both undergraduate attendance and performance. Perna (2004) theorized that females' higher average GPA's result in increased attendance in master's level programs. In terms of racial variances in performance, Walpole (2008) conducted a study of approximately 12,000 students from over 200 institutions of higher education, and found that undergraduate grade point average was the only college environment variable to significantly impact her logistic regression model. She theorized that the lower GPA's typically earned by African-American students could hinder their post-baccalaureate opportunities. Mullen, Goyette, and Soares (2003) found that undergraduate GPA was directly and positively related to graduate enrollment. Their analysis split GPA into ten equal categories, and found that moving up one category level resulted in a 13% increase in the odds of enrolling in a master's program, 20% in an MBA program, 31% in a doctoral (professional practice) program, and 37% in a doctoral (research) program.

Zhang (2005) also examined the impact of undergraduate academic performance on graduate enrollment, finding a strong positive relationship. His analysis found that each one-point increase in undergraduate point average correlated to a 22% increased likelihood of graduate enrollment. Zhang also found higher levels of academic performance to increase the probability of

enrolling in a doctoral program compared to a master's program. Student performance at the secondary level is another factor that influences graduate school aspiration and enrollment, although much of the research has shown that influence to be indirect and manifested through impacts on the quality of undergraduate institution attended (Pascarella, 2004).

Undergraduate Major.

Undergraduate major selection also impacts predicted graduate enrollment rates, with science and mathematics showing the greatest likelihood to predict graduate school enrollment, followed by education, computer science, engineering, and business (Heller, 2001; Zhang, 2005). Millett created a dummy variable for undergraduate majors classified as pure research fields by the Biglan system. The rationale for this was that pure fields (e.g. chemistry, biology, foreign languages, and humanities) have a higher necessity and expectation for graduate school completion compared to applied fields (e.g. business, engineering, health fields). Millett found that students who completed a pure undergraduate major were 2.1 times more likely to apply to graduate school than students who had pursued an applied field of study for their baccalaureate (2003).

Mullen, Goyette, and Soares (2003) also found undergraduate major to significantly influence graduate enrollment in their analysis of the 1992-1993 Baccalaureate and Beyond survey data. They structured the data so that those students who selected "other" when indicating a major were considered as the reference category, and found that mathematics, science, and psychology majors were 5 times and biology majors were 12 times as likely to enroll in a doctoral (research) program. For doctoral (professional practice) programs, enrollees were 1.5 times as likely to have majored in the social sciences and nearly 6 times as likely to have majored in

biology. Students majoring in business, engineering, and the social sciences were all approximately 3 times as likely to enroll in a MBA program as those students in the reference "other" category. Master's programs had the most statistically significant undergraduate major categories predicting enrollment, with the following levels of increased odds: humanities, engineering, public affairs, biology, math, and science all 1.5 times as likely to enroll, education and history majors 2 times as likely, and psychology majors 2.5 times as likely to enroll.

In Zhang's (2005) exploration of the impact of undergraduate major on graduate enrollment, he used education graduates as the reference category. Graduates of business programs were the least likely to pursue graduate education, at a rate 22% lower than the reference category. He found that graduates of the natural sciences, mathematics, and psychology were more likely to enroll in graduate level study, with engineering, natural science, and mathematics graduates more likely to do so at a research institution. Zhang posited that this lower rate of graduate attendance for business majors is a function of higher opportunity costs and significant levels of required work experience.

Undergraduate Indebtedness.

The impacts of accumulated undergraduate indebtedness on graduate enrollment have been the study of significant research since 1990 (Millett, 2003). In terms of students affected, undergraduate borrowing levels and patterns vary by student type. Heller (2001) used the Baccalaureate and Beyond survey to study over 11,000 students who graduated in 1992-1993 and found that students of color, students from low socioeconomic backgrounds, and financially independent students were more likely to borrow than their peers. Additionally, students who attended private institutions were more likely to borrow than graduates of public institutions were.

Students who attended a private for-profit institutions exhibited the highest accumulated debt levels.

In his study of the 1980 High School & Beyond sample, Weiler (1991) found no statistically significant influence of undergraduate indebtedness on either masters or doctoral enrollment decisions. Similarly, an analysis of students who graduated from 32 elite colleges and universities undertaken by Schapiro, O'Malley, and Litten (1991) also failed to find any significant relationship between indebtedness and intentions of enrolling in graduate programs in the arts and sciences. Fox (1992) found that undergraduate debt had no impact on male graduate enrollment decisions, but did negatively impact females in a small but statistically significant way.

Alternatively, Heller (2001) found that undergraduate indebtedness was negatively related to graduate school enrollment, but influenced the model significantly less than other factors (e.g. degree expectations, undergraduate major, undergraduate GPA). He found that every additional $1,000 the student incurred as debt reduced predicted enrollment by only 0.1% (Heller, 2001). Students with undergraduate debt also appear to be more likely to pursue doctoral programs in lieu of masters programs, possibly due to funding differences (Fox, 1992). Millett (2003) used a slightly modified sample of the same 1992-1993 Baccalaureate and Beyond survey that Heller examined, and found largely confirming results with certain differences. Students with less than $4,999 did not differ significantly from those students with no debt; students with between $5,000 and $9,999 were 1.6 times as likely not to apply to graduate school than students with no debt; students with incurred debt of $10,000 to $14,999 were 1.4 times as likely not to apply; and students with greater than $15,000 in debt were associated with an odds ratio of 1.3 times as likely not to apply to graduate school.

Ekstrom, Goertz, Pollack, and Rock (1991) examined data from both the National Longitudinal Study of 1972 and the High School and Beyond study cohorts of 1980 and 1982. The researchers found that students with higher levels of indebtedness were actually more likely to aspire to, apply for, and enroll in graduate education; they also found no significant differences displayed by gender.

Millett (2003) concluded that the substantive variance found by researchers regarding the impacts of undergraduate indebtedness on graduate school aspiration and enrollment was a function of differing datasets and quantitative methodologies. All of the studies referenced here used data from students who graduated before the 1992 amendments to the Higher Education Act took effect (Campaigne & Hossler, 1998). These changes greatly expanded the types and amounts of loans that a student could take out in pursuit of their undergraduate education, and I theorized that the potential additional amounts of student indebtedness would negatively influence future graduate school decisions.

The effect of undergraduate indebtedness can differ by student background characteristics. This has been shown to manifest in two ways: first, students of color are typically less likely to take out loans. Second, students of color often enroll in graduate programs that exhibit the highest levels of borrowing (Johnson, Kykendall, & Winkle-Wagner, 2009). It is possible that underrepresented minority students who accumulated significant levels of undergraduate indebtedness will be less likely to pursue graduate education, particularly if they have a need for funding.

Graduate Financial Aid.

Receipt of financial aid for post-baccalaureate study has been found to positively impact graduate aspiration and enrollment in several studies (Kallio, 1995; Millett, 2003). This positive impact has been shown at both the masters and the doctoral (research and professional practice) level (Weiler, 1991). Ekstrom, et al. (1991) also found receipt of financial aid to be a positive influence in graduate school enrollment; conversely, they found that applying for but failing to receive graduate aid was negatively related to graduate enrollment. The impact that post-baccalaureate aid has on graduate enrollment decisions can differ by gender; Fox's (1992) analysis of the 1987 US Department of Education *Survey of 1985-1986 College Graduates* found only female students to be significantly impacted by graduate aid awards.

In their qualitative analysis of the factors that influence graduate school enrollment by underrepresented minority students, Morelon-Quainoo et al. (2009) discussed the impact of graduate financial aid packages on student choice decisions. Their findings echoed much of the aforementioned research, uncovering a tie between institutional reputation, graduate financial aid packages, and debt aversion. Students in the study weighed out the benefits and costs of each of those areas, and were typically less likely to enroll at a lower-quality institution without substantial graduate aid packages.

Labor Market Alternatives & Opportunity Costs.

A key aspect of the human capital theoretical framework employed in the current study is the idea that an individual faced with a graduate enrollment decision will weigh future potential lifetime earnings against those benefits that would be accrued without completing graduate education (Zhang & Thomas, 2005). As Millett (2003) noted, the measurement of opportunity

cost and economic alternatives is an integral component of graduate choice research. Bedard and Herman (2008) examined the influence that entry-level labor market conditions had on graduate school enrollment for recent bachelor's degree recipients. Their study drew from the 1993 -2001 National Survey of Recent College Graduates (NSRCG), which is conducted biennially. The NSRCG is actually comprised of five distinct and nationally representative samples of students who received their bachelor's degree within the prior two academic years. The sample contains students from five undergraduate major categories: (a) computer science and mathematics, (b) life sciences, (c) physical sciences, (d) social sciences, and (e) engineering. Labor market conditions were derived by examining the Bureau of Labor Statistics Local Area Unemployment Statistics program, which provided state-level unemployment rates. The specific rate used in the study was the unemployment rate for civilian non-institutional 20 to 24-year-olds within a specific state (Bedard & Herman, 2008).

Bedard and Herman (2008) also found that any relationship of unemployment rate and graduate school enrollment varied depending on both program type and student gender. Their research found the majority of graduate enrollment to be acyclical, with no significant relationship observed with unemployment rates. There were a few exceptions to this finding, however. Male doctoral (research) enrollment was found to be counter-cyclical, with every one percentage point increase in unemployment resulting in a corresponding .151 percentage increase in enrollment. Male master's students were found to respond in a pro-cyclical manner, with the one-percent increase in unemployment yielding a .579 percent decrease in enrollment. Females were only significantly influenced within doctoral (professional practice) and MBA enrollment, responding in a counter-cyclical manner with the one-percent increase in unemployment resulting in a .213

increase in enrollment. Bedard and Herman found undergraduate academic performance to specifically impact these cyclical enrollment cycles only for those students with grade point averages (GPA) higher than 3.25. Undergraduate major influenced doctoral (research) enrollment for males in the physical sciences, life sciences, computer science, and mathematics (Bedard & Herman, 2008).

Another interesting opportunity cost effect surfaced in the concept of foregone earnings. Millett (2003) found foregone earnings to be negatively related to graduate school application. Compared to the reference category of $27,000 and above, students with expected annual incomes between $21,000 and $23,999 were 1.4 times less likely to apply, and students with expected incomes between $24,000 and $26,999 were 2 times less likely to apply. Her analysis also examined the impact of foregone earnings on graduate enrollment, but did not discover any statistically significant ($p < .05$) findings. At the lower threshold of .06, students with expected incomes of less than $21,000 were 1.6 times less likely to enroll, and students with foregone incomes between $21,000 and $23,000 were 1.5 times less likely to enroll than the reference threshold of $27,000 and above (Millet, 2003). The impact of foregone earnings negatively influenced enrollment in masters programs, but did not show a statistically significant influence on doctoral program enrollment (Weiler, 1991). Weiler posited that this differentiation could be a result of the ability to work while enrolled in a master's program.

Habitus Variables

The habitus is the first contextual layer included in the current model, and encompasses the student's individual biographical and demographical characteristics, in addition to cultural capital and social capital variables. The student's race, ethnicity, and gender have all been

previously found to indirectly impact graduate school choice processes, and the inclusion of approximations of cultural and social capital have been found to improve the overall power of theoretical models (Perna, 2006).

Biographic and Demographic Characteristics.

Biographical and demographical variables such as parental income, socioeconomic status, and parental education are featured prominently in the literature on undergraduate college choice. Whereas those characteristics have been found to directly impact undergraduate college choice behaviors, research regarding the impact on graduate school choice has been more mixed. A number of authors found that at the point in time that a student considers graduate school, those variables have little direct impact on the choice decision (Hearn, 1987; Pascarella, 1984). Ethington and Smart (1986) and Mullen et al. (2003) found that background characteristics had little to no direct impact on the graduate choice process, although they did influence the process via various intervening variables. While the scholarly literature has shown background characteristics to be of varying importance in predicting graduate school enrollment, there is clearly some actual and significant impact occurring. Historically marginalized populations continue to enroll at lower rates than their non-marginalized counterparts. Perna (2004) recognized this fact, noting that African-Americans, females, and Hispanics share of graduate degrees in 1999-2000 was lower than their share of baccalaureate degrees in 1994-1995. These continued levels of actual underrepresentation highlight the need for further scholarly exploration, and undergird the rationale for explicitly modeling the concepts of cultural capital and social capital in this study.

A demographic factor that has consistently been found to impact the graduate choice process in a number of studies is gender. Ethington and Smart (1986) theorized that gender differences would greatly influence the development of a model, and, therefore, ran separate analyses for men and women. Perna (2004) theorized that women may be potentially under-enrolled in graduate school as a result of personal preferences (including marriage and raising children) or as a result of reduced family support. Satisfaction levels and departmental factors directly influenced men, whereas women's aspirations were directly influenced by parental supportiveness. Moreover, aspirations in general were found to be higher in men than in women and more closely tied to undergraduate major (Hearn, 1987). Men were also found to have a higher likelihood of enrollment in doctoral programs (research and professional practice) than masters programs (Perna, 2004; Weiler, 1991). Perna (2004) did find, however, that females comprised a larger share of enrollment in master's level programs.

Minority students and those individuals with low socioeconomic status have historically been underrepresented in American graduate education (Johnson, 1996; Perna, 2004; Strayhorn, 2009). Graduate funding levels influence graduate school choice decisions for minority students more than their white counterparts (Johnson, 1996; Poock & Love, 2001). This concept supports previous research by Hossler, Braxton, and Coopersmith (1989) and Campaigne and Hossler (1998) that found low and moderate-income students to be significantly less-likely to take out loans to finance their education, and considerably more likely to be impacted by fluctuations in pricing levels. Receipt of increased graduate funding packages would reduce the need for educational loans, and mitigate differences in pricing levels. For certain subsets of African-American students, the desire for professional advancement appears to be a primary factor in

motivating the pursuit of graduate education. In a survey of 106 African-American exercise science doctoral recipients, King and Chepyator (1996) found that professional extrinsic factors influenced over 50% of participants decisions to enroll. While this study was limited to students who pursued doctorates in sport and exercise science, and convenience sampling was used to identify participants, it does provide useful contextual information about factors influencing African-American students' decision to pursue graduate education.

Socioeconomic status influences issues related to graduate school aspiration and enrollment, with first-generation college students being slightly less likely to enroll in graduate school than their peers (Zhang, 2005). The relationship is not strictly positive or negative, however. Walpole (2008) found that students from low socioeconomic background were more likely than their high socioeconomic peers to aspire to a master's degree (40% v. 18%); high socioeconomic students were more likely to aspire to a doctoral (research or professional practice) degree, however (68% v. 44%). Some of these differences could arise from the fact that socioeconomic status is a derived category, typically drawn from parental education and family income status. The discrepancies suggest that direct modeling of those specific variables thought to influence graduate school choice (e.g. parental income, education, and financial support provided) is a more sound approach.

Cultural Capital.

Perna (2004) first introduced cultural capital into studies of graduate school choice. While the theoretical conceptualization is newer, a number of the salient cultural capital variables were explored in previous studies. Cultural capital is the set of attributes related to societal interactions that an individual inherits from either a parent or guardian. How these attributes

interact with social norms can influence the extent to which individuals are able to navigate and succeed in their environment.

One variable related to the concept of cultural capital is parental education level. Interestingly, the influence of parents' educational attainment has showed variance in assorted studies. Pascarella (1984) found parental education level to influence graduate school aspirations indirectly through college environmental and academic performance variables; Hearn (1987) focused on parental support and found it positively and directly influenced student educational plans; Perna (2004) and Millett (2003) actually found parental education to be a statistically significant influence of graduate school enrollment. Another example of this variance exists in a 1992 study where males were found to be impacted by their father's education (but not their mother's), whereas females were impacted by their mother's education (but not their father's) (Fox, 1992). Weiler (1991) showed that parental education positively influenced enrollment in masters programs, but not doctoral (research or professional practice) programs. Mullen et al. (2003) found the opposite, however, noting that parental education did not influence enrollment in MBA programs, slightly influenced enrollment in all other master's programs, and strongly influenced enrollment in doctoral (research & professional practice) programs.

Some of the variance seen between these various studies is likely a result of the differing data sources selected for analysis. The first Baccalaureate and Beyond Cohort (1993) was used in Perna's (2004), Millet's (2003), and Mullen et al.'s (2003) analyses. Given that those studies were the first to draw from a nationally representative database, more credence should be given to their findings, which suggests that parental education does influence graduate school choice processes. The differences that Mullen et al. (2003) found compared to Perna (2004) and Millett (2003)

appear to be related to how master's degree recipients were categorize. Mullen et al.'s analysis delineated between MBA and all other master's students; Perna and Millett considered those students within the same construct.

Parental income has been found to be a significant predictor of graduate school enrollment in a number of studies, including both Millett's (2003) and Zhang's (2005) analysis of 1992-1993 Baccalaureate and Beyond survey respondents. Millett (2003) used family income in excess of $100,000 as the reference category, and found that students hailing from families with total incomes less than $74,999 were between 2 times and 2.4 times as likely not to enroll in graduate education. Zhang (2005) explored the impact of income on a more granular level, using $10,000 incremental categories. His analysis revealed a more subtle level of influence, with each $10,000 increase in income associated with a .37% improvement in the likelihood of pursuing graduate education.

Researchers have also begun to explore the impact that a student's native language has on graduate school aspiration, application, and enrollment. Perna (2004) was the first to include the metric in the modeling of graduate school choice; none of the other four studies that used the Baccalaureate and Beyond dataset to explore graduate school enrollment considered the variable in their analysis (Heller, 2001; Millet, 2003; Mullen et al., 2003; Zhang, 2005). Individuals who grew up in homes where English was the primary spoken language were 1.409 times as likely to enroll in a masters degree program, and 1.057 times as likely to enroll in a first professional degree program (Perna, 2004). These positive findings point towards the importance of the inclusion of this measure of cultural capital in future studies of graduate school choice.

Social Capital.

Perna (2004) also theoretically introduced social capital into graduate school choice research which includes the various networks, connections, and resources to which an individual has access (McDonough, 1997; Perna, 2006). Perna (2004) found a number of measures of social capital to be statistically significant in her exploration of graduate school choice. First, the type of undergraduate institution attended influenced enrollment at various levels of graduate school. Compared to the reference category of "other institution," students who attended a comprehensive undergraduate institution were 1.279 times as likely to enroll in a master's program; students who attended an institution classified as other doctoral university or research I university were 1.276 times and 1.372 times as likely to enroll in a master's program, respectively. Undergraduate institution type was found to be an even stronger predictor at the first professional level. Students who attended a liberal arts institution were 2.342 times as likely to enroll in a first professional program; students who attended a comprehensive institution were 1.676 times as likely; students who attended an institution classified as other doctoral university were 1.912 times as likely, and those who attended a research 1 university were 2.540 times as likely to enroll in a first professional degree program as those students enrolled at an institution categorized as "other."

Interestingly, attending an institution in the state of the student's residence was found to significantly impact enrollment in both masters and first professional programs, with students 1.268 times as likely to enroll in a master's degree program and 1.289 times as likely to enroll in a first professional program, when compared to the reference category of attending an undergraduate institution in another region of the country (Perna, 2004). A number of other

pertinent characteristics related to undergraduate institution type and context are discussed in greater depth in the subsequent section focused on the undergraduate institution context.

Undergraduate Institution Context

The second level of the conceptual model encompasses the characteristics of the student's undergraduate institution. This contextual layer contains variables related to the institution's quality, classification, and control.

Undergraduate Institution Quality.

Researchers have paid significant attention to the impact that institutional quality has on students' post-baccalaureate activities. Institutional quality is typically defined by external rankings (e.g. Barron's or US News & World Report) or by internal measures of admissions selectivity, percentage of full-time faculty members, endowment levels, and average per student instructional expenditures. These measures are directly and positively correlated with graduate school attendance (Eide, Brewer, & Ehrenberg, 1998; Fox, 1992; Millett, 2003; Zhang, 2005).

Eide et al. (1998) examined the impact of undergraduate institutional quality on graduate enrollment via the nationally representative data sets The National Longitudinal Study of the High School Class of 1972 and the High School and Beyond surveys of 1980 and 1982. Their analysis operationalized college quality by examining admissions selectivity as reported in Barron's college guides, yielding three discrete groups (top, middle, and bottom). They further demarcated each selectivity category by the institution's level of control, public or private. Their analysis examined the influence of undergraduate college quality in two separate models, with the first examining the impact on graduate enrollment generally and the second inspecting the difference in enrollment at Carnegie classified research I or research II institutions versus non-research

institutions. Their probit and multinomial logit analyses found that graduates of top private undergraduate institutions were more likely to enroll in graduate school generally, and more likely to attend research I and research II institutions specifically. This probability increase held across all three cohort sets analyzed (Eide et al., 1998).

Ethington and Smart (1986) explored college choice through the Cooperative Institutional Research Program (CIRP) that surveyed new college freshman in 1971 and then conducted a follow-up in 1980. Their research used admissions selectivity as a proxy for institutional quality, measured by the average SAT/ACT score of the overall student body. They generated separate models for males and females, finding admissions selectivity to have a strong positive direct effect on graduate enrollment for men only.

Millett (2003) used the 1992-1993 Baccalaureate and Beyond Longitudinal study to examine the graduate choice process of those students who expressed an expectation to pursue a doctoral degree. College selectivity was divided into three categories (less competitive, competitive, and most competitive) pulled from Barron's publications; she also noted public/private control. Her analysis found that students who attended less competitive institutions were 1.5 times less likely to apply to and were 1.8 times less likely to enroll in graduate school when compared to those students who attended most competitive institutions (Millett, 2003). Mullen, Goyette, and Soares (2003) examined the same Baccalaureate & Beyond Longitudinal Study (92:93). Their analysis found that an increase in one college selectivity quartile to be positively and directly related to graduate enrollment (1.26 times as likely for MBA students and 1.19 times as likely for doctoral – professional practice students).

Zhang (2005) also analyzed the 1992-1993 Baccalaureate and Beyond Longitudinal study, specifically examining the 1997 follow-up survey. Similar to Millett's analysis, Zhang established three selectivity levels (less competitive, competitive, and most competitive) derived from Barron's data, accounted for public/private control, and additionally created a dummy category for historically black colleges and universities (HBCU). Zhang used the less competitive undergraduate institution category as reference, and found that graduates of competitive institutions were approximately 10% more likely to enroll in graduate school in general, and that graduates of most competitive institutions were 16% - 18% more likely to enroll in graduate school within five years of receiving their baccalaureate.

Undergraduate Institution Control and Classification.

The classification and control of the student's undergraduate institution is also associated with graduate school choice processes. Compared to the reference category of "other institution," Perna (2004) noted that graduates of research I universities, other doctoral universities, and comprehensive I universities were more likely to enroll in a master's degree or first-professional program. Graduates of Liberal Arts I institutions were only more likely to enroll in first-professional programs, however.

Mullen et al. (2003) found similar results in their analysis of institutional control and classifications. Their analysis set graduates of comprehensive institutions as the reference category, and found that graduates of private research institutions were more likely to enroll in first-professional programs, graduates of public research institutions were more likely to enroll in a doctoral program, and that individuals who graduated from a liberal arts institution were more likely to enroll in a doctoral or first-professional program.

Zhang (2005) derived a set of variables that reflected both quality and institutional control simultaneously. While he did find a significant impact of institutional quality on graduate school enrollment, no statistically substantive difference between graduates of public and private institutions was found.

One of the more direct studies into the effect of undergraduate institution classification on graduate school aspiration was DeAngelo's 2009 work. Her qualitative research analysis explored whether attending a less selective and non-research institution negatively influenced graduate school choice processes for underrepresented minority students. Her analysis yielded a number of interesting findings. First, students who attended a comprehensive institution were less likely to have had faculty members talk with them about the possibility of graduate education. DeAngelo (2009) also found that those students who were able to engage in undergraduate research were more likely to pursue graduate education. Given that these opportunities are more readily available at research institutions, it highlights a reason for the gaps seen by institution type.

Summary – Graduate School Choice Research

Research into graduate school choice processes is a relatively recent and underdeveloped area of exploration, particularly when compared to the scholarly work that has examined undergraduate college choice decisions. This prior body of research has provided a strong foundation for future research, exploring many of the key variables and conceptual areas that influence graduate school choice decisions. This study builds its research questions by directly examining and assessing that prior body of research, and purposively exploring those areas believed to be germane to graduate school choice processes.

Hypotheses

I next introduce the six operative hypotheses explored in this study. Each of these hypotheses was derived from the established body of literature and research. I follow the presentation of each hypothesis with a discussion of the specific literature that has previously explored that topic.

Hypothesis One.

A student's undergraduate academic performance will significantly impact graduate school aspiration, application, and enrollment; students with higher GPA's are more likely to pursue graduate education.

Substantial research explores the impact of an individual's undergraduate academic performance and major on the decision to pursue graduate education. Heller (2001) found that every single-point increase in undergraduate grade point average yielded a 15% increase in predicted enrollment in graduate school. Millett (2003) did not find undergraduate GPA to significantly influence graduate school enrollment, but did find that it influenced graduate school application. Mullen, Goyette, & Soares (2003) and Zhang (2005) also found a positive and significant relationship between undergraduate academic performance and graduate school enrollment.

Hypothesis Two.

Students who major in business will be less likely to aspire to, apply for admission, or enroll in graduate school than their peers who major in the social sciences, natural sciences, education, or humanities. Students with higher opportunity costs are less likely to pursue graduate education.

Human capital theory is predicated upon the concept that individuals are rational beings making decisions that will maximize their personal utility levels (Paulsen, 2001). A key component of that analysis is the concept of opportunity cost; that an individual weighs the most immediate economic alternative to determine the impact of foregone earnings and direct investment costs (Paulsen, 2001). One key concept that has been used to measure this dynamic in the graduate choice arena is the potential earnings an individual foregoes by not entering the workforce (Bedard & Herman, 2008; Millett, 2003; Weiler, 1991). Given that the Baccalaureate and Beyond dataset employed in this study was conducted only one year after a student's receipt of their baccalaureate degree, the best proxy for determining opportunity cost is the student's undergraduate major (Perna, 2004).

The students' undergraduate major significantly impacts graduate school application and enrollment. Heller (2001) and Zhang (2005) both found that students who majored in a scientific or mathematic field were more likely to enroll in graduate education. Millett (2003) explored the impact of major by classifying programs as either pure (e.g. biology, chemistry, humanities) or applied (e.g. business, engineering) and found that individuals majoring in a pure field were more likely to apply to graduate school. Mullen, Goyette, and Soares (2003) found undergraduate major to be a more statistically significant indicator of graduate school pursuit at the master's level than

the doctoral level, with biology specifically showing significance at multiple levels of graduate education.

Hypothesis Three.

Increased levels of accumulated undergraduate indebtedness significantly and negatively impact a student's decision to pursue graduate school.

Research on the impacts of undergraduate debt levels on graduate school enrollment has been largely ambiguous and inconclusive (Millett, 2003). Weiler (1991), Fox (1992), and Schapiro et al. (1991) all found that undergraduate indebtedness had little or no impact on graduate enrollment. Heller (2001) and Millett (2003) both used the 1992-1993 Baccalaureate and Beyond cohort to measure the impact of student indebtedness, and found a significant and negative relationship between undergraduate debt levels and likelihood of graduate school enrollment. While previous research is unclear regarding the impact of student indebtedness on graduate school choice, I theorize that changes in loan limits authorized in the 1992 Higher Education Reauthorization Act, public policy shifts from grants to loans, and substantial increases in tuition and fee levels will have all contributed to a significant negative relationship between student indebtedness and graduate enrollment (Baum et al., 2010; Hearn and Holdsworth, 2004; Heller, 2001).

Hypothesis Four.

Females are more likely to enroll in graduate school than males. African-American and Hispanic students are less likely to enroll in graduate programs than other students.

Gender has been a component of graduate school choice research in virtually every study conducted (Perna, 2004). In previous studies, men have been found more likely to enroll in

doctoral level programs than females, but less likely to enroll in master's level programs (Perna, 2004; Weiler, 1991). African-American and Hispanic students are consistently less likely to enroll in graduate school than their Asian-American or Caucasian-American counterparts, and are more likely to have graduate enrollment negatively influenced by financial considerations (Johnson, 1996).

Hypothesis Five.

Including indirect measures of cultural and social capital will improve the predictive power of the model, and will provide a more accurate assessment of the impacts that gender and race/ethnicity have on graduate enrollment.

Perna (2004) was the first scholar to purposively include the sociological concepts of cultural and social capital into a theoretical model of graduate school choice, drawing from her own previous college choice work (Perna, 2001), as well as that of Paulsen and St. John (2002), and St. John and Asker (2001). Perna (2004) found that including measures of cultural capital (parental education, native English-speaker) and social capital (parental involvement and financial support, undergraduate institutional characteristics) improved the accuracy and power of the model. Perna recommended that future research include more specific and direct variable measures of cultural and social capital, and theorized that the inclusion of those additional items would improve the overall conceptual model. However, a limiting factor in the analysis of the efficacy of cultural capital and social capital is the availability of variables that directly measure those concepts.

Hypothesis Six.

The undergraduate institution attended significantly influences graduate choice processes. Individuals who graduate from higher quality institutions or an institution classified as a research university will be more likely to pursue graduate education.

The classification and control of a student's baccalaureate institution has, in previous research, been shown to have a strong association with graduate school enrollment. First, students who graduate from private colleges are more likely than their peers who attended a public institution to pursue graduate education (Eide, Brewer, & Ehrenberg, 1998; Mullen, Goyette, & Soares, 2003). The Carnegie Classification of the student's baccalaureate institution is also a strong predictor of graduate school pursuit. Graduates of institutions that are more focused on research are more likely to be enroll in graduate school; students who attend a liberal arts college are also more likely to show a proclivity for graduate education (Mullen et al., 2003; Perna, 2004).

Another key component of the undergraduate institution examined in prior research is the concept of institution quality. As no common measure of undergraduate institution quality exists, most studies have attempted to model quality via a set of approximations and proxies, with the most common being institutional admissions selectivity (Eide et al., 1998). As a number of studies have employed selectivity as a proxy for quality in their analysis of graduate school choice, the results largely reveal a positive and significant relationship between the two. Eide et al. (1998) found that graduates from more selective baccalaureate programs were significantly more likely to enroll in graduate school, specifically at those institutions classified as either research I or research II. In their separate analyses of the 1992-1993 Baccalaureate and Beyond study, Millett (2003), Mullen, Goyette, & Soares (2003), and Zhang (2005) all found that students who graduated from

more-selective undergraduate institutions were more likely to apply to and enroll in graduate education.

Summary

The review of pertinent literature reveals directions for future study. I decided to employ a conceptual model based on econometric human capital theory and cultural and social capital to further research graduate choice processes. While a number of frameworks have been developed over the years, this paper employs a modification of the conceptual model put forth by Perna (2006) for studying undergraduate college choice decisions. This conceptual model is divided into four contextual levels, of which the first two, habitus and undergraduate institutional context, are explored in this paper. The human capital investment decision is at the core of the model and includes variables related to undergraduate major, undergraduate academic performance, and total indebtedness. The first contextual level, habitus, includes the demographic characteristics of race, ethnicity, and gender, the cultural and social capital variables of family income, parent's education, and primary language spoken in the home, and high school type. The second contextual layer of the model encompasses the variables and characteristics of the student's undergraduate institution, including institutional quality, institutional control, and the institutions Carnegie Classification.

Several components of previous research on graduate school choice warrant additional study. Concepts salient to the theory of human capital are particularly interesting. For instance, given the critical interplay between expected utility and assumed direct and indirect costs, further explorations of undergraduate major and undergraduate academic performance should be explored. Numerous studies found undergraduate institutional quality to significantly influence the

graduate enrollment process; as such, this could be a strong way to operationalize and further test the concept of social capital. Graduates of those most competitive and research focused institutions likely have access to more academic and student support services, and are, therefore, more informed and apprised of the graduate school world.

Research on student indebtedness is also of particular interest for two reasons. First, previous research has been ambiguous and at times contradictory, but Heller (2001) and Millett (2003) did find increased impacts of additional student debt. Second, no nationally representative study has examined the impact of student debt using data more current than 1992-1993, and it is theorized that changes in financial aid philosophies (Hearn & Holdsworth, 2004) and policies (Heller, 2001), coupled with significantly increased tuition and fees (Baum et al., 2010) have resulted in substantive changes to the graduate choice process.

The 1992 amendments to the Higher Education Act (HEA) resulted in a large shift with regards to policies for funding higher education (Johnson, Kykendall, & Winkle-Wager, 2009). First, the maximum amount of monies that a student could borrow through the Stafford Loan Program increases from $2,625 to $3,500 for first and second year undergraduates and from $4,000 to $5,500 for third and fourth year college students. The amendments also resulted in an increase in the maximum amount of funds that students could borrow through the Stafford program, with the cap rising for dependent students to from $17,250 to $23,000. A number of program changes were also made that shifted the funding policy from grants to loans: the parental loan program, known as PLUS loans, was uncapped; unsubsidized Stafford loans were introduced; and the need-based Supplemental Loans for Students program was eliminated

(Campaigne & Hossler, 1998). All three of these policy changes could impact a student's graduate school choice processes.

CHAPTER THREE: METHODOLOGY

Enrollment in post-baccalaureate programs has grown in recent years, as the many public and private benefits associated with graduate school completion have become more apparent (Baum et al., 2010). As the number of students pursuing and obtaining the baccalaureate degree has increased, so has the importance of obtaining a graduate degree in terms of individual professional advancement opportunities in a number of fields (Zhang, 2005). While graduate education has consistently grown in both size and importance, theoretically based scholarly study has lagged considerably behind that afforded to undergraduate college choice (Mullen et al., 2003). The majority of research on graduate choice has either been atheoretical, lacking in strong theoretical underpinnings (Hearn, 1987), or has focused on the factors influencing a population at a single institution (Poock & Love, 2001). While these studies made significant contributions to the literature and the field in providing descriptive data on the graduate choice process, they do not help predict future graduate enrollment behaviors.

However, a number of researchers have recently acknowledged this fact, and conducted studies that drew from nationally representative samples (Heller, 2001; Millett, 2003; Mullen Goyette, & Soares, 2003; Perna, 2004; Zhang, 2005). These studies provided significant advances to the base of knowledge related to graduate school choice decisions. They are limited, however, in two regards. First, all five studies use the 1992-1993 Baccalaureate and Beyond study and related follow-up surveys for their data. While there are benefits to this commonality (the ability to cross-reference the efficacy of variables and findings being first and foremost), the major

drawback is the age of the data. Significant changes have occurred within American higher education and graduate studies in the time since the B&B:93 dataset was created. The costs associated with pursuing post-secondary and graduate education have increased dramatically (Millett, 2003) and financing methods have changed significantly, with an increased focus placed on student loans (Hearn & Holdsworth, 2004). The second limitation is the continued lack of a theoretical conceptual model for explaining the graduate choice process. Of the five studies referenced above, only Millett (2003) and Perna (2004) firmly ground their study within a theoretical framework derived from the literature. This lack of strong theory development hinders both applied and theoretical applications of the research. A core objective of this study is to address that concern.

This section of the paper addresses the methodological approach employed for advancing the study of graduate school choice. The purpose of this study is to apply a conceptual framework for graduate school choice. While the ultimate dependent variable of interest is actual enrollment in graduate education, this paper also examines the influence that the independent variables have on plans to attend graduate school by modeling graduate school aspiration and graduate school application. The modeling of graduate school aspiration and application is of particular interest given the data included in the 2000/01 Baccalaureate and Beyond Longitudinal study were collected only one year after those students' baccalaureate graduation.

There are three primary questions that guided the inquiry: first, to what extent do measures of human capital explain graduate school aspiration, application and enrollment; second, how do individual background characteristics, as they exist in the context of the habitus, influence and determine graduate school enrollment; and third, what effect do attributes of the individual's

undergraduate institution have on graduate enrollment processes? These guiding questions are supplemented with additional sub-questions, as outlined below.

1. To what extent do the following measures of human capital explain graduate school aspiration, application, and enrollment?
    a. What influence does undergraduate major have on graduate school choice processes?
    b. How does undergraduate academic performance impact aspiration, application, and enrollment to graduate education?
    c. To what extent does a student's cumulative undergraduate indebtedness influence components of graduate school choice?
2. To what extent do student demographic and background characteristics and the concepts of cultural capital and social capital influence graduate school aspiration, application, and enrollment?
    a. How do gender and race/ethnicity influence the likelihood of graduate school aspiration, application, and enrollment?
    b. To what extent do indirect measures of cultural capital (parents' education, family income, parental assistance with tuition & fees, language most often spoken in home) impact graduate school choice processes?
    c. How do indirect measures of social capital (type of high school attended; undergraduate institution type and location) interact with other aspects of the model and influence the decision to enroll in graduate school?

3. To what extent do characteristics of the undergraduate institution influence graduate school aspiration, application, and enrollment?
    a. To what extent does the undergraduate institution control (public or private) and classification (Carnegie type) influence components of the graduate school choice process?
    b. How does the graduation rate of the undergraduate institution impact graduate school aspiration, application, and enrollment?
    c. Does attending a Historically Black College or University (HBCU) significantly impact graduate school aspiration, application, and enrollment?

Study Design Overview

This study uses data from the 2000/01 Baccalaureate and Beyond Longitudinal Study (B&B:2000/01). The B&B: 2000/01study was conducted on behalf of the National Center for Education Statistics (NCES), an agency within the U.S. Department of Education's Institute of Education Sciences (Charleston, Riccobono, Mosquin, & Link, 2003). The Baccalaureate and Beyond research report serves as the NCES's primary tool for studying the lives and post-graduation activities of baccalaureate recipients, inclusive of graduate education, work experiences, financial situations, and personal experiences (Charleson et al., 2003). The B&B:2000/01 was the second discrete cohort compiled by the NCES. The initial cohort, B&B:93 was comprised of 11,000 students who graduated in the 1992-1993 academic year; the study subsequently followed up with those students in 1994, 1997, and 2003 (Wine, Cominole, Janson & Socha, 2010).

B&B:2000/01 drew from the 2000 National Postsecondary Student Aid Survey (NPSAS), and is comprised of approximately 10,400 sample members who graduated in 1999/2000 (Charleston et al., 2003). B&B:2000/01 served as the initial follow up to the NPSAS:2000 survey, consisting of a follow-up survey one year after the cohort group's college graduation. No further follow up to the B&B:2000/01 was conducted, in contrast to the B&B:93 study that featured follow up surveys in 1997 and 2003 (Charleston et al., 2003).

The study also drew data from a number of administrative systems, including the National Student Loan Data System (NSLDS), the College Board (SAT) & the ACT, the National Student Clearinghouse (NSC), and the Free Application for Federal Student Aid (FAFSA) Central Processing System (CPS). The inclusion of data from these systems allows for a more thorough and robust analysis of the factors that influence graduate school choice (Charleson et al., 2003).

Data Collection

The sample design of B&B:2000/01 employed a complicated multi-stage approach. The initial data was drawn from the NPSAS:2000. Initial sampling occurred at the institutional level via the NPSAS:2000 study; only institutions that satisfied six discreet criteria were considered for the study. The institutions were required to: 1) offered an educational program designed for individuals who had completed secondary education, 2) offered more than just correspondence courses, 3) offer an academic, occupational, or vocational course of study that is either 300 clock hours or 3 months in duration, 4) offer courses that are available to more individuals than the employees or members of a company or group that administered the institution, 5) be located in the United States or Puerto Rico, 6) not be a U.S. service Academy, 7) be open to the public, and 8) be a Title IV participating institution (Charleston et al., 2003, p. 7).

The institutional sampling frame was drawn from the 1998-1999 Integrated Postsecondary Education Data Systems (IPEDS) institutional characteristics, fall enrollment, and completions files, and were subdivided into 22 strata dependent on institutional level, control, highest degree, and percentage of awarded baccalaureate degrees in the field of education. Following the establishment of the institutional strata, NCES developed a stratified systematic sample of students, with the students following in one of the following seven strata: 1) baccalaureate business, 2) baccalaureate non-business, 3) other undergraduate, 4) masters, 5) doctoral, 6) other graduate, and 7) first-professional (Charleston et al., 2003, p. 7).

NPSAS:2000 used a Chromy's sequential probability minimum replacement (PMR) sampling algorithm to select an initial 1,080 institutions. Student samples were subsequently drawn from those colleges and universities identified in the institutional sampling process. Each institution supplied a student enrollment list, which was sampled via a flow basis according to fixed inclusion probabilities. The final stage of the sampling process involved drawing from a pool of potential baccalaureate recipients who were NPSAS:2000 non respondents (Charleston et al., 2003, p. 8). Of the initial sample of 11,700 preliminarily eligible students, a total of 10,030 were interviewed. Of those successfully interviewed, 9,650 were full interviews, ten were partial completion interviews, and 370 were abbreviated interviews. Seventy interviews were determined to be ineligible due to question responses. The unweighted response rate is thus 86% (10,030 completed interviews / 11,630 eligible students); the weighted overall CATI rate was calculated at 75% (Charleston et al., 2003, pp, 24 - 25).

Instrument Design

Data were collected for the B&B:2000/01 study via a computer-assisted telephone interview (CATI). Data elements were derived by first examining the previous B&B:1993/94 cohort study, and were combined with relevant issues of educational research and policy. Next, instrument sections were created on a flow basis by staff at NCES and RTI. The CATI system was setup so that existing data contained in other existing systems was pre-loaded (e.g. NPSAS:2000 interview data) (Charleston et al., 2003, p. 14).

Data Management

I obtained a restricted-use license for B&B:2000/01 from the U.S. Department of Education's National Center for Educational Statistics (NCES). The restricted-use data is shipped with an Electronic Codebook (ECB) that serves as the analyst's initial point of interaction with the data. The data available in B&B:2000/01 were generated from a number of different source files, including SAT and ACT score histories, the National Student Loan Data System(NSLDS), the initial National Postsecondary Aid Survey (NPSAS:2000), and the actual Baccalaureate and Beyond one-year follow up survey. Fortunately, the ECB provides an easy to use graphical interface for browsing and selecting variables for extraction into either SAS or SPSS format.

The variables selected for analysis were extracted via the ECB into SPSS format; I subsequently conducted preliminary analysis and data management in SPSS Version 19. The initial dataset contained 10,028 student records. As the subsequent descriptive analysis and multiple imputation procedures were to be carried out in STATA 12, the first step was to recode all dichotomous and categorical variables so that "0" represented the lowest value

within a category (e.g. Female = 0, Male = 1). The ECB outputs most variables with "1" as the lowest value; failure to recode the variables will result in errors when attempting to run analyses in STATA. The next step was to collapse and modify the categories of several of variables for analysis. I created a composite variable, TOTAL_DEBT, by summing the two B&B:2000/01 variables CBUGLN (Cumulative Federal Loan Amount) and CBFAMLN (Cumulative Family Loan Amount). The variable NBLANG (Language) was collapsed from 29 categories to two (English / Non-English). The Race category (RACE2) was collapsed from eight categories to six by combining American Indian/Alaska Native with Native Hawaiian/Other Pacific Islander and Other with More Than One Race. The variable containing the students undergraduate major (BMAJORS3) was modified so that the 12 categories were reduced to 7 by combining humanities and social/behavioral sciences, math and life/physical sciences, computer/information science and engineering, and vocational/technical with other technical/professional. The 16 categories of income by student dependency type (INCOME) were transformed into 6 categories: dependent, less than $29,999; dependent, $30,000 - $59,999; dependent, $60,000 - $99,999; dependent, $100,000 or more; independent, less than $29,999; independent, $30,000 - $49,000; and independent, $50,000 or more. The Carnegie classification category (CC2000) was reduced from 18 categories to four: Doctoral/Research Universities, Masters College and Universities, Baccalaureate Colleges – Liberal Arts & General, and "other institution" (e.g. Baccalaureate/Associates & Associates Colleges, Specialized Institutions). The nine categories used to represent parent's highest education were collapsed into high school

diploma or less, some college or technical training, bachelor's degree, master's degree or equivalent, and advanced degree or equivalent.

The dependent variables of interest were derived from the B&B:2000/01 variable Graduate School Pipeline (GRDPIP). This variable contained information about a student's progression through a hypothetical pipeline of graduate education (no plans to attend graduate school, plans graduate school in the future, applied for graduate school, accepted to graduate school but not enrolled, and enrolled in graduate school). I derived three dichotomous dummy variables from this initial variable: graduate school aspiration (GRAD_ASP); graduate school application (GRAD_APPLY); and graduate school enrollment (GRAD_ENROLL). These dummy variables were created by "rolling down" all higher-level responses; for instance, graduate school application was coded "1" if the student responded that they had either applied for, been accepted to, or enrolled in graduate school. Graduate school aspiration was coded "1" for all students who responded that they planned to attend graduate school, as well as those that had applied for, been accepted to, or enrolled in graduate school.

Next, I sorted the dataset by the undergraduate institution ID (INSTID) to determine the within-school sample size. The analysis showed that the 10,028 student records were distributed across 689 undergraduate institutions. The number of students sampled from any specific undergraduate institution varied from a low of one student to a high of 91. Multilevel modeling requires a sufficient number of level-two clusters, as well as a satisfactory number of level-one units contained within each cluster. As such, any institution in the sample containing less than five students was deleted from the dataset. This resulted in a reduction of

125 undergraduate institutions and 260 records. The final dataset prepared for analysis, therefore, contained 9,770 students nested within 560 undergraduate institutions.

Missing Data

Following the aforementioned data management procedures, I conducted a preliminary analysis of missing data via the SPSS Multiple Imputation: Analyze Missing Patterns function. The missing values analysis routine provides a comprehensive and graphical representation of the dataset and the variables included therein. The analysis showed that there was a significant level missing data in the B&B:2000/01 dataset. Of the 18 variables selected for analysis, only six contained no missing data; seven were missing between 0.1% and 5.0%; three were missing between 5.0% and 10%; one was missing more than 10%, but less than 20%; and finally, one variable was missing a full 26.5% of its data. Table 3.1 presents this information in tabular format.

The primary negative outcome of this significant amount of missing data contained within the individual variables is the impact on the number of complete cases available for analysis. Figure 3.1, generated by the SPSS Multiple Imputation Missing Patterns routine, provides a graphical representation detailing the overall impact of the missing data by variable, by case, and by overall values. An examination of the total amount of missing data, represented by the values pie chart, reveals that out of the 177,047 unique values contained in the dataset, only 4.6%, or 8,602, are, in fact, missing.

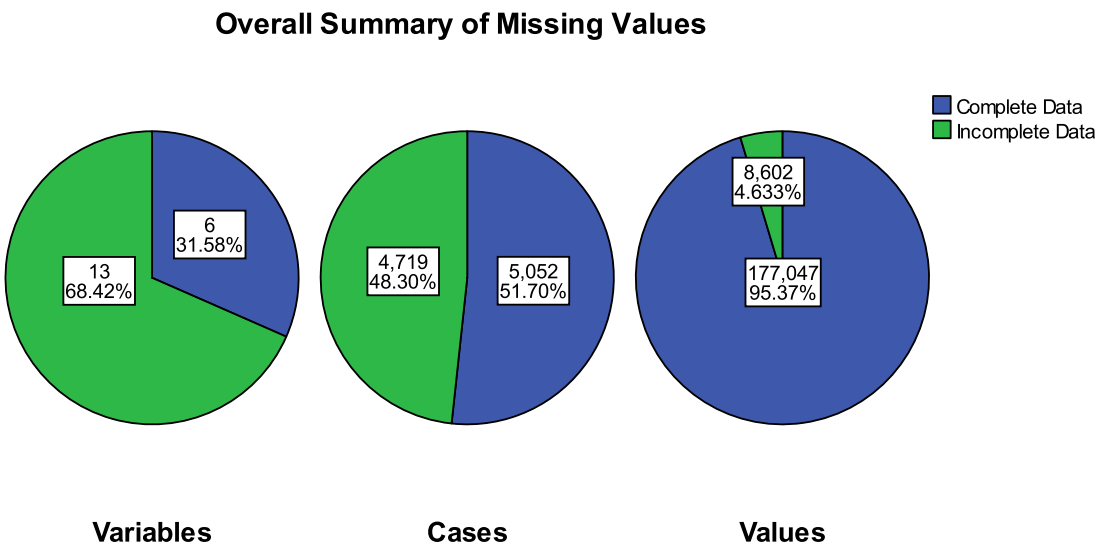

Figure 3.1: Overall summary of missing values

Table 3.1. B&B:2000/01 variables: Missing data

Variable Name	***Missing N***	***Missing Percent***	***Valid N***
SAT derive combined score (*TESATDER*)	2,590	26.5%	7,180
Primary Language (*NBLANG*)	1,270	13.0%	8,500
Total amount borrowed (*TOTAL_DEBT*)	770	7.9%	9,000
Interactions: Debt * Gender, Debt * Race	770	7.9%	9,000
Parent's highest education level (*NPARED*)	570	5.9%	9,200
Graduation rate (combined 1997/2000) (*GRADRATE*)	410	4.2%	9,360
Graduate Degree Pipeline (*GRADPIP*)	290	2.9%	9,480
High school public/private (*CBHSTYP*)	160	1.6%	9,610
Cumulative undergraduate GPA (*GPA2*)	140	1.4%	9,630
Carnegie code (2000) (*CC2000*)	40	.4%	9,730
BA Institution in residence state (*SAMESTAT*)	10	.1%	9,760
BA Institution control (*BCONTROL*)	0	0%	9,770
Total income by dependency (*INCOME*)	0	0%	9,770
Race-ethnicity (*RACE2*)	0	0%	9,770
Undergrad major field (*BMAJORS3*)	0	0%	9,770
BA Institution is HBCU (*HBCUBA*)	0	0%	9,770
Gender (*Gender*)	0	0%	9,770

Unfortunately, regression techniques can only be conducted on cases containing *no* missing data. This approach is known as complete-case analysis, and is the most common historical approach seen in the literature. In this situation, a complete-case analysis would result in a reduction of the sample size from 9,770 to 5,050; this represents a loss of nearly 50% of usable information. A reduction of this many cases would severely bias and jeopardize the efficacy of the study (Allison, 2002).

Multiple Imputation Theory

In early research, a common approach to dealing with missing data was to simply delete a case that contained any amount of missing data; this is, in fact, still the default approach employed by the majority of statistical packages. However, there are a number of statistical and practical concerns with this approach; for instance, in this study it would reduce the sample by approximately 50%.

Fortunately, there is a way to approach missing data that does not require such drastic steps. Multiple imputation is a relatively recent methodological development that allows for the generation of values that replace missing data through a variety statistical methods. First introduced by Rubin in the late 1970's, the approach has, in recent years, become the method of choice for dealing with missing data, as long as certain assumptions are met. Multiple imputation procedures involve directly introducing a random component into the generation of multiple datasets that calculate the predicted value of missing data from the other complete data contained in the dataset. The random component involves taking random draws from the Bayesian posterior distribution of the model parameters (Allison, 2002).

Before proceeding with the multiple imputation procedure, I first reviewed the technical definitions of data missingness. The first and most stringent form of missing data is known as Missing Completely at Random (MCAR). In order for data missing on a variable to be considered MCAR, the probability of their being missing cannot be related to their value, or the value of any other variable in the dataset. While this assumption is often cited by researchers when justifying the use of complete case analysis, it is rarely ever observed with actual data. The next and less rigorous definition is Missing at Random (MAR). The data in a variable can be considered MAR if their probability of its missingness is unrelated to their value, after controlling for all other variables included in the dataset. Unfortunately, it is infeasible to conclusively determine if data are MAR, as it is impossible to know the characteristics of data that do not exist (Allison, 2002). Assuming the data are MAR, multiple imputation procedures generate estimates that are consistent, asymptotically efficient, and asymptotically normal (Allison, 2002). I reviewed the B&B:2000/01 dataset, and determined that it was unlikely for the data to be MCAR. It did seem feasible, however, to consider that the data were MAR. As such, I decided to proceed with the process of developing a multiple imputation model for further analysis.

There are three generally accepted steps in the process of conducting a multiple imputation. First, an imputation model must be specified to generate the missing variables of interest. Next, completed data must be created from the random draws of data, replacing the missing values in each of the imputed datasets. The second full step consists of developing the analytical model of interest, which is then run against the imputed datasets. This process results in the generation of a set of statistical outputs equivalent to the number of implicates

created during the imputation process. For instance, if one were to specify the creation of five datasets via multiple imputation, and then sought to analyze that data via a logistic regression, five separate sets of output would be generated, one for each implicate. The final step is to pool the estimates generated for each imputed dataset into one final result. It is the process of generating multiple datasets that are then fully analyzed that allows the multiple imputation procedure to avoid the issues of bias inherent to other methods of dealing with missing data (Van Buuren, 2007).

The first step of the multiple imputation process is arguably the most time-consuming and important component of the procedure. Development of a proper multiple imputation model involves careful planning to the specific dataset being analyzed, the types of variables it contains, and the research questions to be answered. Just as quantitative analysis methods have become increasingly refined and sophisticated in recent years, so too has the process of structuring multiple imputation models. A proper imputation model should account for any of the types of analysis that will be executed; if not, it is likely that the parameter estimates will be downwardly biased towards zero. This results from the fact that if the model is unable to account for the interactions of various facets of the data, then the imputed data will not reflect any association (Von Hippel, 2009).

Sampling Design

There were a number of important factors to consider in the development of an imputation model. The first consideration was to take into account the sampling design and clustered nature of the data in the imputation procedure. Unfortunately, most multiple imputation packages assume that the data were generated from a simple random sample, and

do not allow the researcher to account for those data structures. Failure to address the sampling design in multiple imputation has received recent scholarly interest, as it can result in a downward bias of subsequent analyses. Reiter, Raghunathan, and Kinney (2006) discuss this issue and provide two statistical alternatives that address the sampling design concern.

Their first approach involves the use of fixed effects to account for the design features. Their second approach is to employ a normal random effects model to incorporate the design directly. They conducted simulations to determine if the two methods provided improvements over the traditional approach that failed to account for clustered data. Their results showed both the fixed effects and the random effects hierarchical model generated point estimates and confidence intervals very close to the original dataset (Reiter, Raghunathan, & Kinney, 2006)

I attempted to employ both options, but was unable to accommodate either with the B&B: 2000/01 dataset. I first attempted to use the REALCOM-IMPUTE software package, which is an emerging option for employing random effects hierarchical models. Originally designed for use with the MLwiN package, REALCOM-IMPUTE is now able to interface directly with STATA (Goldstein, 2011; Bartlett, 2011). Unfortunately, I was unable to complete the execution of those routines without error. Future exploration of this package will likely generate fruitful results. The interface with STATA is relatively new, and it is possible that future updates will address the issues I encountered. I next attempted to account for the clustered sampling design via a fixed effects approach.

The process of establishing dummy variables to facilitate a fixed effects approach for dealing with clustered data is covered by Eddings and Marchenko (2011). In this approach, a

dummy variable is created for each of the clusters included in the model, which, in this case, is the undergraduate institution the student attended. The dummy variables for each undergraduate institution are entered into the imputation model to account for the clustered sampling approach. This approach is recommended only when the number of clusters is small, however. As there were 564 undergraduate institution clusters included in the dataset, STATA was unable to execute the imputation models.

I next attempted to employ a new feature in STATA 12 that allows multiple imputations to be executed within a discrete higher order grouping variable, which again, in this case, is the undergraduate institution. The "by" command instructs STATA to execute a separate imputation model within each undergraduate institution (Eddings & Marchenko, 2011). This option would not execute, unfortunately, due to the small cluster sizes exhibited in the data. In order for the imputation procedure to run, each variable included in the model must vary. For example, a small amount of data was missing on the variable NBLANG, the primary language spoken in the student's home. Within most small clusters, there is no variability on the student's response, as English was the overwhelmingly large value recorded. In a situation where an institution cluster contained only five student records, and one of those records was missing on the value NBLANG, most often the other four records all contained the value of English. This lack of variability prohibited the imputation procedure from completing.

While I was unable to directly account for the clustered sample design of the data, I decided to continue with the imputation process and subsequent multilevel analysis. The work of Reiter, Raghunathan, and Kinney (2006) informed my decision to continue. Their

work found the estimate biases to be a function of how closely the design variables are related to the survey variables. Given that failure to account for the sampling design results in a downward bias of estimates that are used in the subsequent multilevel modeling process, the negative outcome would be an inability to detect a true difference in the multilevel model.

While the inability to directly model the sampling design in the imputation process is a limiting factor, it is less severe than the alternative approaches taken in previous analyses of the Baccalaureate and Beyond dataset (Millet, 2003; Mullen et al., 2003; Perna, 2004; Zhang, 2005). Future research should explore alternative approaches for addressing the sampling design in the imputation process for large-scale research.

Multiple Imputation Models

I conducted the multiple imputation procedures via the fully conditional specification implemented in the "mi impute chained" routine, new to STATA in version 12. This approach allows for the inclusion of continuous, binary, and categorical variables in the creation of the multiple imputation model. Van Buuren (2007) conducted simulations to test the efficacy of the fully conditional specification approach as compared to the traditional joint modeling approach. Some favor the joint modeling approach as it is derived from established parametric statistical theory, whereas the fully conditional specification approach does not possess this theoretical grounding. Van Buuren's (2007) simulation found that in situations where a fully joint distribution was infeasible, the use of a fully conditional specification resulted in less data bias. As the B&B:2000/01 variables of interest were

missing on continuous, binary, and categorical variables, I decided to employ the fully conditional specification.

Sample weights were directly incorporated via the STATA 12 *pweight* specification. The continuous variable TESATDER was modeled using truncated regression. GPA2, TOT_DEBT, GRADRATE, and the interaction terms were modeled via predictive mean matching. I used logistic regression to model the two dichotomous variables, NBLANG and SAMESTAT. Finally, multinomial logistic regression was used to model GRDPIP, NPARED, CBHSTYP, NCPARTUI, and CC2000.

The final component of the multiple imputation model creation was to consider those interaction effects I was interested in exploring during my data analysis. Whereas early imputation literature suggested that analysts impute missing data and then calculate interactions from the complete data sets, Allison (2002) posited that this would lead to a downward bias on the effect of the interaction term. Von Hippel (2009) conducted a full analysis of this approach, and found that calculation of interaction effects after imputation did result in a downward biasing of estimates. Their recommendation is for the analyst to anticipate those interactions that will be of interest, and calculate them from the incomplete dataset prior to imputation. The imputation routine will then model each of those interaction terms as a dependent variable to be imputed. While this might result in a situation where the interaction term does not logically match its base variables (e.g. x1=7, x2=8, x1x2 = 53), it does remove systemic bias from the model. As such, I first calculated the interaction effects of interest, and then conducted the imputation process.

The STATA imputation procedure took approximately one-hour to complete the generation of ten imputed datasets, each containing a full set of 9,770 variables. While I included the dependent variable GRDPIP in the imputation process, I deleted all cases in which its value had been originally missing and was then subsequently imputed (Allison, 2002). This resulted in a reduction of the sample size from 9,770 to 9,483, as 287 cases were deleted.

Conceptual Model

The conceptual model advanced in this study is an adaptation of the approach posited by Perna (2006) in her analysis of undergraduate college choice. It provides a strong mechanism for exploring the intersections of human capital, cultural capital, social capital, and graduate school enrollment, and helps adjust and account for differences in students' resource availability. The model posits that individuals make choice decisions related to additional units of education within the context of four nested layers:1) Habitus, 2) Undergraduate institution context, 3) Graduate school context, and 4) Social, economic, and policy context. The layers move from a broad social, economic, and policy context (layer four) down to the individual context (layer one).

While all four layers play a role, I focus on the impact the first two layers, habitus and undergraduate institution context, have on the graduate school decision process. The rationale for focusing on only the first two layers of the conceptual model is twofold. First, inclusion of only individual and institutional level variables allows for a focused analysis of their effects via the multilevel models. Second, the 2000/01 Baccalaureate and Beyond Longitudinal Study contains very few usable variables from the third and fourth contextual layers.

An overview of the third and fourth contextual layers included in the model is necessary, even though I do not explore them in this study. While this iteration of the Baccalaureate and Beyond Longitudinal Study does not contain a valid set of variables for analysis at the third and fourth contextual layers, it is anticipated that future releases of the study will do so. As such, the full four-layer model could be tested and explored at that point.

The fourth contextual layer focuses on macro-level social, economic, and policy contexts affecting choice decisions. This outermost layer represents the fourth component of Perna's (2006) integrated model. It shapes the overall climate and tenor of choice processes, and includes factors such as national demographic changes, unemployment rates and credit accessibility, and federal initiatives that focus on influencing enrollment patterns (e.g. new grant or aid programs). In proposing the model, Perna (2006) noted that a number of scholarly articles found connections between various policy initiatives and undergraduate choice behaviors. I theorize that those same connections exist at the graduate school level as well, albeit perhaps in different manifestations. Whereas there are significant and frequent policy initiatives constructed at the secondary and post-secondary level focused on increasing baccalaureate attainment rates, there is less focus on increasing the throughput of graduate degree recipients. However, I theorize that macroeconomic factors are more impactful at the graduate level, given the closer tie between graduate program and employment field, as compared to undergraduate major and job category.

The third contextual layer focuses on the ways in which graduate schools and programs influence choice processes. This phase is modified from Perna's (2006) initial model, which conceptualized this third layer as a higher education context within an undergraduate college choice process. The third layer posits that graduate school is not simply the destination within the

choice process, but that it also plays a critical role in providing enrollment information and shaping students' selections. Graduate schools convey information via active marketing and recruitment activities, in addition to more passive mechanisms such as proximity and geographic presence. This information interacts with students' preferences, including institutional type, location, and quality.

I now turn my focus to the two models included in this study for analysis. The second layer of the model, the undergraduate institution context, examines the influences that the student's undergraduate institution has on graduate school choice behaviors. Perna (2006) drew from McDonough's (1997) work that put forth an organizational habitus comprised of various resources and social structures that influence choice processes. Perna's (2006) initial model framed this second layer as a school and community context, focusing on the impact that an individual's school and neighborhood had on college choice decisions. Perna drew from the literature and theorized that low-income and underrepresented student populations were more likely to be situated in an organizational habitus that did not facilitate increased access to baccalaureate education. Within the universe of graduate school choice processes, this second contextual layer is reframed as the undergraduate institution context. I theorize in this study that the availability and types of resources and structural characteristics of the undergraduate institution directly and indirectly influence graduate school choice processes.

The innermost layer in the model, habitus, is comprised of the st gender, race, ethnicity, and socioeconomic status. I include this layer in addition to the undergraduate institution context in this paper's analysis. The habitus also operationalizes the concepts of cultural and social capital as related to choice processes manifested through a human capital investment decision. Perna

(2006) posited that the habitus, inclusive of various measures of cultural and social capital, shape the ways in which an individual approaches and considers an enrollment choice decision. The habitus, conceptualized as an internal schema of thoughts, beliefs, and perceptions, is directly formed and influenced by the environment in which an individual exists, and is unique to that individual. As such, each individual experiences and navigates the choice process differently, from within their own situated context.

The core of the conceptual model focuses on the choice analysis as explored through a human capital investment theoretical framework. The four layers (habitus, undergraduate institution, graduate school context, social, economic, & policy context) all flow into and directly influence the economic choice assessment made by the individual. The student, working from their individually situated context, explores the expected utility (monetary and non-monetary) and weighs it against anticipated direct, indirect, and opportunity costs. Drawing from both Perna's (2006) model as well as previous research, I theorize that student major, undergraduate academic achievement, and undergraduate indebtedness influence the cost/benefit analysis and subsequent choice decisions.

The primary focus of this study is on exploring and testing the factors related to graduate school enrollment conceptualized in layer one (habitus) and layer two (undergraduate institution) of the model. The purpose of this study is not focused on either graduate discipline or specific institution; those questions are substantively large enough to justify an independent analysis and exploration. As such, the dependent variables of interest (graduate school aspiration, application, and enrollment) are each collapsed in a dichotomous manner to encapsulate any post-baccalaureate degree program. This paper also does not attempt to explore the impact of any

contextual factors at the third (graduate school) or fourth level (social, economic, and policy) of the model. While other research has examined economic factors in a longitudinal manner (Bedard & Herman, 2008), or explored the influence of state policies on choice decisions (Perna & Titus, 2004), those topics are outside the scope of this study. A diagram of the full conceptual model is presented as Figure 3.2; the conceptual model specifically tested in this study is provided as Figure 3.3.

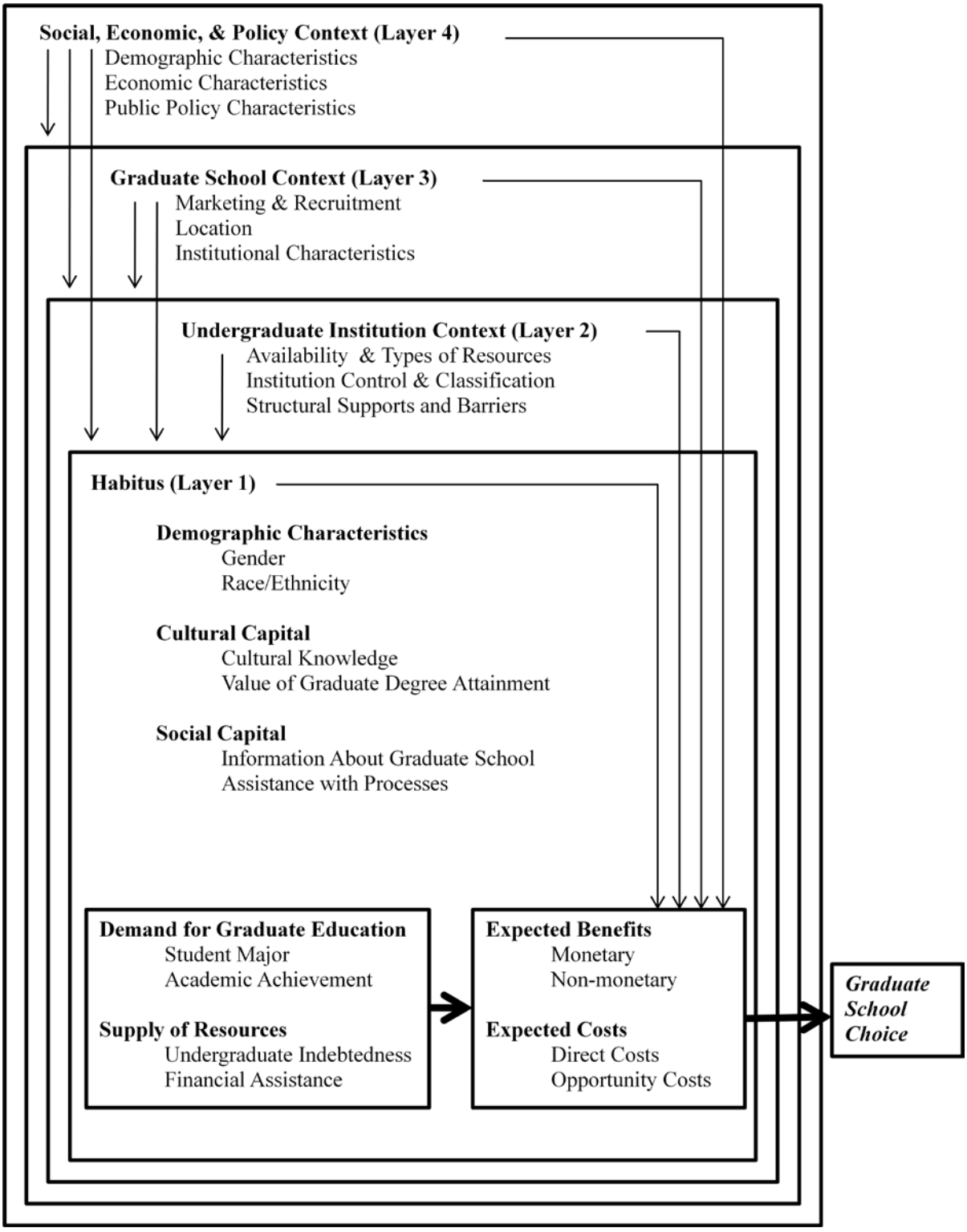

Figure 3.2: Four-layer graduate school choice conceptual model

Variables

The conceptual model explores the concept that students are nested within an undergraduate institution. Previous research (Heller, 2001; Millett, 2003; Mullen et. al, 2003; Zhang, 2005) has shown undergraduate institution type to have a substantive impact on graduate choice decisions. The use of a model in which students are explicitly and hierarchically nested allows for a focused analysis of the relative impact of level-one (student) and level-two (institutional) variables.

The variables selected for inclusion in the study stem from prior research and literature. I focus on those variables that will help elucidate the interplay of individual level background characteristics with factors inherent to the undergraduate institution attended. At the individual level, variables such as race, gender, parent's highest education, high school type, SAT score, undergraduate GPA, undergraduate major, and cumulative undergraduate indebtedness inform the model. At the secondary (institutional) level, I chose factors related to institutional control, Carnegie classification, quality, and undergraduate major. Variables listed for inclusion are presented in Tables 3.2. and 3.3

Figure 3.3 presents the specific conceptual model tested in this study. While the overall proposed conceptual model (Figure 3.2) adapted from Perna includes the third and fourth layers of the theorized graduate school choice construct, this narrowed conceptual model is tailored to include the specific variables available in the 2000/01 Baccalaureate and Beyond study. As the operative research objective of this study was to explore the confluence of individual and institutional variables via a generalized hierarchical linear model, the third

and fourth contextual layers are excluded from consideration and analysis. This allowed for a more focused exploration of those variables included in the first two layers of the model.

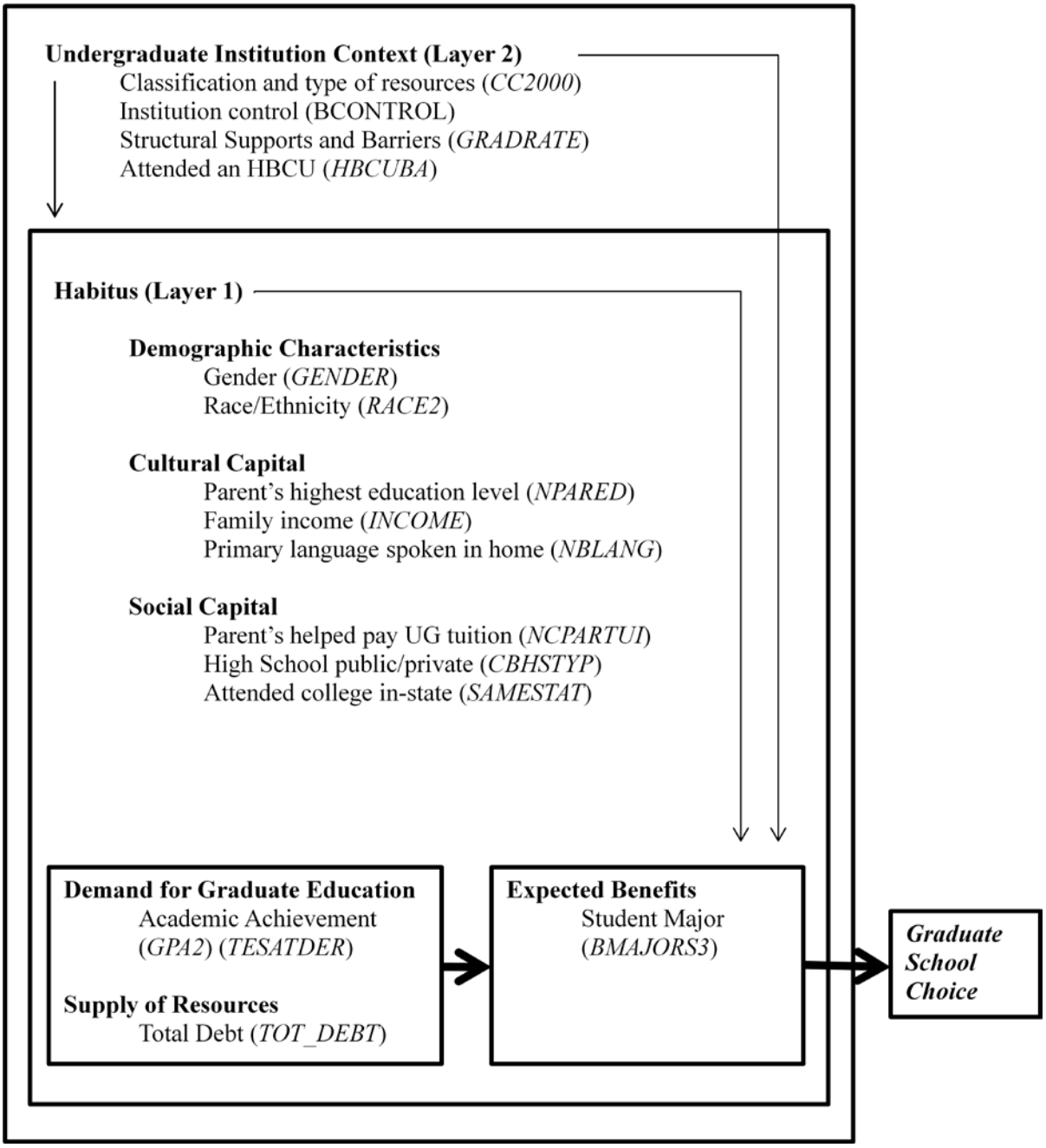

Figure 3.3: Two-layer graduate choice model including B&B:2000/01 variables

Table 3.2. B&B:2000/01 dependent variables

Dependent Variable Name	***Variable Description***
GRDPIP Post-BA degree: Grad school pipeline	This variable indicates how far in a hypothetical graduate school "pipeline" the respondent had progressed after earning the 1999-2000 bachelor's degree as of the B&B interview.

Table 3.3. B&B:2000/01 independent variables

Independent Variable Name	***Variable Description***	***Component of Model***
TESATDER SAT derived combined score	SAT combined score, derived as either the sum of SAT verbal and math scores or the ACT composite score converted to an estimated SAT combined scores.	Human Capital: Demand for Graduate Education
GPA2 Cumulative undergraduate GPA 1999-2000	Student Grade Point Average (GPA) in 1999-2000. Primary source is the GPA reported by the sampled NPSAS institution in CADE. If this was not available, student-reported GPA was used.	Human Capital: Demand for Graduate Education
BMAJORS3 Undergrad major field of study 1	Major field of study for the bachelor's degree, collapsed to 12 categories.	Human Capital: Demand for Graduate Education
TOTAL_DEBT Cumulative borrowed including parents 2000	Includes all loans ever borrowed for undergraduate education, including loans from parents and relatives, for 1999-2000 and prior years.	Human Capital: Supply of Resources
RACE2 Race-ethnicity (with multiple) 1999-2000	Student's race-ethnicity, including Hispanic/Latino and those indicating more than one race.	Habitus: Demographic Characteristics
GENDER Gender 1999-2000	Student's gender. 1.3% of cases (unweighted) were statistically imputed.	Habitus: Demographic Characteristics
NPARED Parent's highest education level 1999-2000	The highest level of education of either parent.	Habitus: Cultural Capital

Table 3.3. (continued)

Independent Variable Name	***Variable Description***	***Component of Model***
INCOME Total income by dependency (categories) 1999-00	Indicates total income in 1998 (categorical).	Habitus: Cultural Capital
NCPARTUI Parents helped pay tuition 1999-2000	Indicates whether anyone, such as respondent's parent(s)/guardian(s), paid respondent's tuition and fees on his/her behalf for the 1999-2000 school year.	Habitus: Cultural Capital
NBLANG Primary language 1999-2000	Indicates the language that was spoken most often at the respondent's home as he/she was growing up.	Habitus: Cultural Capital
CBHSTYP High school public/private	Indicates whether the respondent's high school was public or private.	Habitus: Social Capital
SAMESTAT BA institution in residence state 2000	Indicates whether the sampled NPSAS institution was in the same state as the state of legal residence of the student as of the 1999-2000 base year interview.	Habitus: Social Capital
BCONTROL BA institution control	Control of the institution where the student received the 1999-2000 bachelor's degree.	Undergraduate Institution Context

Table 3.3. (continued)

Independent Variable Name	*Variable Description*	*Component of Model*
CC2000 Carnegie code (2000) NPSAS inst 99-00	The 2000 Carnegie Classification includes all colleges and universities in the United States that are degree-granting and accredited by an agency recognized by the U.S. Secretary of Education. The 2000 edition classifies institutions based on their degree-granting activities from 1995-96 through 1997-98. Source: Carnegie Foundation	Undergraduate Institution Context
GRADRATE Graduation rate 1997/2000	Refers to graduation rate at the NPSAS sample institutions.	Undergraduate Institution Context
HBCUBA Historical Black college indicator 99-00	BA institution is a historical black college.	Undergraduate Institution Context

Methods of Analysis

The proposed methods of analysis draw from an examination of the intersection of the variables found in previous research and established statistical approaches for analyzing student choice decisions. In determining the appropriate statistical methodology for examining graduate school choice decisions, it is beneficial to begin with an examination of the most commonly used approach in educational and social sciences research, ordinary least squares (OLS) linear regression (Allison, 1999a). The reason for beginning the examination of statistical methodologies with OLS regression is that virtually all researchers that have completed a doctoral program in the

social sciences, behavioral sciences, education, or related field will have completed at least one quantitative methods course that covers the technique. As such, this section will provide an overview of OLS regression and the data assumptions required to use the technique. It will next discuss the problems that arise in attempting to use the approach in modeling choice decisions, and offer methodological alternatives that are more statistically sound.

Ordinary Least Squares Regression

OLS regression is a form of the general linear model (GLM), and is a method of statistical analysis frequently used in social sciences research to either explain relationships between variables, or to predict the impact that selected independent variables have on a dependent variable of interest (Mertler & Vannatta, 2010). In its most basic form, OLS regression can be used to explore the impact that a single independent variable of interest has on a single dependent variable. The following vector equation encapsulates the simple OLS regression model, in which the dependent variable of interest (y_i) is a function of the intercept (β_o) plus the single independent variable ($\beta_1 x_i$) and a random residual error (ε_i).

$$y_i = \beta_o + \beta_1 x_i + \varepsilon_i$$

For example, the researcher could run a simple linear regression to determine the impact that a student's IQ ($\beta_1 x_i$) has on ACT test score performance (y_i). In this situation, the statistical package employed would attempt to mathematically fit a line that best predicts the relationship between IQ and test score performance. To do so, the program will attempt to minimize the amount of variance that exists between the predicted regression line and the actual observed data. This variance can be thought of as the error that exists between the observed data and predicted data points (Mertler & Vannatta, 2010). For instance, if an individual with an IQ of 100 is

predicted of scoring a 25 on the ACT, but in reality scored a 27, there would be an error measure of positive two points on the ACT exam. If a subsequent individual with an IQ of 90 was predicted to score a 20, and in fact scored an 18, there would be a measurable error of negative two points. These two errors do not cancel each other out, however, as OLS regression is predicated upon minimizing the total amount of accumulated variance, positive or negative. To accomplish this objective, the amount of error observed in each iteration is squared, canceling out any negative variation, and allowing the total amount of error to be calculated. Thus, in this rudimentary and hypothetical example, the total amount of variance observed would be the sum of two squared and negative two squared, or eight. This process is what gives OLS regression its name; the regression line minimizes the squared variation between predicted and observed data (Allison, 1999a). OLS regression can be expanded to encompass multiple independent variables, as is most often the case in the social science research where clean and easy answers are rare to nonexistent.

OLS regression is a powerful statistical method that affords researchers the capability to examine the impact that various independent variables of interest have on a dependent variable. The method, like all other statistical routines, is predicated upon certain characteristics the data being analyzed is assumed to possess. While there is no commonly agreed upon set of assumptions inherent to OLS regression, the subsequent discussion draws from the set of five presented by Allison (1999a). The assumptions, if adhered to by the data, help improve the performance of the model with regards to bias and efficiency. An objective of the model is to minimize bias; that is, that the data estimates produced by the model are neither systematically overestimated nor underestimated. Efficiency refers to the overall accuracy of the model,

minimizing the total variation that exists, and is expressed via the standard deviation (Allison, 1999a).

The five assumptions of the data help researchers know when OLS regression is appropriate to use. The five assumptions are linearity, mean independence, homoscedasticity, uncorrelated disturbances, and normal distribution of disturbance. The first assumption, linearity, describes a situation in which the dependent variable of interest is a linear function of the independent variables included in the model, plus a random disturbance, or residual error (Allison, 1999a, pp. 122 – 123). The first assumption can be presented mathematically via the following equation (Allison, 1999b, p. 8).

$$y_i = \beta_o + \beta_1 x_i + \varepsilon_i$$

The second assumption, mean independence, deals with the error term (ε_i) specified above. This assumption states that the mean of (ε_i) is always 0, and does not vary as a result of the value of the independent variables ($\beta_1 x_i$). Mathematically, it is represented as (Allison, 1999b, p. 8):

$$E(\varepsilon_i) = 0$$

Homoscedasticity is the third assumption considered. This assumption also deals with the error term (ε_i), and requires that the variance of ε_i does not shift dependent upon the independent variables ($\beta_1 x_i$). The variance is of ε_i is represented as σ^2; the mathematical conceptualization of the third assumption is provided below (Allison, 1999b, p. 8).

$$var(\varepsilon_i) = \sigma^2$$

A further assumption is that for any individual in the sample, the observed error term (ε_i) is uncorrelated with any other individual's error term (ε_j). Mathematically, this assumption is presented as (Allison, 1999b, p. 8.:

$$\text{cov}(\varepsilon_i, \varepsilon_j) = 0$$

The fifth and final assumption considered is that the error term (ε_i) has a normal distribution, and can be presented as (Allison, 1999b, p. 8):

$$\varepsilon_i \sim Normal$$

Returning to the concepts of bias and efficiency, combinations of these five assumptions allow the researcher to determine the appropriateness of OLS regression. Satisfaction of assumptions one (linearity) and two (mean independence) ensures that the OLS sample estimates are unbiased estimates of their true population values. If the researcher finds that the data also allow for satisfaction of assumption three (homoscedasticity) and four (uncorrelated disturbances), then the OLS regression will produce the smallest standard errors possible, rendering it efficient. When this has been achieved, the selected model is typically referred to as the Best Linear Unbiased Estimate (BLUE). In combination with the other assumptions, the fifth assumption of normal distribution of disturbance allows for the use of a *t* table in calculating *p* values and confidence intervals (Allison, 1999a, pp. 122 – 123). While an overview of OLS regression and the assumptions that undergird its efficacy is necessary in selecting an appropriate approach for this research, I will analyze the problems inherent in applying this approach to many studies of graduate school choice.

Violations of OLS Assumptions

A proper examination of appropriate methods for studying graduate school choice decisions begins with an analysis of the types of questions to be asked, and thus the types of dependent variables to be considered and modeled. College choice has been defined as the theoretical modeling of the factors and circumstances that influence an individual's decision to pursue an additional unit of education (Perna, 2006). While certain components of the theoretical modeling process differ for undergraduate college choice and graduate school choice, both are interested in the same underlying outcome, enrollment in a higher level of education. Additionally, at both levels of choice process modeling, students typically belong to one or more higher level organizational units. These two components of choice models present a number of problems for OLS regression techniques.

Categorical Dependent Variables.

In its simplest form, this decision can be conceptualized in a dichotomous manner, either enrollment or non-enrollment. In a more complicated situation it could be defined in multiple categories, such as enrolled in a master's program, enrolled in a doctoral-research program, enrollment in a doctoral-professional practice program, or non-enrollment. Activities that precede enrollment also follow a similar structure; for instance, submitting a graduate school application could be represented as either a yes or no answer, or in the more specific form of: applied to a master's program, applied to a doctoral program, did not apply. As the dependent variables of interest in this study are binary (aspiration to graduate degree, application to graduate school, enrollment in graduate education), the majority of the examples presented will focus on models suitable for those data structures and questions.

This non-continuous dependent variable presents the first challenge to the assumptions of OLS regression. If the dependent variable of interest is categorical, as the measurement of graduate school aspiration, application, and enrollment are, then a violation of assumption three (homoscedasticity) and assumption five (normal distribution of disturbance) has occurred (Allison, 1999b). The violation of homoscedasticity is a result of the fact that the variance of the error term ($\varepsilon_{i,}$) is a function of the coefficients in the model ($\beta_1 x_i$). This violation results in two negative implications for the analysis. First, OLS regression is no longer efficient, which means that other statistical methods will produce the same results with smaller standard errors. Second, and more severe, is the fact that the standard error estimates are biased and no longer consistent estimates of the true standard error. This can result in a situation where the standard errors are either overestimated or underestimated to some unknown amount, which can influence the calculation of test statistics (Allison, 1999b, p. 10).

The violation of assumption five is somewhat simpler to conceptualize and easier to understand. In a situation where the dependent variable is categorical, it is not mathematically possible for the error term to be normally distributed, as $\varepsilon_{i,}$ is limited in the number of values it can take (Allison, 1999b). This violation is much less significant than the violation of homoscedasticity for two primary reasons. First, violation of the assumption does not impact the bias or efficiency of the model; second, in situations where the sample is sufficiently large, the central limit theorem states that the coefficient estimates will exhibit an adequately normal distribution (Allison, 1999a).

As evidenced from the above analysis, use of standard linear regression models predicated upon the calculation of ordinary least squares is problematic and inappropriate in situation in

which the dependent variable of interest is categorical. A number of statistical techniques have been developed that can handle non-continuous dependent variables, including binary logistic regression, multinomial logistic regression, log-linear regression, and probit models. These techniques are all types of generalized linear models (GZLM), which refers to a set of statistical techniques generalized from the previously mentioned general linear model (GLM).

The generalized linear model is comprised of three separate components: the random component, the systematic component, and the link function. The random component refers to the dependent variable y_i, and is represented in the model via a specified probability distribution. The probability distribution describes the way in which the values of the dependent variable are disbursed, and can include options such as the normal distribution (for continuous variables), binomial distribution (for dichotomous variables), multinomial distribution (for multi-category variables), or the Poisson distribution (for count variables). The systematic component of the model encompasses the independent explanatory variables, which combine in a linear manner. The link function refers to the component of the model that connects the random component (dependent variable y_i) to the linear systematic component (independent variable $\beta_1 x_i$) (Agresti, 2007). The link function selected corresponds to the underlying data distribution, and can take the form of an identity link for normal distributions, log link for Poisson distributions, and the logit link for binomial and multinomial distributions (Agresti, 2007). The simplest form of link function, the identity link, allows for a direct modeling of the mean, and is represented by the function $g(\mu) = \mu$. The multivariate linear model is represented as:

$$\mu = \beta_o + \beta_1 x_1 + \ldots \beta_i x_i$$

This formula will look familiar, as it represents the OLS regression model (Agresti, 2007, p. 67).

As was previously referenced, the OLS regression model does not allow for the modeling of non-continuous dependent variables. The generalized linear model accomplishes this objective by substituting a different probability distribution for the random component (replacing the normal distribution) and a different link function (replacing the identity link function). In a situation where the dependent variable of interest is dichotomous, the binomial distribution and the logit link function would be appropriate (Agresti, 2007). Modeling of the non-continuous binomial dependent variable occurs in two steps, removing the upper and lower bounds of the function. By first converting from the probability of an occurrence $p = \left(\frac{occurance\ of\ event}{total\ number\ of\ occurances}\right)$ to the odds of an occurrence, $o = \left(\frac{probability\ of\ event}{probability\ of\ no\ event}\right)$, the upper bound is removed. By subsequently taking the logarithm of that calculated odds, the lower bound is removed. The result is the generalized linear model with a binomial distribution and a logit link function, as shown below (Allison, 1999b, p. 13). This functional model could be adapted to encompass the question of graduate school aspiration, application, and enrollment.

$$\log\left[\frac{p_i}{1-p_i}\right] = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots \beta_k x_{ik}$$

Whereas the previous section established a model specification appropriate for non-continuous dependent variables, the appropriate estimation of the independent variables must now be considered. There are three forms of coefficient estimating models that can be used in generalized linear models: ordinary least squares, weighted least squares, and maximum likelihood. Whereas all three models can be employed in situations where the data is structured in groups, such as a contingency table, only maximum likelihood can be used when the data contains variables attached to individuals (Allison, 1999b). As the majority of educational and social

sciences research is conducted with individual level data, it is important to briefly review this estimation method. Maximum likelihood can be somewhat thought of as the inverse of ordinary least squares, which seeks to minimize the sum of squared variance between predicted and observed values. In contrast, maximum likelihood functions by developing a model that attempts to maximize the probability of predicting the correct value of the occurrence. There are two steps involved in the construction of this estimation, the likelihood function and the maximization procedure (Allison, 1999b). The process of building the likelihood function involves first selecting the data distribution that is assumed (e.g. binomial, Poisson) and the associated function (e.g. logit, log).The second component, maximization, involves the process of substituting multiple possible values in order to achieve the best possible solution (Allison, 1999b).

There are a number of benefits to maximum likelihood estimation techniques, including the fact that in large samples the estimates are consistent, efficient, and normal. Consistency refers to the fact that the probability that the estimate received is close to the actual value increases each and every time the sample size increases. Efficiency was a key failing of OLS regression with non-continuous dependent variables; with maximum likelihood and a large sample, the researcher is assured that no other statistical methodology will exhibit smaller standard errors. Thirdly, in large samples, the distribution received will closely represent the normal distribution (Agresti, 2007). There is, however, one key assumption that must be adhered to in the use of maximum likelihood estimations; it must be assumed that that the observations contained in the sample are independent (Allison, 1999b). This assumption was discussed in more depth in the prior section on OLS regression, and is somewhat problematic for much of the large-scale research on choice processes, as will be covered in greater detail in a subsequent section

As shown above, OLS regression is not an appropriate method for analyzing choice decisions in which the dependent variable of interest is non-continuous. This is a common occurrence in educational and social sciences research, and it appears that researchers have taken steps to ensure that appropriate methods are employed in studies where the data does not satisfy the assumptions of OLS regression. Logistic regression, along with other methods designed to measure non-continuous dependent variables, have been used with increasing regularity in higher education studies. Peng, So, Stage, & St. John (2002) conducted an analysis of the prevalence of logistic regression techniques in *Research in Higher Education, The Review of Higher Education,* and *The Journal of Higher Education* between 1988 and 1999, identifying 52 articles that used the approach. Their analysis revealed that the categorical data analysis methodologies had allowed for advances in the understanding and modeling of various non-continuous dependent outputs. However, they also found a number of methodological inconsistencies, including appropriate sample size, the use of dummy variables, and the reporting of results (Peng, So, Stage, & St. John , 2002).

Virtually every research study on college or graduate school choice behavior has included as the dependent variable of either application to or enrollment in graduate school (Millett, 2003). Measurement of a submitted application or an enrollment decision is classified as a categorical response variable, a type of non-continuous data measured on a nominal or ordinal scale (Agresti, 2007). Three types of categorical data analysis that appear frequently in the literature are binomial logistic regression, multinomial logit models, and probit models (Agresti, 2007). Binomial and multinomial logistic regression models were used by Millett (2003), Heller (2001), Zhang (2005),

Perna (2004), Montgomery (2002), and Mullen et al. (2003). Weiler (1994), Fox (1992), and Bedard & Herman (2008) elected to analyze graduate school choice via probit models.

As evidenced by the preceding discussion, there are a number of problems with OLS regression in studying choice processes in which the dependent variable of interest is non-continuous. Multiple authors and studies have accounted for that fact by employing statistical methods suited for those types of data, such as binary logistic regression, multinomial logit, and probit models. There is, however, another violation of OLS regression commonly violated in large-scale studies of choice processes that has not been readily accounted for or addressed in the literature.

Independence of Observations.

A relatively more recent contribution to the study of education and social sciences questions concerns the fact that the data are often encapsulated in a highly nested environment. For instance, a student might be a part of one and only one classroom, and that classroom is a part of one and only one school. In longitudinal studies, the measurement of interest is housed hierarchically within only one individual, and that individual belongs to only one intervention program (Hedeker, 2003). A third situation is when individuals are cross-classified in a manner that is not purely hierarchical. An example of this could be a county in which multiple middle-schools feed into multiple-high schools (Heck, Thomas, & Tabata, 2010). In each of these situations, a key violation of most statistical methods, including ordinary least squares and maximum likelihood has occurred. Looking back to the third requirement of OLS regression previously listed, it is assumed that each of the observations included in the sample is independent from all other observations. Mathematically, this was represented as:

$$\text{cov}(\varepsilon_{i,}\, \varepsilon_j) = 0$$

This assumption is often violated in that individuals nested within a specific higher-level unit, such as a school or a district, will share many characteristics that impact the statistical modeling process. For instance, students enrolled at a less-selective comprehensive regional public university will likely exhibit high-school academic profiles (GPA & ACT/SAT) scores that are very similar; conversely, those students will likely differ from those enrolled at a highly-selective private liberal arts university. These differences are often exacerbated in that the sampling methodologies used in large-scale educational research projects begin by sampling specific institutions, districts, or schools, and then subsequently sample individual students from within that unit (Heck, Thomas, & Tabata, 2010). This violation of the assumption of independence of observations results in a situation in which the OLS regression model will generate underestimates of the standard error. This can result in a higher probability of obtaining a Type I error, in which the null hypothesis is incorrectly rejected and it is incorrectly assumed that a statistically significant effect exists (Osborne, 2000).

When the dependent variable of interest is continuous, the first step in the process is to apportion the variance of the dependent variable ($\sigma^{2)}$ into within-group (σ^2_w) and between-group (σ^2_b) components. The analysis of the ratio of between-group variation to total variation is known as the intraclass correlation (ρ), and refers to the amount of variation exhibited at the group level (Heck, Thomas, & Tabata, 2010). If more than five percent of the variation is found to exist between groups, then analysis via a multilevel model is warranted. The formula for intraclass correlation is presented below:

$$\rho = \sigma^2_b / (\sigma^2_b + \sigma^2_w)$$

This is referred to as the specification of the null model, which can be specified by the following model in which *i* refers to the individual, and j to the second level organization within which the individual is nested.

$$Y_{ij} = \gamma_{oo} + \mu_{oj} + \varepsilon_{ij}$$

The next step in the process is to build the individual-level random intercept model.

$$Y_{ij} = \beta_{oj} + \beta_{1ij} + \beta_{2ij\ldots} + \beta_{nij} + \varepsilon_{ij}$$

The final step in the process is to build the group-level random intercept model. This model allows for an exploration of variability in the intercepts across second level organizations.

$$\text{Boj} = \gamma_{oo} + \gamma_{o1} + \gamma_{o2\ldots} \gamma_{on} + \mu_{oj}$$

Finally, a slope and intercept model is run to determine if the slopes vary across the second level organization. If it is found that the slopes vary by organization, a subsequent question is whether the magnitude of the variance in the slope is related to features of the organization.

While nearly every prior study of the graduate choice process has correctly employed some variation of the generalized linear model to account for the non-continuous dependent variable of application/non-application or enrollment/non-enrollment, virtually none have done so in a way that addresses the inherent nested structures that exist between students, undergraduate majors, and undergraduate institution types. Engberg & Wolniak (2009) noted this fact and raised the concern that failing to account for the multilevel structures innate to college choice research can result in a number of undesirable side effects, including the receipt of standard error estimates that are too small. This is a result of the reliance of non-multilevel models on the assumption that the observations included in the sample are fully independent: this is clearly not the case given the clustered nature of major and institution type (Osborne, 2000).

Techniques

The methodology proposed for this paper is generalized hierarchical linear modeling with a binomial distribution and a logit link, in which students are nested within an undergraduate institution. The generalized hierarchical linear model is a type of multilevel model that is useful when individuals are nested in various ways (Heck, Thomas, & Tabata, 2010). The generalized hierarchical linear model advanced in this paper is appropriate for two reasons, one technical and the other theoretical. First, the sampling methodology employed in the construction of the B&B:2000/01 was a multi-stage design, in which institutions were first selected and students were subsequently drawn from that set. As such, one of the common and required assumptions of ordinary least squares (OLS) regression, independence of observations (also referred to as uncorrelated disturbances), has been violated (Allison, 1999a). If a standard OLS regression model were used and the clustered nature of the data was not accounted for, it is possible that the analysis would yield standard errors that are too small, increasing the chance of receiving a Type I error. (Garson, 2011).

The use of a multi-level modeling approach is also of theoretical benefit. As OLS regression only allows for the modeling of variance at a single level, it would be impossible to jointly model the impact of both individual and institutional level effects on graduate school choice processes simultaneously (Porter & Umbach, 2001). Multi-level modeling, however, can concurrently explore the impact of individual and institutional effects because the beta coefficients are not treated as fixed effects, as in OLS, but as random effects drawn from a normal distribution of betas (Garson, 2011).

The first step in the process was to run descriptive statistics in order to explore differences between the three dependent variables of graduate school aspiration, application, and enrollment. I next began examination of the generalized linear mixed model. As the three dependent variables (aspiration, application, and enrollment) are discrete, three separate sets of models were developed. The model is comprised of three components: a binomial error distribution, a linear regression equation, and a logit link function represented by the equation (Hox, 2002):

$$\eta = \text{logit}(p) = \ln(p/1\text{-}p)$$

Specification of the null model is made by the equation listed below, in which the dependent variable *Y* is transformed via the logit link function into the variable η. The dependent variable η is the probability from 0 to 1 that an individual *i* in undergraduate institution *j* aspires to, applies to, or enrolls in graduate school, depending on the model specified (Luke, 2004).

$$\text{Level 1: } \eta_{ij} = \beta_{0j}$$

$$\text{Level 2: } \beta_{0j} = \gamma_{00} + u_{0j}$$

Via substitution, the single equation null model can be represented as:

$$\eta_{ij} = \gamma_{00} + u_{0j}$$

I employed HLM 7 as the software package used to analyze the multilevel data. As the dependent variables of interest (graduate school aspiration, graduate school application, and graduate school enrollment) were all dichotomous, I chose the HLM 7 Bernoulli distribution. HLM 7 also allows for the specification of weights at both levels of the multilevel model. The variable INSTWT was selected as the level-two weight, while the derived weight STU_WT was specified at level one. The STU_WT variable was calculated by dividing the analysis weight (BB01AWT) by the institution weight (INSTWT)

(Pfeffermann, Skinner, Homes, Goldstein, & Rasbash, 1998). HLM 7 also allows for the analysis of up to ten imputed datasets. Data were imputed using STATA 12, and then split into ten separate files for inclusion in the HLM 7 analysis.

Centering.

I grand-mean centered all variables included in the analysis, with the exception of those variables being tested for a randomly varying slope; those variables were group mean centered. Mean centering involves calculating the mean value for a predictor, and then subtracting that mean from each variable value in the dataset (Adams, 2010). This transforms the interpretation from being based on the raw score of interest to being based upon an observed values deviation from the mean of all values in the dataset (Luke, 2004). In grand-mean centering, the value of the mean is calculated by taking the average across all variables in the dataset; group-mean centering creates a separate mean for each individual level-two cluster included in the study. In this study, that involved calculating a separate mean for each of the 564 undergraduate institutions (Heck, Thomas, & Tabata, 2010).

Standard Errors.

When a generalized hierarchical linear model is specified in HLM 7, four sets of output are provided for each model. Unit-specific and population-average models are provided with both model-based standard errors and robust-standard errors. All results presented in this chapter are unit-level analyses with robust standard errors. The difference between population-averaged and unit-specific models is the way in which the parameters are estimated and the intended inferences the researcher plans to make. Unit-specific models typically employ a form of maximum likelihood estimation and are designed to measure the

influence of variables at all levels of the model on the dependent variable, while controlling for random effects. Population-average models use General Estimating Equations (GEE) to estimate the parameters instead of a maximum likelihood based approach. These models do not control for random effects, but average those across all level-one units in the population. Population-average models are better suited for research questions that seek to explore the impact of level-one variables only across the population, whereas unit-specific models are designed to examine the difference of level-one and level-two variables between level-two clusters (Hox, 2002). As the research objective of this study is to explicitly explore the impact of undergraduate institution characteristics on graduate school choice decisions, unit-specific results are reported.

The decision of whether to use model-based standard errors or residual-based robust standard errors largely comes down to assumptions about the data being analyzed. If there are no concerns about model misspecification, normality of the residuals, or outliers, then the model-based standard errors will be efficient and unbiased. If there are concerns about any of those categories that result in heteroscedasticity, then robust-standard errors provide another form of data output that is not as sensitive to those concerns (Hox, 2002). An examination of the residual output file in this study revealed a lack of normality, and thus the robust standard errors were selected. A sufficiently large number of level-two units is required for effective use of the robust standard errors; Hox (2002) recommends at least 100. As there were 564 level-two undergraduate institutions included in this study, there were no concerns about employing the robust standard errors.

Multilevel Estimation Methods.

Another new feature of HLM 7 is the option of selecting alternate estimation methods to the traditional restricted maximum likelihood (REML) and full information maximum likelihood (FML) approaches. Both a high-order Laplace and an adaptive Gaussian quadrature approximation to maximum likelihood are provided for analysis. I selected the adaptive Gaussian quadrature approach, as it has been shown to handle small cluster sizes particularly well (Raudenbush, Yang, & Yosef, 2000). Thus, all output contained in this chapter was estimated via the adaptive Gaussian quadrature approach, and is provided in the unit-specific format with robust standard errors.

Model Building.

I conducted three separate sets of generalized hierarchical linear models to explore the influence of individual and institutional factors on graduate school choice processes. As the dependent variable of interest in each of these models was dichotomous (aspire/not aspire, apply/not apply, enroll/not enroll) the dependent measure had to be transformed into a form that would allow a linear modeling of the independent variables of interest. The three equations used are presented below.

$$\text{Prob}(GRAD\_ASP_{ij}=1|\beta_j) = \phi_{ij}$$

$$\text{Prob}(GRAD\_APP_{ij}=1|\beta_j) = \phi_{ij}$$

$$\text{Prob}(GRAD\_ENR_{ij}=1|\beta_j) = \phi_{ij}$$

For each of these models, let η_{ij} represent the logit transformation of the independent variable, represented by the formula below.

$$\eta_{ij} = \log[\phi_{ij}/(1 - \phi_{ij})]$$

I first created a set of models that contained no independent variables, with a separate model created for each of the dependent variables (aspiration, application, and enrollment). This model is known as the null model or one-way ANOVA, and allows the intercept to vary. This variance of the intercept allowed me to examine the amount of variance that exists between and within undergraduate institutions (Umbach, 2007). The full mixed model containing both level-one and level-two information is presented below:

$$\eta_{ij} = \gamma_{00} + u_{0j}$$

I calculated the intraclass correlation (ICC) using the formula outlined by Snijders and Bosker (1999), for use in situations where the dependent variable of interest is dichotomous. I calculated an intraclass correlation of .064 for the aspiration model, .019 for the application model, and .016 for the enrollment model. The formula advanced by Snijders and Bosker and used in this study is provided below:

$$\rho_1 = \frac{\tau_0^2}{\tau_0^2 + \frac{\pi^2}{3}}$$

The intraclass correlation calculations indicated that 6.4% of the variance in graduate school aspiration exists between undergraduate institutions; this drops to 1.9% and 1.6% in the graduate school application and enrollment models, respectively. While this may seem like a trivial amount of variation to attempt to model via a multilevel approach, Porter and Swing (2006) argue that there are a number of reasons to take this approach. First, quantitative survey research rarely explains more than 30% of the variance observed; as such, the variance witnessed here is not an insignificant amount. They also note that small ICC

calculations have not limited prior educational research, and that it is still possible to find independent variables that have large impacts on the dependent variables of interest.

The next model I created at each step of the process was the human capital model. This model contained only those variables theorized to interact with the human capital component of the conceptual model, and includes a student's total accumulated debt, undergraduate major, undergraduate grade point average, and SAT score.

$$\eta_{ij} = \beta_{0j} + \beta_{1j}*(TOT\_DEBT_{ij}) + \beta_{2j}*(HUM\_SBS_{ij}) + \beta_{3j}*(MAT\_SCI_{ij}) + \beta_{4j}*(CS\_IS\_EN_{ij}) + \beta_{5j}*(EDUCATE_{ij}) + \beta_{6j}*(HEALTH_{ij}) + \beta_{7j}*(VOC\_TEC_{ij}) + \beta_{8j}*(GPA2_{ij}) + \beta_{9j}*(TESATDER_{ij}) + u_{0j}$$

I next created the full within-institution model. This model, also known as the level-one model or individual level model, included all level-one variables in the analysis. In addition to the human capital variables discussed above, this model also incorporated all of the cultural capital and social capital variables (gender, race/ethnicity, primary language, parents highest level of education, dependency status and income, type of high school attended, parental tuition assistance). The full within-institution formula is provided below.

$$\eta_{ij} = \beta_{0j} + \beta_{1j}*(TOT\_DEBT_{ij}) + \beta_{2j}*(HUM\_SBS_{ij}) + \beta_{3j}*(MAT\_SCI_{ij}) + \beta_{4j}*(CS\_IS\_EN_{ij}) + \beta_{5j}*(EDUCATE_{ij}) + \beta_{6j}*(HEALTH) + \beta_{7j}*(VOC\_TEC_{ij}) + \beta_{8j}*(GPA2_{ij}) + \beta_{9j}*(TESATDER_{ij}) + \beta_{10j}*(GENDER_{ij}) + \beta_{11j}*(BLACK_{ij}) + \beta_{12j}*(HISPANIC_{ij}) + \beta_{13j}*(ASIAN_{ij}) + \beta_{14j}*(AI\_AN\_NH_{ij}) + \beta_{15j}*(RAC\_OTH_{ij}) + \beta_{16j}*(NBLANG_{ij}) + \beta_{17j}*(SAMESTAT_{ij}) + \beta_{18j}*(PEC\_SCOL_{ij})$$

$$+ \beta_{19j}*(PED\_BACH_{ij}) + \beta_{20j}*(PED\_MAST_{ij}) + \beta_{21j}*(PED\_DOC_{ij})$$

$$+ \beta_{22j}*(DEP\_3059_{ij}) + \beta_{23j}*(DEP\_6099_{ij}) + \beta_{24j}*(DEP\_100_{ij})$$

$$+ \beta_{25j}*(IND\_LT19_{ij}) + \beta_{26j}*(IND\_2049_{ij}) + \beta_{27j}*(IND\_50_{ij})$$

$$+ \beta_{28j}*(HS\_PRIV_{ij}) + \beta_{29j}*(HS\_FOREN_{ij}) + \beta_{30j}*(TUI\_SOME_{ij})$$

$$+ \beta_{31j}*(TUI\_ALL_{ij}) + \beta_{32j}*(TUI\_NA_{ij}) + u_{0j}$$

The next step in the model-building process was to construct the random-intercept model, which allows the intercept to vary as a function of a set of level-two predictor variables. The level-two variables included in each of the models (aspiration, application, and enrollment) include whether the student's undergraduate institution was an HBCU, the institution's cohort graduation rate, the institution's control (public/private/for-profit), and the institution's Carnegie Classification. The full level-two model is presented below.

$$\beta_{0j} = \gamma_{00} + \gamma_{01}*(HBCUBA_j) + \gamma_{02}*(GRADRATE_j) + \gamma_{03}*(CON\_PRIV_j)$$

$$+ \gamma_{04}*(CON\_PRI4_j) + \gamma_{05}*(CC\_MAST_j) + \gamma_{06}*(CC\_BACC_j)$$

$$+ \gamma_{07}*(CC\_OTHER_j) + u_{0j}$$

Interaction Effects

I also tested a number of level-one interactions for each step of the graduate school choice process. This was done as part of the within-institution generalized hierarchical linear models. The interactions tested were: Total Debt * Gender, Total Debt * Black, Total Debt * Hispanic, Total Debt * Asian, Total Debt * American Indian/Alaska Native/Native Hawaiian/Pacific Islander, Total Debt * Other, and Total Debt * Minority. I created the dummy variable "minority" set equal to one when the student was not white. I also explored

a number of random slopes models at each point of the graduate school choice process. The variables of undergraduate indebtedness, black, Hispanic, and minority were tested for randomly varying slopes. The results for the level one interactions and the random slopes models are presented within the context of their operative hypotheses and research questions.

Limitations

There are a number of factors that limit this study. I address each of these issues directly, commenting on those limitations impacts on my findings and results.

Age of the Dataset

This study is limited first and perhaps foremost by the dataset selected for analysis, the 2000/01 Baccalaureate and Beyond Longitudinal Study. At the time of writing, this study was over ten years old, as it surveyed students who received the baccalaureate degree during the 1999-2000 year (Charleston, Riccobono, Mosquin, & Link, 2003). Several macro-level events and policy shifts have occurred since that time, including the early 2000's recession and the Great Recession of 2007 – 2009, both of which have ravaged state and federal budgets. The cost-of-attendance at the majority of our nation's colleges and universities has skyrocketed during that time as well, putting an increased burden on the students who wish to pursue additional levels of education (Baum, Ma, & Payea, 2010). It is distinctly possible that these policy changes will have altered the way in which individuals consider whether to pursue graduate education. Consequently, the findings of this study are therefore not as current or as applicable as they might be if the data were more recent.

Timeframe of the Data Collection

A second limiting factor of the dataset is that it only incorporates graduate school choice decisions one year after students' baccalaureate graduation. As many students elect to work for a number of years prior to enrolling in graduate education, this study is limited in that it cannot account for those individuals. Students with certain majors, such as business or education, are likely required to obtain a number of years of work experience before exploring a graduate degree. As such, those students graduate school application and enrollment decisions are less likely to be accurately modeled than if the data were collected many years after the receipt of their baccalaureate degree.

Unfortunately no additional follow-up collections were provided for the 2000/01 Baccalaureate and Beyond Longitudinal Study. The most recent Baccalaureate and Beyond: 2008/09 Longitudinal Study is slated to include, at a minimum, a follow-up in 2012. It is recommended that future research examine the 2012 Baccalaureate and Beyond follow-up survey.

While this study is limited in its ability to address potential graduate school enrollments beyond the one-year post-baccalaureate mark, it does provide a strong view of graduate school aspiration. Whereas the enrollment results only capture those individuals who ultimately decided to enroll in graduate school within one year of the completion of their baccalaureate, the aspiration results provide information on the overall universe of individuals who ultimately plan to complete a graduate degree. As such, the findings of the aspiration models provide information about individuals who might have ultimately pursued a graduate degree more than one-year after completing their baccalaureate degree.

Dataset Construction

This study is also limited by the methodological approach employed by the National Center for Educational Statistics (NCES) in their construction of the 2000/01 Baccalaureate and Beyond Longitudinal Study (B&B:2000/01). NCES constructed the study via a multistage stratified sampling procedure, which is a cost-effective approach towards developing a nationally representative dataset. This stratified sampling approach resulted in two methodological limitations for this study, however.

The first is a function of the number of individual students sampled within any given institution. As multilevel models require sufficient within-institution variance for adequate estimation, I was forced to delete from the sample any institution that contained less than five student samples. This resulted in an elimination of 130 undergraduate institutions from the dataset, as well as the 550 student cases contained therein. As the distribution of schools with a small within-school sample size was not random, it is distinctly possible that these reductions introduced unneeded bias into the analysis. While it would have been possible to maintain the full dataset by exploring the data via a complex sampling routine (e.g. Complex Samples in SPSS, Survey Data Analysis in STATA), this would have prohibited the ability to explicitly explore and model the multilevel nature of the data. Given the recent rise of multilevel modeling in educational settings, it would be highly desirable if future iterations of the Baccalaureate and Beyond Longitudinal Study specified a minimum within-school sample size of at least five students.

The second methodological limitation of the stratified sampling design arose when I attempted to perform a complex multiple imputation process to address the missing data contained in the dataset. I was unable to account directly for the nested structure of the data

during the imputation process, primarily as a function of the lack of within-institution variability on certain variables that contained missing data. It is possible that this introduced noise into the data, resulting in a downward biasing of the multilevel parameter estimates.

Inability to Directly Measure Cultural and Social Capital

An additional limitation of this study was the lack of well-defined measures of cultural capital and social capital. In her previous analysis of the 1993 Baccalaureate and Beyond Longitudinal Study, Perna (2004) noted that a key limitation of her study was the lack of variables that directly measure cultural capital or social capital, and called for an inclusion of those types of variables in future iterations of the Baccalaureate and Beyond Longitudinal Study. Unfortunately, that clarion call was issued after this version (B&B:2000/01) of the study had already been completed; I was therefore forced to model many of the same imperfect approximations that Perna explored in 2004. The lack of direct measures of cultural capital and social capital makes it significantly more difficult to determine the actual effects that those concepts on the graduate school choice process. It is possible that the indirect measures used in this study, while derived from prior research, are not strong approximations of students' actual accumulated cultural capital or social capital.

Omitted Variable Bias

A potential limitation of any quantitative study is omitted variable bias. While regression equations allow researchers to narrow in on the effects of individual measures by holding constant all other variables included in the model, there is always the potential that variables or measures not included in the analysis actually influence the dependent variable of interest. There are two components of the model tested in this paper in which omitted

variable bias is potentially problematic. The first, approximations of cultural capital and social capital, was covered in the previous section. The second area is equally concerning, and includes those variables associated with the student's undergraduate institution. There were limited variables in the dataset attached to the undergraduate institution that I could include in the model building process. As such, the scope of effects I could actually examine at the second level of the model (undergraduate institution) was limited only to those variables contained in the analysis.

Institutional Selectivity Measures

No measure of institution selectivity was included in the B&B:2000/01 restricted use file. As such, I opted to model the institution's cohort graduation rate in the generalized hierarchical linear models. The rationale for this decision was derived from research that shows a very strong relationship between institutional selectivity and graduation rates. In her analysis of graduation rates, selectivity, and low-income enrollments, Horn (2006) found that very selective doctoral and baccalaureate liberal arts institutions exhibited higher graduation rates than less-selective institutions. Baum and Ma (2011) echoed this finding, noting that institutional selectivity was highly correlated with graduation rates. They found that highly selective institutions graduated students at the rate of 83%, whereas open enrollment institutions only graduated 27% of their students. Moltz (2009) aligned compared analyzed institutional graduation rates and Barron's selectivity categories, finding a positive and linear relationship between the two. Noncompetitive undergraduate institutions exhibited the lowest graduation rate, at 34.7%, while the most competitive institutions featured a graduation rate of 87.8%. Astin (2004) noted that the graduation rate of a baccalaureate institution is primarily a reflection of entering students

characteristics, that differences in institutional graduation rates are largely a function of entering student characteristics, and that over two-thirds of any variation observed in institutional graduation rates are a result of differences in the entering student body.

The literature clearly shows a strong and positive association between institutional admissions selectivity and cohort graduation rates. While institutional selectivity is not included as a variable in the restricted use dataset of the 2000/01 Baccalaureate and Beyond Longitudinal Study, the variable is available for analysis in the public-use data file accessible through the online statistical software tool POWERSTATS. I examined the direct association between institutional selectivity and cohort graduation rates via linear regression. Institutional selectivity was divided into four categories, with the category of highest selectivity serving as the reference category in the analysis. I found that the intercept was a graduation rate of 65.857; moving from a highly selective institution to a moderately selective institution results in a reduction of 17.780 in the institution graduation rate, minimally selective institutions exhibited graduation rates 29.489 lower, and open admission institutions graduation rates were 35.321 lower than the reference category of highly selective institutions. These findings, in concert with the significant body of literature, provide support for my decision to include the cohort graduation rate as a proxy for institutional quality in the analysis.

In fact, the rationale for including cohort graduation rate in the analysis extends beyond these considerations. There are a number of articles that question the long held rationale of blindly accepting institutional selectivity as a proxy for the academic quality of the institution. In their analysis of selectivity and educational quality, Kuh and Pascarella (2004) noted that measures of institutional selectivity are typically determined largely by average SAT/ACT scores. Their

analysis found institutional selectivity to be weakly associated with the quality of the student's undergraduate education. A similar analysis was conducted by Pascarella et al. (2006), finding that institutional admissions selectivity served as a poor signal for the quality of a student's undergraduate education, and was perhaps indicative of why the majority of previous research failed to find a significant association between the two measures.

Missing Data

A number of the variables chosen for analysis included substantive levels of missingness; simply executing a listwise deletion process would have drastically reduced the sample size and overall efficacy of the study. Therefore, I employed an advanced multiple imputation by chained equations approach to address this concern; this approach is substantially more advanced than those used in previous analyses of graduate school choice behaviors. It is limited, however, in that it did not account for the clustered and hierarchical nature of the data during the imputation process due to technical limitations of the available software. Future research should continue to explore ways in which the clustered nature of the data can be directly modeled and accounted for in the imputation process.

Another limitation of the study was the need to delete 545 cases representing 125 undergraduate institutions due to small within-school samples. In order to ensure adequate multilevel modeling, any institution that contained fewer than five student records was deleted from the analysis. While the small institutional sample sizes are a function of the complex sampling methodology employed in the creation of the Baccalaureate and

Beyond Longitudinal Study, it would be beneficial for future iterations to ensure a larger minimum within-school sample size.

Summary

This study advances an integrated conceptual model of graduate school choice that draws from established college choice literature. It is based primarily in the economic theory of human capital, and includes the important sociological concepts of cultural and social capital. The study is important for multiple reasons. First, it continues the work most recently refined by Perna (2004) that seeks to develop a comprehensive and integrated conceptual model of graduate school choice. The model, adapted from Perna's work in undergraduate college choice, explicitly conceptualizes the concepts of cultural capital and social capital, while ultimately still explaining the graduate school choice decision through human capital investment theory. Secondly, it uses data from the 2000/01 Baccalaureate and Beyond Longitudinal Study; this data is more current than the bulk of previous research (which featured the 1992-1993 Baccalaureate and Beyond cohort). Use of this dataset allows for exploration of recent policy and macro-level economic changes that have occurred in the late 1990's; namely, increases in tuition and the cost of attendance at the undergraduate level, and an increased reliance on loans as the primary method for financing the baccalaureate degree. Third, the methodology selected is a generalized hierarchical linear model that allows for the explicit modeling and examination of individual and institutional effects on graduate school aspiration, application, and enrollment. This model accounts for differences that occur between various institution types, and minimizes the chance of obtaining a Type I error (rejecting the null hypothesis erroneously) resulting from violations of the assumption of independence of observations.

CHAPTER FOUR: RESULTS

The completion of a graduate degree is increasingly tied to an individual's ability to progress into the middle-upper to upper components of our society. The graduate degree is required for entry into a number of professions (e.g. law, medicine) and is often seen as a minimum qualification in consideration for management and executive positions (e.g. MBA, Ed.D.). While graduate education has become more important in our society, its benefits are unfortunately still distributed in an inequitable manner. Recent increases in baccalaureate attainment enjoyed by underrepresented populations have not carried into Master's and Doctoral education. Women, African Americans, and Hispanics are three categories of individuals who have continued to obtain a lower percentage share of graduate education than their largely white male counterparts (Perna, 2004).

The purpose of this study is to explore the intersection of individual and institutional effects in explaining graduate school aspiration, application, and enrollment. The dataset selected for this analysis is the Baccalaureate and Beyond 2000/01 Longitudinal Study (B&B:2000/01). The Baccalaureate and Beyond project serves as the U.S. Department of Education's primary data point for exploring post-baccalaureate educational outcomes. B&B:2000/01 represents the most current dataset available for advanced analysis via a restricted-use data license.

This chapter describes the process of data analysis and the results found. The first section of this chapter provides descriptive statistics and a preliminary analysis of the data.

Next, I provide the results of the various generalized hierarchical linear models corresponding to each of the three dependent variable of interest (graduate school aspiration, application, and enrollment.) The chapter concludes with a discussion of the findings within the context of the initial guiding research questions.

Descriptive Analysis

I began by calculating descriptive statistics in STATA 12. These statistics were generated via the routine "mi estimate : mean" that automatically pools estimates across the ten implicates created in the multiple imputation described in Chapter Three. I will first discuss the characteristics of those variables situated at level one of the analysis (the student level, derived from the habitus and human capital investment components of the conceptual model), and will then discuss the level two variables of interest (undergraduate institution level).

Level-One Variables

The 2000/01 Baccalaureate and Beyond Longitudinal Study collected a vast quantity of student-level data from a number of sources, including SAT & ACT data files, the National Student Loan Data System (NSLDS), the National Postsecondary Student Aid Study (NPSAS), and the actual B&B survey instrument. I selected variables for inclusion following a thorough review of the literature and analysis of the operative research questions. Variables presented below, in Table 4.1, are those situated at level-one of the model, and are characteristics of the individual students included in the dataset. The analysis sample weight BB01AWT was applied to all descriptive statistics calculations.

Of the 9,483 students included in the final analysis, 83.1% indicated that they aspired to graduate education. 33.1% had applied for graduate school, and 26.7% were actually enrolled in a graduate program. There were substantially more females than males in the weighted sample used for analysis, with the count being 58% female and 42% male. White, non-Hispanic students represented the majority of the sample, at 74%. The largest group of students (35%) majored in the humanities or social/behavioral sciences; the second largest category belonged to business/management majors. Full level-one descriptive statistics are presented in table 4.1.

Table 4.1. Level-one variables: Descriptive statistics

Variable Name	***N***	***Mean***	***Std. Error***	***95% Conf. Interval***	
Graduate Aspiration	9,483	.831	.005	.821	.841
Graduate Application	9,483	.331	.006	.319	.343
Graduate Enrollment	9,483	.267	.006	.256	.279
SAT derived score	9,483	1,059.914	4.344	1,050.847	1,068.981
Undergraduate GPA	9,483	3.160	.007	3.150	3.180
Business	9,483	.205	.006	.193	.217
Social/Behavioral Sciences	9,483	.347	.006	.335	.359
Math/Life & Physical Sciences	9,483	.089	.003	.083	.096
Computer or Information Sciences/Engineering	9,483	.089	.004	.082	.096
Education	9,483	.091	.003	.085	.098
Health	9,483	.079	.003	.073	.085
Vocational/Technical/Other	9,483	.100	.004	2.302	2.411
Total amount borrowed	9,483	12,778.64	209.329	12,367.530	13,189.750
Gender	9,483	.576	.007	.563	.589
White	9,483	.736	.006	.724	.747
Black	9,483	.080	.004	.073	.087
Hispanic or Latino	9,483	.086	.004	.078	.094
Asian	9,483	.059	.003	.052	.065

Table 4.1 (continued)

Variable Name	***N***	***Mean***	***Std. Error***	***95% Conf. Interval***	
American Indian/Alaska Native/Native Hawaiian/Pacific Islander	9,483	.011	.001	.009	.014
Other or two or more races	9,483	.028	.002	.024	.033
English Primary Language	9,483	.111	.006	.099	.122
BA Institution in residence state	9,483	.782	.005	.771	.792
Parent's highest education: HS Diploma or Less	9,483	.285	.007	.272	.298
Parent's highest education: Some College or Training	9,483	.197	.005	.186	.207
Parent's highest education: Bachelor's Degree	9,483	.244	.006	.232	.256
Parent's highest education: Master's Degree	9,483	.164	.005	.154	.174
Parent's highest education: Doctoral Degree	9,483	.110	.004	.101	.118
Dependent: Less than $29,999	9,483	.097	.004	.090	.105
Dependent: $30,000 - $59,999	9,483	.163	.005	.154	.173
Dependent: $60,000 - $99,999	9,483	.187	.005	.177	.199
Dependent: More than $100,000	9,483	.126	.004	.118	.134

Table 4.1 (continued)

Variable Name	***N***	***Mean***	***Std. Error***	***95% Conf.***	***Interval***
Independent: Less than $19,999	9,483	.208	.005	.198	.219
Independent: $20,000 - $49,999	9,483	.167	.005	.128	.146
Independent: More than $50,000	9,483	.081	.004	.074	.089
HS: Public	9,483	.843	.005	.833	.853
HS: Private	9,483	.149	.005	.240	.159
HS: Foreign	9,483	.008	.001	.005	.010
First year parent/relative pay tuition: None of it	9,483	.468	.008	.453	.483
First year parent/relative pay tuition: Some of it	9,483	.138	.005	.128	.148
First year parent/relative pay tuition: All of it	9,483	.203	.006	.191	.215
First year parent/relative pay tuition: N/A	9,483	.191	.006	.179	.203

Level-Two Variables

Examination of the level-two (undergraduate institution) descriptive statistics revealed a number of interesting facets of the Baccalaureate and Beyond 2000/01 Longitudinal Study data. In terms of institution type, the largest group of students included in the study graduated from an institution classified as a doctoral/research university, at roughly

48%. Graduates of master's institutions comprised the second largest cohort at approximately 36%; students from baccalaureate colleges (liberal arts and general) represented only 12% of the total population. The majority of students (66%) graduated from a public institution, while 33% completed their baccalaureate degree at a private not-for-profit college or university. The average cohort graduation rate for all institutions included in the study was 53%. The level-two variables are presented below, in Table 4.2.

Table 4.2. Level-two variables: Descriptive statistics

Variable Name	***N***	***Mean***	***Std. Error***	***95% Conf. Interval***
BA Institution HBCU	9,483	.019	.002	.016 .022
Graduation Rate	9,483	53.011	.247	52.526 53.496
BA Control: Public	9,483	.657	.006	.644 .669
BA Control: Private	9,483	.330	.006	.318 .342
BA Control: Private for Profit	9,483	.013	.002	.010 .017
Carnegie: Doctoral	9,483	.477	.007	.464 .490
Carnegie: Masters	9,483	.364	.006	.351 .376
Carnegie: Baccalaureate	9,483	.118	.004	.110 .126
Carnegie: Other	9,483	.041	.003	.035 .046

Level-One and Level-Two Cross-Tabulations

An examination of cross tabulations reveals a variety of interesting aspects of the data. A slightly higher percentage of females aspired to, applied for, and ultimately enrolled in graduate school. While white students comprised the vast majority of students in the dataset, they exhibited the lowest percentage of graduate school aspirations, applications, and enrollment. Although white students represented 74% of the population, they represented only 70% of the total graduate school enrollment. An astounding statistic is that 93% of the African-American students aspired to graduate education, by far the highest percentage of any race/ethnicity. In fact, African-American students exhibited the highest within-race percentage of graduate school aspirations, applications, and enrollments. The full cross-tabulations are presented below, in tables 4.3 and 4.4.

Table 4.3. Cross tabulations column percentages (By percent of total)

	Total		***Aspiration***		***Application***		***Enrollment***	
	N	***%***	***N***	***%***	***N***	***%***	***N***	***%***
Total	9,483		7,882		3,136		2,536	
Gender								
Male	4,019	42%	3,274	42%	1,234	42%	1,030	41%
Female	5,464	58%	4,608	58%	1,902	58%	1,506	59%
Race/Ethnicity								
White	6,978	74%	5,630	71%	2,134	68%	1,770	70%
Black	757	8%	707	9%	350	11%	243	10%
Hispanic/Latino	815	9%	727	9%	319	10%	251	10%
Asian	556	6%	482	6%	199	6%	162	6%
AI/AN/NH/PI	109	1%	97	1%	36	1%	27	1%
Other	268	3%	239	3%	98	3%	82	3%
UG Major								
Business/Mgmt	1,942	20%	1,463	19%	471	15%	378	15%
Hum/Soc Sci.	3,289	35%	2,873	36%	1,253	40%	1,004	40%
Math/ Life Sci.	845	9%	766	10%	428	14%	363	14%
Comp/Info. Sci./Engineer	841	9%	661	8%	223	7%	187	7%
Education	864	9%	776	10%	251	8%	188	7%
Health	751	8%	622	8%	265	8%	225	9%
Other/Tech/Voc	950	10%	721	9%	244	8%	191	8%
Parents Ed								
HS Diploma	2,516	28%	2,045	27%	733	24%	572	23%
Some College	1,754	20%	1,454	20%	591	20%	453	19%
Bachelors	2,184	24%	1,785	24%	747	25%	618	25%
Masters	1,482	17%	1,304	17%	561	19%	460	19%
Advanced	996	11%	888	12%	390	13%	334	14%
Carnegie Type								
Doctoral	4,514	48%	3,777	48%	1,512	49%	1,258	50%
Masters	3,432	36%	2,847	36%	1,161	37%	920	37%
Baccalaureate	1,120	12%	941	12%	352	11%	270	12%
Other	380	4%	287	4%	92	3%	71	4%

Table 4.4. Cross tabulations row percentages (by percent of group)

	Total		***Aspiration***		***Application***		***Enrollment***	
	N	***%***	***No***	***Yes***	***No***	***Yes***	***No***	***Yes***
Total	9,483		1,601	7,882	6,347	3,136	6,947	2,536
			17%	83%	67%	33%	73%	27%
Gender								
Male	4,019	42%	19%	81%	69%	31%	74%	26%
Female	5,464	58%	16%	84%	65%	35%	72%	28%
Race/Ethnicity								
White	6,978	74%	19%	81%	69%	31%	75%	25%
Black	757	8%	7%	93%	54%	46%	68%	32%
Hispanic/Latino	815	9%	11%	89%	61%	39%	69%	31%
Asian	556	6%	13%	87%	64%	36%	71%	29%
AI/AN/NH/PI	109	1%	11%	89%	67%	33%	75%	25%
Other	268	3%	11%	89%	63%	37%	69%	31%
UG Major								
Business/Mgmt	1,942	20%	25%	75%	76%	24%	81%	19%
Hum/Soc Sci.	3,289	35%	13%	87%	62%	38%	69%	31%
Math/ Life Sci.	845	9%	9%	91%	49%	51%	57%	43%
Comp/Info. Sci./Engineer	841	9%	21%	79%	73%	27%	78%	22%
Education	864	9%	10%	90%	71%	29%	78%	22%
Health	751	8%	17%	83%	65%	35%	70%	30%
Other/Tech/Voc	950	10%	24%	76%	74%	26%	80%	20%
Parents Ed								
HS Diploma	2,516	28%	19%	81%	71%	29%	77%	23%
Some College	1,754	20%	17%	83%	66%	34%	74%	26%
Bachelors	2,184	24%	18%	82%	66%	34%	72%	28%
Masters	1,482	17%	12%	88%	62%	38%	69%	31%
Advanced	996	11%	11%	89%	61%	39%	66%	34%
Carnegie Type								
Doctoral	4,514	48%	16%	84%	67%	33%	72%	28%
Masters	3,432	36%	17%	83%	66%	34%	73%	27%
Baccalaureate	1,120	12%	16%	84%	69%	31%	76%	24%
Other	380	4%	24%	76%	76%	24%	81%	19%

Large differences exist between the seven undergraduate major categories included in the study. Business students lagged behind all of their other peers at every step of the graduate school pipeline, with only 75% indicating that they aspire to graduate school, 24% having submitted a graduate application, and 19% enrolled in a graduate program. Business students exhibited the largest drop-off in terms of percentage of the population total (20%) to the percentage of actual graduate enrollments (15%). Those students who majored in mathematics or the life/physical sciences represented the opposite end of the spectrum, with 91% aspiring to a graduate degree, 51% having submitted an application, and an impressive 43% actually enrolled in graduate school. Mathematics and life/physical science students also exhibited graduate school enrollment rates 5% higher than their share of the population total (14% vs. 9%, respectively). Students who majored in the humanities, social sciences, and behavioral sciences also saw a similar 5% overrepresentation in graduate school enrollments. In fact, 40% of all graduate school enrollees majored in one of those three fields, compared to their composition of only 35% of the population total.

The highest parental education level tracked graduate school choice in a fairly linear manner. At the point of graduate aspiration, 81% of students whose parents had achieved no more than the high school diploma aspired to graduate school, compared to 89% of students whose parents had received a doctoral or advanced degree. The gap increased to 10% between the two categories when examining graduate school applications, with the high school or less cohort rating in at 29%, and the doctoral or advanced group applying at 39%. The gap between the two categories was largest when reviewing graduate school enrollments, with only 23% of students whose parents achieved a high school diploma or less

actually enrolled in graduate school, compared to 34% of students from the doctoral/advanced parental education classification.

A similar trend emerged when examining the Carnegie Classification of the college or university that the student attended for their baccalaureate degree. The differences were least pronounced at the point of graduate school aspiration, with only graduates of institutions classified as “other” showing a lower rate of interest (76% compared to 83/84% of graduates of doctoral/research universities, master’s universities, and baccalaureate institutions). The difference was more pronounced at the graduate school application and enrollment points of the pipeline, with a difference of 9% between graduates of doctoral/research institutions and “other institutions” (33% v. 24% at the point of application, and 28% v. 19% at enrollment).

Multilevel Modeling

The Baccalaureate and Beyond 2000/01 Longitudinal Study employed a complex sampling design in which undergraduate institutions were first selected for inclusion, and students were then selected from those institutions (Charleston, Riccobono, Mosquin, & Link, 2003). Use of standard single level regression techniques (e.g. ordinary least squares, logistic) requires that the assumption of independence of observations be met; otherwise the researcher might receive standard errors that are too small, resulting in the possible receipt of a Type I error (Osborne, 2000). As such, I selected a multilevel modeling approach to explore the operative hypotheses.

The results of the generalized hierarchical linear models are presented below. Table 4.5 provides the coefficients, odds ratios, and levels of significance for each of the models (aspiration, application, and enrollment). The coefficients presented represent the change in

the log-odds of the dependent variable of interest being equal to one when there is a one-unit change in the independent variable (Perna, 2004). The odds ratio is derived by exponentiating the coefficient. The odds ratio can be conceptualized as the change in the odds of the dependent variable of interest occurring as a result of a corresponding one-unit change to the independent variable of interest. Whereas the coefficient is bounded by zero and one, the odds ratio is only bounded by zero at the low end, with no bound on the upper end. An odds ratio greater than one indicates that the dependent variable of interest is more likely to occur; correspondingly, an odds ratio that is less than one means that the dependent variable of interest is less likely to occur (Peng, So, Stage, & St. John, 2002).

For example, if the odds ratio for being female was calculated as 2.00 in the aspiration model, this would mean that females were twice as likely to aspire to graduate school as males, when all other variables in the model are held constant. If the odds ratio was .50, however, this would mean that females were only half as likely to aspire to graduate school than males, when holding all other variables in the model constant.

The results presented represent the final "full" random-intercept model containing all level-one and level-two variables. Appendices A - C provide additional information on each step of the model building process, including the human capital model, the within-institution model, and the random intercept model. Appendices D - F list the standard errors and confidence intervals of each estimate. All models were weighted at both levels of analysis using the NPSAS institutional weight (level-two) and an individual student weight (level-one). The individual student weight was calculated by dividing the analysis weight by the institutional weight.

Table 4.5 Full generalized hierarchical linear models

	Aspiration Model		Application Model		Enrollment Model	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio
Intercept, β_0	1.862***	6.438	-0.791***	0.453	-1.125***	0.325
Human Capital Variables						
Total Debt	0.000	1.000	0.000	1.000	0.000	1.000
Major: Humanities & Social/Behav. Sci.	0.703***	2.020	0.681***	1.976	0.494***	1.638
Major: Math & Life/Physical Sciences	0.898***	2.456	1.104***	3.016	0.984***	2.676
Major: Comp./Info. Sci. & Engineering	0.083	1.087	0.162	1.176	0.158	1.171
Major: Education	1.121***	3.069	0.100	1.105	-0.073	0.930
Major: Health	0.326	1.385	0.219	1.244	0.187	1.206
Major: Vocational/Tech./Prof./Other	0.031	1.032	-0.059	0.943	-0.129	0.879
Major: Business/Mgmt. (Reference)						
Undergraduate GPA	0.004**	1.004	0.005***	1.005	0.006***	1.006
SAT Score	0.000	1.000	0.000	1.000	0.000	1.000
Cultural & Social Capital Variables						
Female	-0.193	0.824	0.026	1.027	0.025	1.026
Male(Reference)						
Race: Black, non-Hispanic	1.317***	3.731	0.750***	2.117	0.419*	1.521
Race: Hispanic or Latino	0.575*	1.777	0.406+	1.501	0.163	1.178
Race: Asian	-0.255	0.775	-0.044	0.957	-0.148	0.862
Race: Am. In./AK or HI Native/Pac. Is.	0.615	1.850	-0.075	0.927	-0.217	0.805
Race: Other	0.083	1.086	0.183	1.200	0.144	1.155
Race: White, non-Hispanic (Reference)						

Table 4.5 (Continued)

	Aspiration Model		Application Model		Enrollment Model	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio
Cultural & Social Capital Variables						
English not primary language in home	0.897*	2.452	0.252	1.286	0.174	1.191
English primary language (Reference)						
Attended College in state of residence	0.091	1.095	0.148	1.160	0.112	1.118
Attended college out-of-state (Reference)						
Parents Highest Education: Some College	0.255+	1.290	0.219	1.245	0.111	1.118
Parents Highest Education: Bachelor's	-0.026	0.974	0.255+	1.290	0.221+	1.247
Parents Highest Education: Master's	0.311	1.365	0.339*	1.404	0.315+	1.371
Parents Highest Education: Doctoral	-0.002	0.998	0.303	1.354	0.169	1.184
Parents Edu.: HS or less (Reference)						
Dependent: $30,000-$59,999	-0.216	0.805	-0.006	0.994	0.095	1.100
Dependent: $60,000-$99,999	-0.311	0.733	-0.133	0.875	-0.111	0.895
Dependent: $100,000 or more	-0.170	0.844	-0.041	0.960	0.058	1.060
Independent: Less than $19,999	-0.322	0.724	-0.285	0.752	-0.204	0.815
Independent: $20,000-$49,999	-0.498*	0.608	-0.141	0.868	-0.074	0.929
Independent: $50,000 or more	-0.700*	0.497	-0.672**	0.511	-0.548*	0.578
Depend.: Less than $29,999 (Reference)						
High School Attended: Private	0.152	1.165	-0.036	0.965	0.091	1.096
High School Attended: Foreign	-0.439	0.645	0.061	1.062	-0.018	0.982
HS attended: Public (Reference)						

Table 4.5 (Continued)

	Aspiration Model		Application Model		Enrollment Model	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio
Cultural & Social Capital Variables						
Parental Tuition Assistance: Paid Some	0.284	1.328	-0.037	0.964	0.037	1.038
Parental Tuition Assistance: Paid All	0.105	1.111	0.151	1.163	0.166	1.181
Parental Tuition Assistance: N/A	-0.149	0.862	0.180	1.197	0.043	1.044
Parental assistance: None (Reference)						
Undergraduate Institution Variables						
Institution is HBCU	0.419	1.520	0.462+	1.587	0.437	1.549
Institution is not HBCU (Reference)						
Graduation Rate	0.007	1.007	-0.002	0.998	0.000	1.000
BA Control: Private	0.134	1.144	0.201+	1.222	0.082	1.085
BA Control: Private-for-profit	-0.598	0.550	-0.321	0.726	-0.191	0.826
BA Control: Public (Reference)						
Carnegie: Masters Institution	0.033	1.034	0.021	1.021	0.014	1.014
Carnegie: Baccalaureate Institution	-0.219	0.804	-0.336**	0.715	-0.367**	0.693
Carnegie: Other	-0.777**	0.460	-0.697**	0.498	-0.646*	0.524
Carnegie: Doctoral (Reference)						

*** p < .001, ** p < .01, * p < .05, + p < .10

Graduate School Aspiration

The first multilevel model explored the impact of the independent variables on the dependent variable representing graduate school aspiration.

Human Capital Variables.

I will first present the results for the variables associated with the human capital component of the graduate school aspiration model. The first construct explored was the impact of a student's undergraduate grade point average on graduate school aspiration. I found that students who possessed higher grade point averages exhibited a positive and significant relationship with graduate school aspiration. In the full model, each .01 increase in GPA yielded a 1.004 increase in the likelihood of aspiring to graduate school.

Another way of examining the impact of undergraduate GPA on graduate school aspiration is to examine the magnitude of the association across standard deviations. Since I grand-mean centered all variables, the generalized hierarchical linear model estimated the impact of each one-unit variation from the mean GPA of 3.16 on a students graduate school aspiration. Given that the standard deviation for undergraduate GPA was .48, I calculated the influence that moving one standard deviation from the mean GPA had on graduate school aspiration. A student who earned a GPA one standard deviation from the mean GPA of 3.16 is 1.2 times as likely to aspire to graduate school. Thus, a student with a 3.64 undergraduate GPA would therefore be 1.2 times as likely to aspire to graduate school.

The field in which the student majored for their baccalaureate degree also influenced graduate school aspiration. Compared to the reference category of majoring in business/management, those who majored in the humanities, social science, behavioral

sciences, mathematics, life sciences, physical sciences, and education were all significantly more likely to aspire to graduate school. Those who majored in computer/information sciences, engineering, health, or any other major were not statistically different from those that majored in business/management. Education majors were more than three times as likely to aspire to graduate school compared to business majors, which was the largest difference observed.

The total amount of debt that a student accumulated while completing their baccalaureate degree was not a statistically significant predictor of graduate school aspiration. I subsequently entered the variable representing the total amount of accumulated indebtedness into the generalized hierarchical linear model for graduate school aspiration by itself, and still failed to find a statistically significant relationship.

Moreover, I tested a number of interactions with undergraduate indebtedness. Those interactions were Total Debt * Gender, Total Debt * Black, Total Debt * Hispanic, Total Debt * Asian, and Total Debt * American Indian/Alaska Native/Native Hawaiian/Pacific Islander. I also tested an interaction of Total Debt * Minority, in which minority was a dummy variable created to model the effect of all non-white students. Only the interaction for Total Debt * Black was found to be a statistically significant predictor of graduate school aspiration. The odds ratio for aspiring to graduate education for African-American students was .999946, with a significance level of $p = .020$. This indicates that increased levels of accumulated undergraduate indebtedness is associated with a small but statistically significant moderation of graduate school aspiration for African-American students.

I also tested whether accumulated undergraduate indebtedness varied by the student's undergraduate institution. I accomplished this by allowing the slope to randomly vary by total indebtedness. I did not find evidence to support this question, however, as the generalized hierarchical linear model failed to converge when estimating graduate school aspiration.

Cultural and Social Capital Variables.

Variables theorized to be indirect approximations of a student's accumulated cultural and social capital were also entered in the model. I first explored the effect of being female, and found no significant relationship between the student's gender and graduate school aspiration. While gender was not a statistically significant predictor of graduate school aspiration, students' race/ethnicity was found to be an important construct. Specifically, both African-American and Hispanic/Latino students aspire to graduate school at significantly higher rates than their white peers. When accounting for all other variables in the model, Hispanic/Latino students were found to be 1.8 times as likely to aspire to gradue school, and African-American students were 3.7 times as likely to do so.

Additionally, I created a number of random slope models to see if the effect of these demographic variables varied by the undergraduate institution the student attended. I tested a dummy variable for minority status (all non-white students) in addition to gender and the other standard race/ethnicity classifications. Only in the cases of gender and minority were the variance components found to be significant. As gender and minority status vary by undergraduate institution, I next modeled their slopes as outcome measures. Tables 4.6 and 4.7 provide the coefficients, odds ratios, and significance levels for the randome slope model for gender and minority status, respectively.

Table 4.6 Aspiration random slope model: Gender

	Coefficient	Odds Ratio
Random Intercept Model Variable		
Female	-0.193	0.824
Male(Reference)		
Random Slope Model Variables		
Female Slope, Intercept	-0.004	0.996
Institution is HBCU	0.960	2.612
Institution is not HBCU (Reference)		
Graduation Rate	0.008	1.008
BA Control: Private	-0.400	0.670
BA Control: Private-for-profit	-0.785	0.456
BA Control: Public (Reference)		
Carnegie: Masters Institution	0.224	1.252
Carnegie: Baccalaureate Institution	-0.299	0.742
Carnegie: Other	0.001	1.001
Carnegie: Doctoral (Reference)		

*** p < .001, ** p < .01, * p < .05, + p < .10

While the variance components for gender was significant, I did not find any of the level-two variables to significantly impact the model. The random slope model for gender was based upon only 538 of the 564 institutions included in the model that had sufficient data for analysis.

The random slope model for minority students used only 451 of the 564 insitutions, but revealed a number of potentially interesting findings. Attending an HBCUand a private-for-profit institution were associated with signficantly lower levels of graduate school aspiration. I interpret this finding with great caution, however, as the number of non African-American minority students attending an HBCU in the sample is miniscule. Thus, these results are possible the result of noise in the data, and should only be used to guide potential areas of future inquiry. Minority students who attended a private-for-profit institution were .17 times as likely to aspire to graduate

school as an individual who attended a public institution. Interestingly, the institutions graduation rate had a slighlty negative association with graduate school aspiration, but only at a signficance level of $p < .10$.

Table 4.7 Aspiration random slope model: Minority

	Coefficient	Odds Ratio
Random Intercept Model Variable		
Minority	0.649**	1.913
Non-Minority (Reference)		
Random Slope Model Variables		
Minority Slope, Intercept	0.489***	1.631
Institution is HBCU	-4.989**	0.007
Institution is not HBCU (Reference)		
Graduation Rate	-0.021+	0.979
BA Control: Private	-0.245	0.782
BA Control: Private-for-profit	-1.801*	0.165
BA Control: Public (Reference)		
Carnegie: Masters Institution	-0.203	0.816
Carnegie: Baccalaureate Institution	-0.077	0.926
Carnegie: Other	-0.140	0.869
Carnegie: Doctoral (Reference)		

*** p < .001, ** p < .01, * p < .05, + p < .10

Individuals who grew up in a home where English was not the primary language were 2.5 times as likely to aspire to graduate school (compared to the reference category of growing up in a home where English was the priamry language spoken). The highest level of education the student's parents completed showed a small level of influence on graduate school aspiration. Compared to the reference category of having parents who earned no more than the high school diploma, students whose parents completed some college were 1.3 times as likely to aspire to

graduate school. I found no significant relationship for any other parental education level. Compared to the reference category of a dependent student whose family income level was less than $29,000, only the variables indicating that student held independent status statistically influenced graduate school aspiration. Independent students earning greater than $20,000 per year were approximately half as likely to aspire to graduate school.

Three of the variable sets associated with cultural and social capital had no significant effect on graduate school aspiration. The type of high school the student attended, whether or not the student attended college in their state of residence, and whether the student received tuition assistance from their parents all failed to significantly influence graduate school aspiration.

Undergraduate Institution Context.

I modeled a number of characteristics of the student's undergraduate institution, but failed to find many significant predictors of graduate school aspiration. The variables associated with whether the institution was an HBCU, public or private, and graduation rate showed no significant association with graduate school aspiration. Only the variable encapsulating the institution's Carnegie Classification significantly influenced graduate school aspiration. Compared to the reference category of having graduated from a doctoral/research university, students who received their baccalaureate from an institution classified as "other" were roughly half as likely to aspire for graduate school. Attending either a masters or baccalaureate institution did not differ significantly from a doctoral/research institution.

Graduate School Application

I next explored the impact that the independent variables had on graduate school application. Many of the variables I found to be significant predictors of graduate school

aspiration were also significant when examining graduate school application. I first present the variables associated with the human capital component of the model, followed by cultural and social capital variables, and conclude with characteristics of the undergraduate institution.

Human Capital Variables.

Undergraduate grade point average was found to be significantly and positively associated with graduate school application. Each .01 increase in the student's undergraduate grade point average was associated with being 1.005 times as likely to submit an application for graduate school. It is again clearer to examine the impact in terms of standard deviations from the mean GPA of 3.16. A student with an undergraduate GPA one standard deviation above (3.64) above the mean is 1.27 times as likely to apply to graduate school as a student with a 3.16 GPA.

Undergraduate major was also a significant predictor of graduate school application. Compared to the reference category of majoring in business/management, students who majored in the humanities, social sciences, behavioral sciences, mathematics, life sciences, and physical sciences were significantly more likely to have submitted a graduate school application. Those who majored in the humanities or social/behavioral sciences were approximately twice as likely to do so; individuals who majored in mathematics or the life/physical sciences were three times as likely to have done so, when holding all other variables in the model constant. I found no significant difference between education and business majors in the graduate school application model, however.

I did not find any significant relationship between submitting a graduate application and the interaction terms (Total Debt * Gender, Total Debt * Black, Total Debt * Hispanic, Total Debt * Asian, and Total Debt * American Indian/Alaska Native/Native Hawaiian/Pacific Islander, Total Debt * Minority.) I also failed to find evidence that the impact of accumulated undergraduate indebtedness varied by the student's undergraduate institution.

Cultural and Social Capital Variables.

There was no significant relationship between gender and graduate school application, but I did find race/ethnicity to be an important predictor. Compared to the reference category of white students, Both African-American and Hispanic/Latino students were more likely to have submitted a graduate school application, with African-American students roughly twice as likely to have done so, and Hispanic/Latino students one and a half times as likely.

I again tested a number of random slope models to determine if gender and race/ethnicity vary by undergraduate institution. Gender and minority status were the only two variables to exhibit a significant variance components, therefore, I modeled their slopes as outcomes. Tables 4.8 and 4.9 contain the random slope coefficients, odds ratios, and significance levels for gender and minority status, respectively. It is important to note that these random slope models represent exploratory analyses, and the results should be used only to spur potential areas of future research.

At the point of submitting a graduate application, I found that having attended a private-for-profit institution was the only institution control category to be significant for female students. Female graduates of a private-for-profit institution were roughly one-quarter

as likely to apply for graduate school as female graduates of public institutions. The random slope model for gender includes only the 538 of 564 institutions with sufficient data for analysis.

Table 4.8 Application random slope model: Gender

	Coefficient	Odds Ratio
Random Intercept Model Variable		
Gender	0.026	1.027
Male (Reference)		
Random Slope Model Variables		
Gender Slope, Intercept	0.117	1.250
Institution is HBCU	-0.087	1.091
Institution is not HBCU (Reference)		
Graduation Rate	-0.005	0.995
BA Control: Private	-0.019	0.981
BA Control: Private-for-profit	-1.380*	0.252
BA Control: Public (Reference)		
Carnegie: Masters Institution	-0.027	0.973
Carnegie: Baccalaureate Institution	-0.099	0.906
Carnegie: Other	-0.058	1.060
Carnegie: Doctoral (Reference)		

*** p < .001, ** p < .01, * p < .05, + p < .10

The random slope model for minority status was again based on only the 451 of the 564 institutions that had sufficient data for analysis. Additionally, attending an institution with an increased graduation rate was associated with a slight decrease in the likelihood of submitting a graduate school application. As these comparisons were generated based upon the aggregate category of non-white students, it is possible that this finding is a result of noise in the model. While these findings are intended only for exploratory analysis, future

research should examine in greater depth the effects of institutional quality on minority students' graduate school choice processes. Graduates of a baccalaureate institution were roughly one-half as likely to apply for graduate school as graduates of doctoral/research institutions, at a significance level of $p < .10$.

Table 4.9 Application random slope model: Minority

	Coefficient	Odds Ratio
Random Intercept Model Variable		
Minority	0.424***	1.528
Non-Minority (Reference)		
	0.356**	1.427
Random Slope Model Variables		
Minority Slope, Intercept		
Institution is HBCU	-0.286	0.751
Institution is not HBCU (Reference)		
Graduation Rate	-0.012*	0.988
BA Control: Private	0.364	1.440
BA Control: Private-for-profit	-0.436	0.647
BA Control: Public (Reference)		
Carnegie: Masters Institution	-0.256	0.772
Carnegie: Baccalaureate Institution	-0.599+	0.549
Carnegie: Other	-0.717	2.048
Carnegie: Doctoral (Reference)		

*** p < .001, ** p < .01, * p < .05, + p < .10

Parental education attainment was also a significant predictor of submitting a graduate school application. When holding all other variables in the model constant, I found that students whose parents obtained a bachelor's degree were approximately 1.3 times as likely to submit an application for graduate school compared to the reference category of having parents who obtained no more than the high school diploma. Students whose parents

completed a master's degree were 1.4 times as likely to have done so, again compared to the reference category. Dependency status and income was also significantly associated with submitting a graduate school application; independent students with incomes greater than $50,000 were roughly half as likely to submit an application to graduate school as dependent students with incomes less than $29,999.

Finally, there were a number of variable categories that exhibited no significant relationship to graduate school application. The student's native language, the type of high school the student attended, whether the student attended college in their state of residence, and whether the student received tuition assistance from their parents all did not significantly influence the graduate school application model.

Undergraduate Institution Context.

Variables associated with the student's undergraduate institution influenced graduate school application more than graduate school enrollment. Students who graduated from an HBCU were 1.5 times as likely to apply for graduate school as those students who did not attend an HBCU, although the level of significance was only $p < .10$. Compared to those students who attended public institutions, graduates of a private college or university were 1.2 times as likely to apply to graduate school, at the same $p < .10$ level of significance. The undergraduate institution's Carnegie Classification was a significant predictor of submitting a graduate school application. Compared to the reference category of receiving the baccalaureate degree from a doctoral/research institution, students who attended an institution classified as "other" were roughly half as likely to apply for graduate school, and graduates of baccalaureate colleges were three-quarters as likely to have done so.

Graduate School Enrollment

The final model I estimated examined actual student enrollments in graduate school. I will again present the human capital variables first, followed by the cultural and social capital components of the model, and conclude with characteristics of the student's undergraduate institution.

Human Capital Variables.

I found that the variable categories that were significantly associated with enrolling in graduate school were identical to those associated with having submitted an application. A student's undergraduate academic performance continued to be a significant predictor, with each .01 increase in GPA associated with the student being 1.006 times as likely to enroll in graduate school. A student who obtained an undergraduate GPA of 3.64 (one standard deviation above the mean of 3.16) is 1.33 times as likely to enroll in graduate school as an individual with a 3.16 GPA.

Students who majored in the humanities or social/behavioral sciences were 1.6 times as likely to enroll in graduate school as those students who majored in business. Mathematics, life, and physical science majors were roughly two and a half times as likely to have enrolled in graduate school as business students. No other student majors exhibited a significant difference from business on influencing enrollment in graduate school.

Cultural and Social Capital Variables.

Gender did not significantly influence graduate school enrollment, which is consistent with what I found in the graduate school aspiration and application models. In examining the influence of race/ethnicity on graduate school enrollment, I found that only African-

American students differed from the reference group of white students. When accounting for all other variables in the model, African-American students were roughly one and a half times as likely as white students to enroll in graduate school. I again tested random slope variables for gender and race/ethnicity. Gender was the only variable in which the variance components was significant, indicating that gender varies by undergraduate institution. No level two variables were significant predictors of graduate school enrollment by gender, however.

The highest education attained by the student's parents was also associated with enrolling in graduate school. Students whose parents obtained a bachelor's degree were roughly 1.2 times as likely to enroll in graduate school as those students whose parents completed a high school diploma or less, at a significance level of $p < .10$. Students whose parents completed a master's degree were approximately 1.4 times as likely to enroll in graduate school as the reference category, again at the $p < .10$ level of significance. Dependency status and income again influenced the model, with independent students who earned greater than $50,000 being between one-half and three-fifths as likely to enroll in graduate school as dependent students whose families earned less than $29,999.

I did not find the student's primary language, high school type, parental tuition support, or residency status of the undergraduate institution to significantly influence graduate school enrollment.

Undergraduate Institution Context.

At the point of actually enrolling in graduate school, only the Carnegie Classification of the student's undergraduate institution was a significant variable in the model. Compared

to students who graduated from doctoral/research universities, graduates of institutions classified as “other” were roughly one-half as likely to enroll in graduate school. Graduates of baccalaureate institutions were roughly two-thirds as likely to have done so, again compared to the reference category of having attended a doctoral/research institution.

Answers to the Research Questions

The purpose of this study was to determine the impact of individual and institutional characteristics on the graduate school choice processes of aspiration, application, and enrollment. Three operative research questions serve to address this purpose, each comprised of three sub-sections. I next address the results of this analysis within the construct of each question and sub-question.

1. *To what extent do the following measures of human capital explain graduate school aspiration, application, and enrollment?*

Human capital theory is the predominant approach for exploring educational choice decisions (Paulsen & Toutkoushian, 2008). In this study, a number of variables representative of the human capital investment decision served as the building blocks for the generalized linear mixed models. Student major, undergraduate grade point average, SAT score, and cumulative undergraduate indebtedness were entered first into each step of the three models. My results showed that a number of the human capital variables were indeed strong predictors of graduate school aspiration, application, and enrollment.

   a. *What influence does undergraduate major have on graduate school choice processes?*

I found that a student's undergraduate major significantly and consistently influenced all three graduate school choice processes. Compared to the reference category of having majored in business/management, students who studied in the humanities, social sciences, behavioral sciences, mathematics, and life or physical sciences were consistently more likely to aspire to, apply for, and enroll in graduate school. Education majors were more likely to aspire to graduate school, but did not differ significantly from business students when comparing their rates of applying to or enrolling in graduate school. Students who majored in computer or information sciences, engineering, health related fields, or any other major did not significantly differ from business students at any stage of the graduate school pipeline.

b. How does undergraduate academic performance impact aspiration, application, and enrollment to graduate education?

A student's undergraduate academic performance, as measured by their cumulative grade point average, significantly affected graduate school aspiration, application, and enrollment. I found the association was at its weakest point in graduate school aspiration, and at its strongest in the graduate school enrollment models. I also tested SAT scores in each of the models, but did not find a significant influence at any phase of the graduate school choice process. These initial findings give credence to the concept that measures of human capital pay a key role in explaining graduate school choice decisions.

a. To what extent does a student's cumulative undergraduate indebtedness influence components of graduate school choice?

The amount of debt a student accumulated while completing the baccalaureate degree was theorized to have a negative influence on graduate school aspiration, application, and enrollment. I

tested this by including students' total debt in each of the generalized hierarchical linear models. However, I did not find student debt to be a statistically significant variable at any stage of the graduate school process (aspiration, application, or enrollment). I also ran a set of models that included only the student debt variable, and again failed to see any statistically significant relationship.

2. *To what extent do student background characteristics and the concepts of cultural capital and social capital influence graduate school aspiration, application, and enrollment?*

While human capital investment theory serves as the primary theoretical framework for exploring educational choice decisions, it historically has not taken into account the concept of individuals' differing preferences. In recent years the concepts of cultural capital and social capital have in been introduced in choice research as a mechanism for approximating and accounting for those difference in preference that arise from an individual's background and life experiences (Perna, 2004). In addition to the more traditional demographic measures included in choice research (e.g. gender, race), this study also explicitly included and modeled a number of indirect measures of cultural and social capital. I found that including proxy measures of cultural capital and social capital were frequently statistically significant predictors of graduate school aspiration, application, and enrollment. Inclusion of these variables also reduced the overall variance components in the models, which indicates that these variables help explain the overall differences seen in the rates of graduate school aspiration, application, and enrollment. The variance components are presented in table 4.10. The human capital model included the variables of total debt, undergraduate major, undergraduate GPA, and SAT score. The cultural and social capital variables included in the model were gender, race, primary language spoken in the home,

residency status at the baccalaureate institution, parental education, family income and dependency status, the type of high school attended, and the amount of parental tuition assistance provided.

Table 4.10 Comparison of capital models

	Aspiration		Application		Enrollment	
	Human Capital	Human, Cultural, & Social Capital	Human Capital	Human, Cultural, & Social Capital	Human Capital	Human, Cultural, & Social Capital
Variance Components	.480	.377	.276	.243	.268	.263
Reliability	.499	.434	.466	.429	.426	.405
Df	563	563	563	563	563	563
p-value	< .001	< .001	< .001	< .001	< .001	< .001

a. How do gender and race/ethnicity influence the likelihood of graduate school aspiration, application, and enrollment?

I included variables indicating a student's gender and race or ethnicity in this study as a component of the cultural capital and social capital measures. Gender did not significantly impact graduate school aspiration, application, or enrollment. The category of student race was split into a set of six dummy variables, with white students established as the reference category. Only African-American students differed significantly from their white peers at each phase of the graduate school choice process. African-American students were consistently and significantly more likely to aspire to, apply for, and enroll in graduate school, when accounting for all other

variables in the model. Hispanic and Latino students were significantly more likely to aspire to and apply for graduate school only.

I next examined the impact of race on graduate school aspiration, application, and enrollment without including any other variables. This allows for an analysis of the impact of controlling for other variables in the model. I did not find many substantial differences between the race only model and the full models. Only African-American students exhibited a substantial difference, with the odds ratio for aspiring to, applying for, and enrolling in graduate school being larger in the full model than the race only model. For instance, at the point of graduate school aspiration the odds ratio was 3.731 in the full model, but only 3.056 in the race only model. African-American students were 2.117 times as likely to apply for graduate school as their white peers in the full model, but only 1.750 times as likely to do so in the race only model. Finally, African-American students did not differ significantly from white students in the race only enrollment model, but were 1.5 times as likely to enroll in graduate school in the full model. These findings indicate that controlling for the other variables in the model accentuates the impact of race on graduate school choice.

b. To what extent do indirect measures of cultural capital (parents' education, family income, parental assistance with tuition & fees, language most often spoken in home) impact graduate school choice processes?

I included indirect measures of cultural capital in the generalized hierarchical linear models in an attempt to account for differences in students' preferences for graduate school. Several of these factors were statistically significant predictors of graduate school aspiration, application, and enrollment; inclusion of the block of variables related to cultural and social capital

also reduced the variance components of each model. The highest education level obtained by a student's parent influenced all three stages of the graduate school choice process, albeit at lower ($p < .10$) levels of significance. Individuals whose parents completed either the baccalaureate or master's degree were more likely to apply for and enroll in graduate school than those who obtained the high school diploma or less.

I also explored the impact of family income and dependency status. Compared to the reference category of being a dependent student with a family income less than $29,000, no other student dependency classifications with higher family incomes were significantly more likely to aspire to, apply for, or enroll in graduate school. Independent students with large annual incomes (greater than $50,000) were significantly less likely to do so, however, in each step of the process.

The language most commonly spoken in the student's home is another factor that serves as a measure of cultural capital in graduate school preferences. All languages other than English were collapsed into a single category so that the variable was a dichotomous representation of the language most frequently spoken. Students who grew up in households where English was not the primary language spoken were significantly more likely to aspire to graduate school, but did not differ significantly in their rates of applying for or enrolling in graduate school.

I also modeled the amount of tuition assistance that a student's parents or relatives provided for their undergraduate education. Compared to the reference category of not receiving any tuition assistance, none of the other categories significantly differed at any phase of the graduate school choice process.

c. *How do indirect measures of social capital (type of high school attended; undergraduate institution type and location) interact with other aspects of the model and influence the decision to enroll in graduate school?*

Three categories of high school types were considered, public high schools, private high schools, and foreign high schools. I found no statistically significant difference on graduate school aspiration, application, or enrollment for graduates of any of the three types of high schools. Exploring attendance of an undergraduate institution in a state other than the one in which the student held residency was a means of accounting for differing social networks. I found no statistically significant differences, however, when examining a student's residency for baccalaureate attendance. Additional findings related to the undergraduate institution attended by the student are presented following the next research question.

3. *To what extent do characteristics of the undergraduate institution influence graduate school aspiration, application, and enrollment?*

Literature on graduate school choice often focuses on the role of characteristics of the institution an individual attended for the baccalaureate degree. As that prior research failed to account for the nested and hierarchical structures inherent in choice decisions, the studies often modeled characteristics of the undergraduate institution at the first (and only) level of the analysis. This study is different in that it directly explored variables attached to the student's undergraduate institution in the second level of a set of generalized hierarchical linear models. I found that a number of these level-two institution variables significantly influenced graduate school aspiration, application, and enrollment, as discussed below.

a. *To what extent does the undergraduate institution control (public or private) and classification (Carnegie type) influence components of the graduate school choice process?*

Variables included in the study indicate whether the student's undergraduate institution was public, private not-for-profit, or private for-profit. A modification of the collapsed Carnegie Classification was also included, with institutions separated into doctoral/research universities, master's universities, baccalaureate colleges (liberal arts and general), and "other institutions" (e.g. specialized schools). While "other" was the only classification that was a statistically significant predictor of graduate school aspiration, I did find a number of categories to be significantly associated with graduate school application and graduate school enrollment. For instance, graduates of private colleges were more likely to apply for graduate school, but were not significantly different in the graduate school enrollment model. In addition, compared to the reference category of attending a doctoral/research university, graduates of baccalaureate and "other" undergraduate institutions were statistically less likely to apply for and enroll in graduate school.

b. *How does the graduation rate of the undergraduate institution impact graduate school aspiration, application, and enrollment?*

Previous literature has frequently explored the concept of undergraduate institutional quality, but much of that work has operationalized quality by modeling institutional admissions selectivity. This study sought to reconceptualize the review of institutional quality by modeling the output measure of cohort graduation rate instead. However, I failed to find a significant

relationship between a student's undergraduate institutional graduation rate and graduate school aspiration, application, or enrollment.

c. *Does attending a Historically Black College or University (HBCU) significantly impact graduate school aspiration, application, and enrollment?*

I created a dummy variable in the model to indicate if the student's undergraduate institution was a historically black college or university. Attending an HBCU was not significantly associated with either graduate school aspiration or graduate school enrollment, but did have a significant impact on submitting a graduate school application ($p < .10$).

Summary

I constructed three generalized hierarchical linear models to explore the impact of individual and institutional factors on the graduate school processes of aspiration, application, and enrollment. The first block of variables in the model explored the relationship of the human capital construct to the graduate school choice process, with undergraduate major and undergraduate achievement positively and significantly influencing aspiration, application, and enrollment. I next explored the impact of demographic characteristics, cultural capital, and social capital variables on the model. African-American and Hispanic or Latino students were more likely to move through the pipeline than their white peers; moreover, including the remaining cultural and social capital variables reduced the overall level of variance components. Directly modeling characteristics of the student's undergraduate institution at the second level of the generalized hierarchical linear model

revealed the institution's Carnegie Classification to be a significant predictor of graduate school aspiration, application, and enrollment.

The concluding chapter explores the findings in detail. It compares those findings with previous research, highlighting both areas of agreement and divergence. I also examine the implications for established graduate school choice theories, and present recommendations for pertinent areas of future research.

CHAPTER FIVE: IMPLICATIONS AND CONCLUSIONS

Access to and completion of graduate education is associated with a number of benefits for both the individual completing the degree and society as a whole. Individual benefits often include higher lifetime wages, reduced levels of unemployment, and an increased quality of life (Baum, Ma, & Payea, 2010). Successful completion of the graduate degree is also a prerequisite to entry for a number of high-earning or high-status positions (e.g. medical doctor, attorney, college professor, allied health professions, educational administration) in our society.

There are also several societal benefits gained from increased levels of graduate education attainment. The increased earnings accrued by individuals with a graduate education yield increased tax payments at the local, state, and federal level. The lower levels of unemployment exhibited by those with a graduate degree result in a lower demand for government services, compounding the financial benefits of the higher tax base. Completion of a graduate degree also appears to benefit future generations; the children of those individuals with a graduate degree obtain higher levels of education as well (Baum et al., 2010).

While it is clear that the advantages of graduate education stretch from the individual to the societal level, changes in the global environment threaten to undermine these benefits. The United States has long served as the world's standard with regards to quality graduate education; this position is currently being challenged by the educational investments being made in other countries. These advancements threaten the pipeline of talented individuals from abroad who have historically elected to pursue their graduate degree in the U.S. Many of those individuals tend to

remain and work in the U.S.; without those students in the graduate pipeline, the ripple effect for our national economy could be large and negative (Wendler et al., 2010).

This potential loss of international graduate students would not be as concerning if there was an adequate supply of domestic students to fill the gap in enrollments. However, within the U.S., there exist large discrepancies among the students who elect to pursue a graduate degree, with the attainment rates differing across various student backgrounds. Although improvements have been made when comparing educational attainment rates between various student sub-populations, gaps still exist when comparing historically underrepresented groups (e.g. low-income, first-generation, minority) with their majority peers. These historically underrepresented groups also comprise many of the fastest growing subsets of our nation's population; without a dramatic improvement in graduate attainment rates for these students, it will likely be impossible to ensure our pipeline of graduate students is filled and operating at full efficiency (Wendler et al., 2010).

The purpose of this study was to explore these issues of graduate school choice and enrollment within an empirical framework. I adapted the conceptual model used to guide the study from Perna's (2006) previous work in exploring undergraduate college choice decisions, incorporating the theories of human, cultural, and social capital. The model contends that individuals make graduate school choice decisions within the context of four nested layers:1) Habitus, 2) Undergraduate institution context, 3) Graduate school context, and 4) Social, economic, and policy context. While each of the four layers play an important role in understanding the choice process as a whole, this study focused on the first two aspects of the model: individual (or habitus) factors and undergraduate institution factors.

I analyzed a nationally representative dataset, the 2000/01 Baccalaureate and Beyond Longitudinal Study, via a series of generalized hierarchical linear models. The key research objective was to explore the ways in which characteristics of individuals and the undergraduate institutions they attended converge to influence the three phases of graduate school choice: aspiration, application, and enrollment. The study generated a number of interesting results; I will next discuss those within the context of the operative hypotheses and the larger body of previous research.

Theory, Previous Research, and Implications

A review of the established literature on both college choice and graduate school choice processes provided a framework for the existing knowledge on the topic as well as a revealing of questions that still exist. Each hypothesis generated for this study was derived from the existing body of literature. I next explore, in greater depth, the results obtained for each of the hypotheses within the context of the prior research.

Hypothesis One

A student's undergraduate academic performance will significantly impact graduate school aspiration, application, and enrollment; students with higher GPA's are more likely to pursue graduate education.

Researchers have frequently explored student's undergraduate academic performance in the graduate school choice literature. Heller (2001), Millett (2003), Mullen, Goyette, and Soares (2003), and Zhang (2005) all found a significant positive relationship between a student's academic achievements and their proclivity for graduate school. The results of this analysis strongly confirm the established body of literature that students with higher levels of

exhibited academic performance would be more likely to aspire to, apply for, and enroll in graduate education

Implications.

While the finding that students with higher undergraduate grade point averages are more likely to pursue graduate education seems logical and benign, there are a number of subtle interpretations of interest. First, while the results of this study did find a student's undergraduate GPA to be a significant predictor of graduate school aspiration, application, and enrollment, those findings were stronger in association at each subsequent phase of the graduate school pipeline. While I draw comparisons between the models with caution, it is useful to examine differences in coefficients and odds ratios. At the point of graduate school aspiration, moving one standard deviation (.48) from the mean undergraduate GPA of 3.16 resulted in the student being 1.2 times as likely to aspire to graduate school. This odds ratio increased to 1.27 times as likely at the point of graduate school application, and 1.33 times as likely at the point of graduate school enrollment.

This increase in the strength of association as the individual progresses through the graduate school choice process potentially highlights a disconnect between that individual's aspiration and their own academic ability. While a student's academic achievement is positively associated with all three steps of the graduate school process (aspiration, application, and enrollment), the fact that the magnitude of that association is larger at the point of applying and enrolling in graduate school highlights the importance of GPA in determining actual graduate school attendance. An individual who aspires to graduate school might determine when reviewing admissions requirements that they do not fall into a

competitive range of potential applicants, and thus decides not to pursue a graduate program. While this study cannot conclusively determine a relationship between the models of aspiration, application, and enrollment, it does point to a potential area of future research.

Hypothesis Two

Students who major in business will be less likely to aspire to, apply for admission, or enroll in graduate school than their peers who major in the social sciences, natural sciences, education, or humanities. Students with higher opportunity costs are less likely to pursue graduate education.

A key component of human capital theory as applied to graduate school choice is that students will weigh the potential benefits of pursuing a graduate degree against the earnings they forego by not participating in the workforce. As the Baccalaureate and Beyond 2000/01 Longitudinal Study captured information only one year after a student received the baccalaureate degree, the undergraduate major provides a strong proxy for measuring these opportunity costs (Perna, 2004).

Business majors were consistently less likely than their peers who majored in the humanities, social sciences, behavioral sciences, mathematics, life sciences, and physical sciences to aspire to, apply for, and enroll in graduate education. Business majors were also significantly less likely to aspire to graduate school than Education majors, although no statistical difference existed between the two groups at the point of graduate school application or graduate school enrollment. These findings are consistent with the established body of graduate school choice literature (Heller, 2001; Zhang, 2005; Millett, 2003; Mullen et al., 2003).

Implications.

While the findings of this study largely support the prior body of research examining the impact of a student's undergraduate major on the various processes involved with the pursuit of a graduate degree, there are a number of details worth exploring in more depth. Perna (2004) and Millett (2003) proposed two distinct conceptual approaches for considering the role that a student's undergraduate major has on determining graduate school choice processes.

Perna (2004) chose to group the various undergraduate majors into four categories based upon expected starting salaries. The lowest quartile included education, history, and psychology; the second quartile was comprised of humanities, social sciences, public affairs, social services, and other; the third quartile included business and management majors, and the highest quartile included math, other sciences, health professions, and engineering.

Millett (2003) adapted the Biglan system, divided the majors into two discrete categories, pure and applied. The pure category of major included fields such as chemistry, biology, foreign languages, and the humanities; the applied category was comprised of business, engineering, education, and health professions. The conceptual rationale for this dichotomization of majors is based on the theory that pure fields have an increased expectation and inherent requirement for graduate study, whereas the applied fields are designed to prepare an individual for immediate work, with a much lower need for graduate education.

The results of this study align more with Millett's (2003) conceptual analysis than Perna's (2004). The only major categories statistically different from business at each step of

the graduate school pipeline were the humanities/social/behavioral sciences and mathematics/life/physical sciences. All of these majors showed an increased likelihood of pursuing graduate school than business majors. Moreover, Millett classified all of these majors as pure, and my findings echo her results. While those majoring in the humanities/social/behavioral sciences were classified as lower earning majors by Perna, mathematics and the life/physical sciences were a subset of the highest earning quartile. Human capital theory would expect those students with the highest expected starting salaries to pursue graduate education at a lower percentage; the findings of this study do not support that concept directly. Additionally, at the point of graduate school application and graduate school enrollment, all of the majors classified as applied by Millett (computer/information sciences, engineering, health, vocational/technical/professional/other) showed no significant difference from business majors.

Given that my full models accounted for the student's earnings and financial resources, I further tested this finding by re-running all three of my generalized hierarchical linear models without any measures of student income. By doing so, I removed the control for dependency status and income that had been included in the full models, and explored the effect of undergraduate major in a more direct manner. I found no difference between these reduced models and the full models that accounted for income. The same undergraduate majors that were significantly associated with graduate school aspiration, application, and enrollment in the full model remained influential in the reduced model. As such, it appears that the type of undergraduate major matters more than the earnings potential when modeling graduate school choice behaviors one year after completion of the baccalaureate. Given that

over 50% of the sample classified themselves as a dependent student, these findings make logical sense. An individual who is still reliant upon a parent or guardian for resources would be less inclined to directly weigh the economic benefits of pursuing a graduate degree, and instead would be more influenced by the intrinsic expectations of pursuing that graduate degree within their individual field of study.

Another interesting component to the findings of this study relate to the varying preferences exhibited by education majors. At the point of graduate aspiration, education majors differed from business majors more than any other category. Education majors were over three times as likely to aspire to graduate school than their peers who majored in business; the next highest differential was for mathematics and life/physical science majors, who were roughly two and a half times as likely as business majors to aspire to graduate school. While there is a clear and significant difference between education and business majors at the point of graduate school aspiration, there was no significant difference found at the point of either graduate school application or graduate school enrollment. It is possible that this finding shows a limitation of the data in that the survey was conducted only one year after the completion of the baccalaureate degree; perhaps many of those education majors who aspire to graduate school planned on working for a year or more prior to entering graduate school. This would explain the differences seen between aspiration and application and enrollment.

Hypothesis Three

Increased levels of accumulated undergraduate indebtedness significantly and negatively impact a student's decision to pursue graduate school.

Substantial research on the impact of undergraduate indebtedness on graduate school choice has occurred in recent years, with much of that research being either inconclusive or contradictory (Millett, 2003). Significant changes were made to the U.S. Higher Education Act when it was reauthorized in 1992 that resulted in an increased reliance on loans as a financing mechanism, and greatly increased the maximum caps on borrowing rates (Campaigne & Hossler, 1998).

In this study, the total amount of debt that a student accumulated while completing their baccalaureate degree was not a statistically significant predictor of graduate school aspiration, application or enrollment. I subsequently entered the variable representing the total amount of accumulated indebtedness into the models of aspiration, application, and enrollment by itself, and still failed to find a statistically significant relationship.

These results align with the work of Weiler (1991) and Schapiro, O'Malley, and Litten (1991), who found no association between indebtedness and graduate education. The finding contradicts, however, the findings of Heller (2001), Fox (1992), Millett (2003) who concluded that a negative association exists between debt and graduate education, and Ekstrom, Goertz, Pollack, and Rock (1991) who discovered a positive association between debt and graduate school.

Implications.

It is surprising that I found no association between indebtedness and graduate school choice processes, for two primary reasons. First, I anticipated that the findings of this study would

more closely track the results obtained by Heller (2001) and Millett (2003), as their studies drew from the previous iteration (1993) of the Baccalaureate and Beyond Longitudinal Study. As their work was also derived from a nationally representative dataset generated via a similar approach to this study, I expected a closer alignment of results.

These findings are also surprising given the substantive policy changes enacted in the 1992 Higher Education Act Reauthorization process. Those policy changes included a transition from grants to loans as the primary mechanism for funding undergraduate degrees, and a substantial increase in the amounts of loans that a student could borrow in a given year or over the course of their baccalaureate degree. I theorized that those changes would result in increased levels of accumulated undergraduate student indebtedness, and that the increased levels of debt would act as a counter-agent to higher educational aspiration via the human capital component of the conceptual model.

While the finding that accumulated undergraduate indebtedness does not influence graduate school choice processes is surprising, it is not without certain logical explanations. First, it is plausible that the policy changes included in the 1992 Higher Education Act that authorized increased levels of undergraduate indebtedness did not, in fact, result in students taking on unmanageable loan levels. It is also possible that states and institutions of higher education increased their own contributions to financial aid programs that mitigated the need for indebtedness.

It is also possible that the ability to defer undergraduate loan repayments while enrolled in graduate school acts as a financial incentive for certain students to pursue graduate education. By

doing so, the individual would lessen their immediate opportunity cost of enrolling, which aligns with the theory of human capital investments.

Hypothesis Four

Females are more likely to enroll in graduate school than males. African-American and Hispanic students are less likely to enroll in graduate programs than other students.

Gender has been a commonly explored component of graduate school choice (Perna, 2004). Prior studies have found African-American and Hispanic students to be less likely to enroll in graduate school than their white peers.

The findings of this study contradict this hypothesis as well as much of the existing body of past research. First, there was no statistically significant difference between males and females at any stage of the graduate school pipeline, differing from the findings of Millett (2003), Perna (2004), Weiler (1991) Zhang (2005). Additionally, African-American students were actually significantly more likely to aspire to, apply for, and enroll in graduate school than their white peers. Hispanic/Latino students were not statistically different from white students when comparing actual graduate school enrollments, but were more likely to both aspire to and apply for graduate school. These findings differ from the previous work of Millett (2003) and Zhang (2005).

Implications.

The initial review of descriptive statistics showed that female students comprised a larger portion of the sample than males (58% to 42%). Their share of the percentage of individuals aspiring for, applying to, and enrolling in graduate school were also higher than males at each step in the process, although the gap narrowed at each subsequent level (i.e.

enrollment gap was narrower than application, which was narrower than aspiration). The multilevel analysis, however, found no statistical difference between males and females, when controlling for all other variables included in the model. This finding implies that perhaps the educational attainment gap between men and women has finally begun to close at the graduate level. This would not be entirely surprising; females have made a number of advancements in baccalaureate enrollment and attainment in recent years, and graduate education was one of the last areas where parity had not yet been achieved (Perna, 2004).

The finding that African-American students are significantly more likely than their white peers to aspire to, apply for, and enroll in graduate school does contradict some early research, but aligns with the findings of Millett (2003) and Perna (2004). A highly interesting bit of nuance that this study provides, however, is an analysis of how those differences change between the first phase of the graduate school pipeline, aspiration, and the last phase, enrollment. Again, I draw comparisons between the models with caution, but it is useful to examine differences that appear.

The difference between African-American and white students is at its strongest at the point of graduate school aspiration, with African-American students being just under four times as likely as their white peers to aspire to a graduate degree. Whereas African-American students are 3.7 times as likely as their white peers to aspire to graduate school, they are only two times as likely to apply for and one and a half times as likely to enroll in a graduate program. While the findings that African-American students outpace their white peers in aspiring to, applying for, and enrolling in graduate school is certainly positive, there are two confounding issues that warrant consideration.

First, the change in magnitude of the difference between African-American and white students between graduate school aspiration and enrollment is troubling. While this difference could be the result of statistical differences in the samples, it is also possible that these results point to an inflated level of graduate school aspiration among African-American students that is not being converted into actual graduate enrollments. Second, these findings highlight an issue that Perna (2004) noted in her previous research on graduate school enrollment. The multilevel models specifically account for and hold all other variables in the model constant. While this is beneficial when examining the discreet effect of race/ethnicity on graduate school choice processes, it is problematic in that few African-American students possess characteristics comparable to white students included in the model (e.g. parents' education attainment, dependency status and income). This concern is borne out in the analysis of graduate school choice that I conducted that included only race as an independent variable. The difference between African-American and white students proclivity for graduate school was smaller in the race-only models, indicating that controlling for those other individual and institutional variables comprise a substantial portion of the differences observed. Even more troubling is that in the race-only model African-American students showed no significant difference from their white peers concerning actual enrollment in graduate school.

The statistically significant difference between Hispanic/Latino students and white students contradicts the findings of Millett (2003), but confirms the results presented by Perna (2004). Hispanic/Latino students seem to mirror the same trends as exhibited by their African-American peers, but in a less clearly pronounced way. Whereas African-American

students differed from the reference group of white at every step of the graduate pipeline, Hispanic/Latino students differed only at the points of graduate school aspiration and graduate school application. This appears to be very similar to the phenomenon found within the context of African-American versus white students. The same limitations that apply to African-American students regarding the implications of these findings also apply to Hispanic/Latino students.

Hypothesis Five

Including indirect measures of cultural and social capital will improve the predictive power of the model, and will provide a more accurate assessment of the impacts that gender and race/ethnicity have on graduate enrollment.

Like many explorations of educational choice before it, this study was grounded in the theoretical construct of human capital. A common criticism of human capital theory, however, is its inability to account for individuals' differing preferences. Perna (2004) posited that including measures of cultural capital and social capital would help address this concern, and concluded that doing so improved the overall efficacy of her graduate school choice model.

This study largely mirrors Perna's (2004) approach in attempting to account for cultural and social capital via the indirect measures provided within the Baccalaureate and Beyond Longitudinal Study. My results also echo and support her findings, as the inclusion of cultural and social capital in the generalized hierarchical linear models resulted in a reduction of the models' variance components.

Implications.

I explored a number of indirect measures of cultural and social capital in this analysis. For example, the question of whether English was the primary language spoken in the student's home was found to be a significant predictor of graduate school aspiration, but not application or enrollment. Interestingly, those students who did not grow up in a home where the most commonly spoken language was English had an increased proclivity for graduate education. This differs from Perna's (2004) findings, as she concluded that growing up in a predominately English speaking home was associated with an increased likelihood of enrolling in a master's program. Another indirect measure of social and cultural capital was whether students attended an institution in their home state of residence. This measure did not significantly influence graduate school aspiration, application, or enrollment. This differs again from Perna, who found that individuals who attended college in their state of residence were more likely to enroll in either a master's or first-professional degree program.

I also tested the impact of the individual's dependency status and household income level as a measure of cultural and social capital. While there were no statistically significant differences between any of the students classified as dependents, regardless of their household income, a number of categories of independent students were substantially less likely to aspire to, apply for, or enroll in graduate school. This finding is similar to Perna's (2004), although direct comparisons are difficult. This study established a dependent student with a household income of less than $29,999 as the reference category, and, therefore, the findings indicate a significant difference between dependent and independent students. Alternatively, Perna (2004) treated independents with incomes greater than $30,000 as the reference category. However, her findings that only

dependent students statistically differ from the reference category are in parallel to the findings of this study.

I also found a statistically weak association between the highest education level achieved by a student's parents and his or her graduate school aspiration, application, and enrollment. These findings differ but do not outright contradict those of Perna (2004). Her analysis established that compared to the reference category of having a parent with an advanced degree, those students whose parents had obtained the bachelor's or less were less likely to enroll in a graduate program. My analysis, however, used having a parent with no more than the high school diploma as the reference category, and found only a weak but positively increased likelihood of applying for or enrolling in graduate school for those students whose parents had earned either the bachelor's or master's degree. Thus, the findings of this study are a consistent but less pronounced version of what Perna discovered.

There were two other variables I explored in the analysis of cultural capital and social capital that were not found to be significant predictors of graduate school aspiration, application, or enrollment. I found no statistical difference when considering the amount of direct tuition assistance that students received from their parents. Perna (2004), however, did find an association. I also tested whether the student's high school type influenced their graduate school choice process, and found no statistically significant association between having attended a public, private, or foreign high school and the pursuit of graduate education.

The findings of this study related to the impact of cultural capital and social capital on the measurement of graduate school choice processes are two-fold. First, I found significantly fewer cultural and social capital variables to influence the graduate school choice process than Perna

(2004). Given that I employed a more methodologically advanced approach, the findings of this study call into question the efficacy of including those indirect measures of cultural and social capital in future research.

Second, while inclusion of the block of cultural capital and social capital variables did improve the overall efficacy of the model, the lack of significance on the majority of the individual independent variables points to the need for more explicit and direct measures of cultural and social capital in future studies. Perna (2004) previously acknowledged this, and the findings of this study reiterate that point in an even clearer light.

Hypothesis Six

The undergraduate institution attended significantly influences graduate choice processes. Individuals who graduate from higher quality institutions or an institution classified as a research university will be more likely to pursue graduate education.

The type of institution students attend for their baccalaureate degree has been shown to significantly impact the graduate school choice process. Students who attend either more selective institutions or doctoral/research institutions have been more likely to apply and enroll in graduate school (Millett, 2003; Mullen, Goyette, & Soares, 2003; Zhang, 2005).

The findings of this study largely support the prior body of research, showing the characteristics of the student's undergraduate institution substantially and significantly influences graduate school choice processes. This study specifically found that graduates from institutions classified as either baccalaureate or "other" (e.g. specialized institution) were significantly less likely to apply for or enroll in graduate education that their peers at doctoral/research institutions.

Implications.

Characteristics of the institution from which a student earned the baccalaureate degree were of theoretical interest in this study for two reasons. First, Perna (2004) showed that the type of institution attended was a statistically significant predictor of graduate school enrollment, and indicated that it was one of her stronger measures of social capital. My second interest in exploring characteristics of the undergraduate institution the student attended was due to the clustered nature of the 2000/01 Baccalaureate and Beyond Longitudinal Study, which first sampled institution, and then selected students from those institutions. I elected to employ a set of generalized hierarchical linear models to analyze the dataset, directly accounting for and exploring the clustered nature of the data.

The findings of this study support the concept that the type of undergraduate institution attended will significantly influence the student's likelihood of aspiring to, applying for, and enrolling in graduate education. The association was stronger at the point of graduate application and graduate enrollment, however, than graduate school aspiration. While only the institution type of "other" was shown to significantly differ from the reference category of doctoral/research universities at the point of graduate school aspiration, graduates of baccalaureate colleges were significantly less likely to apply for or enroll in graduate school.

Whereas the majority of prior research has explored the concept of undergraduate institutional quality via a variable indicating the institution's admissions selectivity, this study sought to focus on the effects of an output measure instead. I entered the cohort graduation rate for the student's undergraduate institution as a level-two variable, but did not find it to significantly influence graduate school aspiration, application, or enrollment. This does not conflict with prior

research per se, but does show that the use of selectivity as a proxy for quality is perhaps a flawed metric, owing to the issue of selection bias.

This study differed from the work of Millett (2003), Perna (2004), and Zhang (2005) in that it considered, as discrete measures, the control of the undergraduate institution (public, private not-for-profit, private for-profit) and the institution's Carnegie Classification (doctoral/research university, master's university, baccalaureate college, other). Doing so allowed for an examination of the differing effects of these two variables. Although I found the institution's Carnegie Classification to be a significant predictor of graduate school aspiration, application, and enrollment, the control of the institution was largely unrelated to the graduate school choice process. The only exception was in the model of graduate school application, in which attending a private not-for-profit institution had a positive relationship with having submitted an application. I also explored whether attending a historically black college or university (HBCU) was associated with the phases of the graduate school choice process. It was again only in the graduate school application model that a statistically significant association was found.

Discussion, Implications, and Future Research

The findings of this research help provide guidance for future scholarly investigations into the factors influencing graduate school choice processes. I next discuss those key areas of potential future research within the context of the findings of this study. I begin with an examination of the limitations and the advantages that are inherent to this study. I continue with an analysis of the implications that the findings of this study present for theory, future research, practice, and policy.

Limitations and Advantages

This study employed multilevel modeling methods in the examination of graduate school choice processes. The conceptual model advanced in this study was adapted from Perna's (2006) development of an overarching conceptual framework for exploring undergraduate college choice decisions that included the theories of human capital, cultural capital, and social capital. I begin by exploring the theoretical limitations of the study, and then describe the advantages that this study presents to the literature.

Limitations.

This limitations section serves only to provide context for the subsequent discussion; a full examination of the limitations of this study is provided at the conclusion of Chapter Three. First, the findings of this study are limited by the age of the dataset used in the analysis. The 2000/01 Baccalaureate and Beyond Longitudinal Study was over ten years old when this study was conducted, which limits the extent to which the findings can be generalized. American higher education is a dynamic field, and substantive changes have occurred in the last decade concerning access, affordability, and student success.

This study is also limited in that only captures graduate choice application and enrollment decisions one year after the student's completion of the baccalaureate degree. A number of fields (e.g. business, education) often require that students obtain work experience prior to enrolling in a graduate program, and this study cannot account for those factors. The lack of direct and explicit measures of cultural capital and social capital also limit the findings of this study. While indirect approximations derived from prior research were

employed in the multilevel analyses, it is still possible that they fail to accurately measure the student's true accumulation of cultural and social capital.

All graduate programs were collapsed in this study into a single metric that facilitated the testing of the multilevel theoretical model. While this approach allowed for a more focused and concise assessment of graduate school choice processes, it masks differences that exist between the various post-baccalaureate programs. Future research should build upon the theoretical model advanced in this study by incorporating multiple discreet graduate degree program options as the dependent variable of interest. Previous single level regression modeling revealed substantial differences by program type (e.g. masters, doctoral-professional practice, doctoral-research), and future research should explore those differences via the multilevel modeling strategy advanced in this study.

Advantages.

While there are inherent limitations to this study, there are also substantial advantages and ways in which this research advances the field. The first distinct advantage that this study provides is that the B&B:2000/01 dataset is seven years more current that the 1993 Baccalaureate and Beyond Longitudinal Study, which was analyzed in the majority of the seminal studies on graduate school choice (Heller, 2001; Millett, 2003; Mullen, Goyette, & Soares, 2003; Perna, 2004; Zhang, 2005). As such, it provides a fresher view of graduate school choice processes, and the factors thought to influence those processes.

One key benefit to the more recent timing of this study is the fact that the majority of the students included in the study matriculated after the 1992 Reauthorization to the Higher Education Act. The reauthorization process included a number of large policy changes to the

U.S. system of student grants, loans, and aid. These changes largely resulted in an increased reliance on loans as the primary source by which students funded their enrollment in a college or university (Campaigne & Hossler, 1998).

This study was able to explicitly model those changes and examine the impacts of student indebtedness and post-baccalaureate education decisions. The fact that I found no statistical connection between a student's accumulated undergraduate indebtedness and their proclivity towards graduate education indicates that these policy shifts have perhaps not had the negative impact on student enrollments that the higher education community feared.

Another benefit of this study is that it is significantly more methodologically advanced than the bulk of prior research on graduate school choice processes. The first component of this methodological advancement was accomplished by executing a complex multiple imputation procedure that addressed the issue of missing data. The majority of the previous research either fails to discuss how missing data were handled (e.g. Heller, 2001), or addresses the issue but adopts a methodologically inappropriate approach. The most common approach has been to employ a process known as dummy variable adjustment, in which a dummy variable is created for each instance of missingness on an independent variable (Mullen et al., 2003; Perna, 2004; Zhang, 2005). Millett (2003), however, did not adopt that approach. She instead appears to have accepted the standard complete-case analysis method, which results in the deletion of every case that contains any amount of missing data. Both of these approaches produce substantially biased estimates, and are no longer recommended for use in any circumstance (Allison, 2002).

Alternatively, this study employed a multiple imputation procedure that invoked chained equations under a fully conditional specification. This allowed for the use of appropriate statistical methods for the generation of ten fully complete imputed datasets. I used truncated regression to estimate the values missing on the student's SAT score, predictive mean matching for Total Debt, GPA, and Graduation Rate, logistic regression to model the two dichotomous variables, and multinomial logistic regression to model the five categorical variables. Given the substantial amount of missing data included in the various iterations of the Baccalaureate and Beyond Longitudinal Studies, it is likely that this approach yielded less-biased estimates in the subsequent analyses than has been seen in prior research.

The issue of missing data is not a trivial one in quantitative analyses of large-scale datasets. If the data is not missing completely at random (which is rarely the case), then the methods adopted by Heller (2001), Millett (2003), Mullen et al., (2003), Perna, (2004), and Zhang (2005) represent potentially biased estimates of the factors influencing graduate school choice processes. By employing an advanced multiple imputation procedure featuring chained equations, I was able to minimize these issues and deliver more accurate parameter estimates.

The next key methodological advantage of the study was its use of a set of generalized hierarchical linear models that directly account for the nested structure of the data. Failure to account for this clustered nature of the data can yield standard error estimates that are too small, potentially resulting in a Type I error. None of the previously referenced research employed a multilevel modeling methodology to explore graduate school choice

processes via the Baccalaureate and Beyond Longitudinal Study. Those authors did use a variety of methods to attempt to account for the clustered nature of the data, however. Perna (2004) simply adopted a high threshold of statistical significance, adopting a minimum $p < .001$ level for results interpretation. Heller (2001) used robust-standard errors in his analysis. Zhang (2005) discusses using the included design effects to address the issue of clustering, but it is unclear if he did so in his analysis. Millett (2003) created a sample weight that was derived from the design effect weight. Mullen et al. (2003) used the software program SUDAAN in addition to SAS, as SUDAAN produces design-corrected standard errors.

The analytical approach in this study is advantageous for two reasons. First, it is methodologically more advanced and sophisticated than the approaches listed above. The various generalized hierarchical linear models were estimated with weights specified at both levels of the analysis, and an adaptive Gaussian quadrature procedure was used to generate the parameter estimates. At a theoretical level, this study is valuable as it explicitly models the variation that exists between different undergraduate institutions in influencing graduate school choice processes. Given the fact that the majority of prior research discussed the significant role of undergraduate institution in influencing graduate school choice processes, the ability to explicitly model and explore that variation is of great value.

Implications for Theory and Future Research

This study has supplemented the body of literature related to graduate school choice processes in several unique and meaningful ways. It has also helped to reveal a number of areas that are ripe for future research and analysis, and provided refinements to the

theoretical underpinnings of graduate school choice research. I will address each of those, and comment on any pertinent findings from this study that inform those recommendations.

First, I recommended that future studies procure a more recent nationally representative dataset that will allow for an exploration of the myriad of environmental changes that have occurred since 2001. Fortunately, NCES has already commissioned a new version of the Baccalaureate and Beyond Longitudinal Study. The 2008/09 public-use data has already been released, and the restricted use data file is anticipated to be made available at some point in 2012. Unlike the limited one-year timeframe of the B&B:2000/01 study, NCES has already begun work on the four year follow up to the 2008/09 study, slated to result in the creation of the 2008/12 Baccalaureate and Beyond Longitudinal Study. I hope that a ten-year follow up of that study will be conducted as well, as was previously done with the 1993/03 Baccalaureate and Beyond Longitudinal Study. The ability to model graduate school choice over a number of years holds broad practical and theoretical benefit, as it provides a significantly larger window in which to capture graduate school enrollment behaviors.

It would also be of benefit if a nationally representative dataset were developed that contains a minimum within school sample size. This would greatly assist in the process of developing multilevel models that analyze the highly clustered data inherent to educational choice decisions. More sophisticated approaches are needed for multiple imputation procedures when the data is either highly clustered, or was generated via a complex sampling design. Progress has been made on this front (e.g. REALCOM IMPUTE), but no workable solution was available for use in this study, unfortunately.

This study also contributes to the theoretical literature that explores graduate school choice processes. First, I demonstrated that Perna's (2004) undergraduate college choice conceptual model could be adapted and applied to graduate school choice research. By operationalizing key variables at the individual (level-one) and institutional (level-two) stages of the model, I was able to explicitly and discreetly model the effects of each. While this study was limited by the quantity and quality of variables associated with a student's undergraduate institution, a key finding still emerges from this research. The findings of this study demonstrate that variables associated with students are more powerful in shaping graduate school choice decisions than characteristics of the undergraduate institution they attended. Future research should attempt to locate and model additional characteristics of the undergraduate institution to determine if they influence graduate school choice processes.

I only considered only the first two-levels (individual and institutional) of the conceptual model in this study, and collapsed all potential graduate school options into a single measure. Future studies should build upon my findings, and incorporate the third and fourth levels of the model into the study. The third layer of the conceptual model includes characteristics of the institution and graduate program the student decides to enroll in, and the fourth layer encompasses the broad social, economic, and policy context.

While I did not find accumulated undergraduate indebtedness to significantly influence any step of the graduate school choice process, future research should continue to explore this concept. It is possible that the rapid increases in tuition and fees seen between 2000 and 2010 have resulted in increased indebtedness levels that would affect graduate school choice processes. I also collapsed all forms of student indebtedness into a single

metric; future research should explore whether differing effects exist by loan type (e.g. subsidized, unsubsidized, private).

Another implication for theory and future research concerns cultural and social capital variables. Scholars have started exploring ways to build on the traditional approach of modeling educational choice decisions via a human capital theory approach. Perhaps most notable is the model advanced by Perna (2004; 2006) that explicitly models concepts of cultural capital and social capital as a way of accounting for differing preferences. My findings echoed those of Perna (2004) in that inclusion of indirect measures of cultural capital and social capital variables improved the overall efficacy of the models tested. A limitation I found, however, was that the majority of the cultural and social capital variables tested did not significantly influence graduate school choice decisions.

This finding points towards the continued explicit inclusion of cultural and social capital concepts within graduate school choice frameworks. Unfortunately, many of the nationally representative datasets fail to include direct and appropriate measures of cultural capital and social capital, leaving the researcher to rely on approximations and indirect measures. Cultural and social capital is largely defined as being accumulated by the student prior to his or her graduation from high school but there are areas in which future surveys could focus on the collegiate experience. In college, cultural capital could be measured by exposure to artistic and cultural events. Social capital measures could focus on the extent to which the undergraduate institution provided information about graduate school opportunities, allowed for faculty/student interactions, and advanced undergraduate research

projects. The inclusion of direct measures of cultural capital and social capital would allow for a more focused analysis of the efficacy of those models.

I modeled dependency and income as a measure of cultural capital in my analysis, which was supported by the fact that over 50% of the sample was comprised of dependent students. These dependent students are far more reliant on their families for support, and their graduate school choice decisions are therefore more contingent upon family circumstances. In future studies that include a student follow-up more than one year beyond the point the student receives the baccalaureate degree, it would make more sense to separate out dependency and income, and include income as a component of the human capital interaction. At that point, the majority of the students in the sample should have achieved independent status, and their own personal earnings would act as an opportunity cost limitation in the human capital component of the model.

I included two variables in this study that attempted to account for a student's pre-baccalaureate characteristics. I modeled the student's SAT score as a human capital component of the model, and they type of high school attended as a social capital variable. These variables did not significantly influence any step of the graduate school choice process, and therefore should be excluded from future studies. Doing so will help to generate a more parsimonious model.

Given the small number of cultural and social capital variables available and the general overlap seen between the two, I recommend adopting the nomenclature advanced by Strayhorn (2009), and combine these two conceptual frameworks into a single measure called "sociocultural capital". Doing so eliminates some of the awkward decisions of

attempting to separate out similar measures into one of the two categories, and helps to simplify the overall conceptual model.

Implications for Policy and Practice

Several implications and recommendations for policy and practice become apparent within the context of this study. First, the findings highlight a number of factors to consider when working with students who are considering pursuing a graduate education. While the impact of a student's undergraduate major is clearly tied to disciplinary expectations for graduate education, it is still worth noting that graduate school enrollment patterns vary significantly by major. Academic advising programs should note these differences in explaining post-graduation options, and the benefits of pursuing a graduate education as they related to students' specific major choices.

Moreover, while this study revealed that the student background characteristics of SAT score, type of high school attended, and parental income do not significantly influence graduate school choice behaviors, other individual-level variables are still important. First generation college students are less likely to aspire to, apply for, and enroll in graduate school than their peers. Colleges and universities should seek to identify these students as early as possible in their undergraduate career and provide them with information and counseling about graduate school.

While this study found African-American and Hispanic/Latino students to be more likely than their white peers to pursue a graduate education, it highlights additional work needed in improving undergraduate attainment rates for those historically underrepresented populations. As the potential pool of graduate enrollees is comprised primarily of white

students, additional programs and policies should focus on equalizing access to and completion of the baccalaureate degree for underrepresented populations.

The findings of this study demonstrate that underrepresented minority students who successfully complete a baccalaureate program are well prepared and poised for graduate education. This study highlights the fact that only a small number of underrepresented students actually reach that point, however, by analyzing the impact of race along on graduate school aspiration, application, and enrollment. Those secondary analyses revealed that when all other variables were excluded from the model, African-American students failed to actually enroll in graduate school at a significantly different rate from their white peers. As such, colleges and universities should seek out African-American students early in their undergraduate tenure and provide focused academic advising on decisions germane to the decision of whether or not to pursue a graduate degree.

As illustrated in this study, this would include discussions about the importance of academic performance and major selection. Particular attention should be paid to first-generation African-American students, given the lower enrollment rates exhibited. While the findings of this study are certainly encouraging, it must be noted that the students selected for inclusion in the study are by definition different from the average entering collegiate freshman class, in that these students have persisted and completed the baccalaureate degree.

An important framing of those advising and outreach activities would be the positive aspects of the fact that African-American students who complete the baccalaureate degree are more likely than their white peers to pursue a graduate program. Strayhorn (2009) has highlighted the fact that not enough of the dialogue focuses on the successes of African-

American students, and the findings of this study would surely serve as a strong point of encouragement for students considering their future options.

Finally, graduates of institutions classified as “other” (e.g. special focus institutions) and baccalaureate colleges were less likely to pursue a graduate education. Individuals working at those institutions should consider creating programs that provide students with additional information about graduate school. Those institutions could also potentially invite representatives from graduate admissions offices to campus to meet students and discuss graduate options with them.

Conclusions

The purpose of this study was to explore the effect that individual and institutional factors have on graduate school choice processes. I advanced a conceptual model that explicitly constructed the process as a nested progression, with students situated within undergraduate institutions. The model, adapted from the work of Perna (2006), provided the framework for exploring the impact of the theories of human capital, cultural capital, and social capital on the graduate school choice processes of aspiration, application, and enrollment. The model positioned the factors that influence the graduate school choice decision within the context of four nested layers:1) Habitus, 2) Undergraduate institution context, 3) Graduate school context, and 4) Social, economic, and policy context. These four layers move from a broad social, economic, and policy context (layer four) down to the individual context (layer one). However, I limited this study to an examination of the first two layers of the conceptual model as I wanted to isolate the individual and institutional level variables in analyzing their effects via the multilevel models. A set of generalized hierarchical linear models were developed that explicitly modeled the effect of

individual and institutional variables, and allowed for an accounting of variance between institutions.

I observed several key findings. First, a student's undergraduate academic performance, as measured by their cumulative grade point average, was positively associated with increased levels of graduate school aspiration, application, and enrollment. Students who majored in the humanities, social sciences, physical sciences, mathematics, life sciences, and physical sciences were also more likely to aspire to, apply for, or enroll in graduate education. The total amount of debt a student incurred while completing their baccalaureate did not influence any phase of the graduate school choice process, however.

A number of variables associated with student demographics, cultural capital, and social capital also inform our understanding of the graduate school choice process. Whereas gender had been a strong determinant of graduate school choice in the past, there was no significant difference between males and females in this study. African-American and Hispanic/Latino students, however, were significantly more likely than their white peers to exhibit progression in the graduate school pipeline from aspiration to enrollment. Individuals whose parents completed either the baccalaureate or master's degree were more likely to apply for and enroll in graduate school, compared with those whose parents obtained no more than the high school diploma. Independent students were less likely to aspire to, apply for, or enroll in graduate school when compared to their dependent peers.

I also found characteristics of the institution where the student received the baccalaureate degree to influence the graduate school choice process. Attending a private institution or an HBCU yielded slightly higher rates of graduate school application, but not aspiration or

enrollment. Attending an institution classified as “other” (e.g. specialized institution) or a baccalaureate college resulted in lower levels of graduate school engagement compared to graduates of doctoral/research institutions, particularly at the point of application and enrollment.

This study has advanced the body of knowledge related to graduate school choice processes in a number of ways. The use of data that are more recent and a more sophisticated methodological approach refined the existing body of knowledge with respect to the factors that influence graduate school aspiration, application, and enrollment. Future research should extend this work by further honing the methodological approach and by identifying more recent and/or comprehensive sources of data. As post-undergraduate opportunity continues to shift in our changing economic climate, the role of graduate education will become more important as students attempt to navigate their options after college. Understanding which individual student level and undergraduate institution level factors influence the decision to pursue graduate education can help improve both graduate school program efficiency and overall educational equity.

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Appendices

Appendix A: GHLM Model Building: Graduate School Aspiration

	Human Capital Model		Within Institution Model		Random Intercept Model	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio
Intercept, β_0	1.638***	5.144	1.740***	5.696	1.862***	6.438
Human Capital Variables						
Total Debt	0.000	1.000	0.000	1.000	0.000	1.000
Major: Humanities & Social/Behav. Sci.	0.732***	2.080	0.653***	1.921	0.703***	2.020
Major: Math & Life/Physical Sciences	1.020***	2.774	0.933***	2.542	0.898***	2.456
Major: Comp./Info. Sci. & Engineering	0.155	1.168	0.029	1.029	0.083	1.087
Major: Education	1.193***	3.296	1.158***	3.185	1.121***	3.069
Major: Health	0.209	1.232	0.263	1.300	0.326	1.385
Major: Vocational/Tech./Prof./Other	0.104	1.109	0.034	1.035	0.031	1.032
Major: Business/Mgmt. (Reference)						
Undergraduate GPA	0.001	1.001	0.003+	1.003	0.004**	1.004
SAT Score	0.001	1.001	0.001	1.001	0.000	1.000
Cultural & Social Capital Variables						
Female			-0.206	0.814	-0.193	0.824
Male(Reference)						
Race: Black, non-Hispanic			1.400***	4.054	1.317***	3.731
Race: Hispanic or Latino			0.552*	1.737	0.575*	1.777
Race: Asian			-0.200	0.819	-0.255	0.775
Race: Am. In./AK or HI Native/Pac. Is.			0.703	2.020	0.615	1.850
Race: Other			0.132	1.141	0.083	1.086
Race: White, non-Hispanic (Reference)						

	Human Capital Model		Within Institution Model		Random Intercept Model	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio
Cultural & Social Capital Variables						
English not primary language in home			0.896*	2.449	0.897*	2.452
English primary language (Reference)						
Attended College in state of residence			0.105	1.111	0.091	1.095
Attended college out-of-state (Reference)						
Parents Highest Education: Some College			0.228	1.256	0.255+	1.290
Parents Highest Education: Bachelor's			-0.042	0.958	-0.026	0.974
Parents Highest Education: Master's			0.278	1.321	0.311	1.365
Parents Highest Education: Doctoral			-0.102	0.903	-0.002	0.998
Parents Edu.: HS or less (Reference)						
Dependent: $30,000-$59,999			-0.203	0.816	-0.216	0.805
Dependent: $60,000-$99,999			-0.259	0.771	-0.311	0.733
Dependent: $100,000 or more			-0.091	0.913	-0.170	0.844
Independent: Less than $19,999			-0.403+	0.668	-0.322	0.724
Independent: $20,000-$49,999			-0.543*	0.581	-0.498*	0.608
Independent: $50,000 or more			-0.704**	0.495	-0.700*	0.497
Depend.: Less than $29,999 (Reference)						
High School Attended: Private			0.185	1.203	0.152	1.165
High School Attended: Foreign			-0.484	0.616	-0.439	0.645
HS attended: Public (Reference)						

	Human Capital Model		Within Institution Model		Random Intercept Model	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio
Cultural & Social Capital Variables						
Parental Tuition Assistance: Paid Some			0.297	1.346	0.284	1.328
Parental Tuition Assistance: Paid All			0.117	1.124	0.105	1.111
Parental Tuition Assistance: N/A			-0.179	0.836	-0.149	0.862
Parental assistance: None (Reference)						
Undergraduate Institution Variables						
Institution is HBCU					0.419	1.520
Institution is not HBCU (Reference)						
Graduation Rate					0.007	1.007
BA Control: Private					0.134	1.144
BA Control: Private-for-profit					-0.598	0.550
BA Control: Public (Reference)						
Carnegie: Masters Institution					0.033	1.034
Carnegie: Baccalaureate Institution					-0.219	0.804
Carnegie: Other					-0.777**	0.460
Carnegie: Doctoral (Reference)						

*** p < .001, ** p < .01, * p < .05, + p < .10

Appendix B: GHLM Model Building: Graduate School Application

	Human Capital Model		Within Institution Model		Random Intercept Model	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio
Intercept, β0	-0.903***	0.405	-0.901***	0.406	-0.791***	0.453
Human Capital Variables						
Total Debt	0.000	1.000	0.000	1.000	0.000	1.000
Major: Humanities & Social/Behav. Sci.	0.676***	1.965	0.629***	1.876	0.681***	1.976
Major: Math & Life/Physical Sciences	1.158***	3.183	1.116***	3.053	1.104***	3.016
Major: Comp./Info. Sci. & Engineering	0.138	1.148	0.112	1.118	0.162	1.176
Major: Education	0.118	1.126	0.114	1.121	0.100	1.105
Major: Health	0.122	1.129	0.114	1.121	0.219	1.244
Major: Vocational/Tech./Prof./Other	-0.016	0.984	-0.058	0.944	-0.059	0.943
Major: Business/Mgmt. (Reference)						
Undergraduate GPA	0.003**	1.003	0.004***	1.004	0.005***	1.005
SAT Score	0.000	1.000	0.000	1.000	0.000	1.000
Cultural & Social Capital Variables						
Female			0.027	1.027	0.026	1.027
Male(Reference)						
Race: Black, non-Hispanic			0.848***	2.336	0.750***	2.117
Race: Hispanic or Latino			0.437+	1.549	0.406+	1.501
Race: Asian			-0.032	0.968	-0.044	0.957
Race: Am. In./AK or HI Native/Pac. Is.			-0.027	0.974	-0.075	0.927
Race: Other			0.238	1.269	0.183	1.200
Race: White, non-Hispanic						

	Human Capital Model		Within Institution Model		Random Intercept Model	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio
Cultural & Social Capital Variables						
English not primary language in home			0.253	1.288	0.252	1.286
English primary language (Reference)						
Attended College in state of residence			0.165	1.179	0.148	1.160
Attended college out-of-state (Reference)						
Parents Highest Education: Some College			0.194	1.214	0.219	1.245
Parents Highest Education: Bachelor's			0.225+	1.252	0.255+	1.290
Parents Highest Education: Master's			0.303*	1.354	0.339*	1.404
Parents Highest Education: Doctoral			0.247	1.280	0.303	1.354
Parents Edu.: HS or less (Reference)						
Dependent: $30,000-$59,999			0.003	1.003	-0.006	0.994
Dependent: $60,000-$99,999			-0.104	0.902	-0.133	0.875
Dependent: $100,000 or more			-0.008	0.992	-0.041	0.960
Independent: Less than $19,999			-0.325+	0.722	-0.285	0.752
Independent: $20,000-$49,999			-0.169	0.844	-0.141	0.868
Independent: $50,000 or more			-0.656**	0.519	-0.672**	0.511
Depend.: Less than $29,999 (Reference)						
High School Attended: Private			-0.037	0.963	-0.036	0.965
High School Attended: Foreign			0.029	1.029	0.061	1.062
HS attended: Public (Reference)						

	Random Intercept Model		Within Institution Model		Human Capital Model	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio
Cultural & Social Capital Variables						
Parental Tuition Assistance: Paid Some			-0.041	0.960	-0.037	0.964
Parental Tuition Assistance: Paid All			0.147	1.159	0.151	1.163
Parental Tuition Assistance: N/A			0.138	1.148	0.180	1.197
Parental assistance: None (Reference)						
Undergraduate Institution Variables						
Institution is HBCU					0.462+	1.587
Institution is not HBCU (Reference)						
Graduation Rate					-0.002	0.998
BA Control: Private					0.201+	1.222
BA Control: Private-for-profit					-0.321	0.726
BA Control: Public (Reference)						
Carnegie: Masters Institution					0.021	1.021
Carnegie: Baccalaureate Institution					-0.336**	0.715
Carnegie: Other					-0.697**	0.498
Carnegie: Doctoral (Reference)						

*** p < .001, ** p < .01, * p < .05, + p < .10

Appendix C: GHLM Model Building: Graduate School Enrollment

	Random Intercept Model		Within Institution Model		Human Capital Model	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio
Intercept, β0	-1.245***	0.288	-1.246***	0.288	-1.125***	0.325
Human Capital Variables						
Total Debt	0.000	1.000	0.000	1.000	0.000	1.000
Major: Humanities & Social/Behav. Sci.	0.501***	1.650	0.447**	1.564	0.494***	1.638
Major: Math & Life/Physical Sciences	1.047***	2.850	0.988***	2.686	0.984***	2.676
Major: Comp./Info. Sci. & Engineering	0.130	1.139	0.122	1.130	0.158	1.171
Major: Education	-0.027	0.973	-0.067	0.935	-0.073	0.930
Major: Health	0.099	1.104	0.103	1.108	0.187	1.206
Major: Vocational/Tech./Prof./Other	-0.061	0.941	-0.124	0.884	-0.129	0.879
Major: Business/Mgmt. (Reference)						
Undergraduate GPA	0.005***	1.005	0.006***	1.006	0.006***	1.006
SAT Score	0.001	1.001	0.001	1.001	0.000	1.000
Cultural & Social Capital Variables						
Female			0.028	1.028	0.025	1.026
Male(Reference)						
Race: Black, non-Hispanic			0.524**	1.690	0.419*	1.521
Race: Hispanic or Latino			0.197	1.217	0.163	1.178
Race: Asian			-0.114	0.892	-0.148	0.862
Race: Am. In./AK or HI Native/Pac. Is.			-0.166	0.847	-0.217	0.805
Race: Other			0.197	1.217	0.144	1.155
Race: White, non-Hispanic (Reference)						

	Human Capital Model		Within Institution Model		Random Intercept Model	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio
Cultural & Social Capital Variables						
English not primary language in home			0.183	1.201	0.174	1.191
English primary language (Reference)						
Attended College in state of residence			0.131	1.140	0.112	1.118
Attended college out-of-state (Reference)						
Parents Highest Education: Some College			0.095	1.100	0.111	1.118
Parents Highest Education: Bachelor's			0.204	1.227	0.221+	1.247
Parents Highest Education: Master's			0.296+	1.344	0.315+	1.371
Parents Highest Education: Doctoral			0.135	1.145	0.169	1.184
Parents Edu.: HS or less (Reference)						
Dependent: $30,000-$59,999			0.099	1.104	0.095	1.100
Dependent: $60,000-$99,999			-0.089	0.915	-0.111	0.895
Dependent: $100,000 or more			0.087	1.090	0.058	1.060
Independent: Less than $19,999			-0.243	0.784	-0.204	0.815
Independent: $20,000-$49,999			-0.100	0.905	-0.074	0.929
Independent: $50,000 or more			-0.542*	0.581	-0.548*	0.578
Depend.: Less than $29,999 (Reference)						
High School Attended: Private			0.094	1.098	0.091	1.096
High School Attended: Foreign			-0.056	0.945	-0.018	0.982
HS attended: Public (Reference)						

	Human Capital Model		Within Institution Model		Random Intercept Model	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio
Cultural & Social Capital Variables						
Parental Tuition Assistance: Paid Some			0.029	1.030	0.037	1.038
Parental Tuition Assistance: Paid All			0.170	1.185	0.166	1.181
Parental Tuition Assistance: N/A			0.011	1.011	0.043	1.044
Parental assistance: None (Reference)						
Undergraduate Institution Variables						
Attended an HBCU					0.437	1.549
Did not attend an HBCU (Reference)						
Graduation Rate					0.000	1.000
BA Control: Private					0.082	1.085
BA Control: Private-for-profit					-0.191	0.826
BA Control: Public (Reference)						
Carnegie: Masters Institution					0.014	1.014
Carnegie: Baccalaureate Institution					-0.367**	0.693
Carnegie: Other					-0.646*	0.524
Carnegie: Doctoral (Reference)						

*** p < .001, ** p < .01, * p < .05, + p < .10

Appendix D: Full GHLM: Graduate School Aspiration

	Coefficient	Standard Error	Odds Ratio	Odds Ratio Conf. Interval	*t*-ratio	Approx. *d.f.*	*p*-value
Intercept, β_0	1.862	0.055	0.055	(5.777,7.176)	33.765	556.000	<0.001
Human Capital Variables							
Total Debt	0.000	0.000	0.000	(1.000,1.000)	1.001	1077.000	0.317
Major: Humanities & Social/Behav. Sci.	0.703	0.152	0.152	(1.500,2.720)	4.632	8887.000	<0.001
Major: Math & Life/Physical Sciences	0.898	0.241	0.241	(1.531,3.939)	3.725	8887.000	<0.001
Major: Comp./Info. Sci. & Engineering	0.083	0.196	0.196	(0.740,1.596)	0.423	8887.000	0.672
Major: Education	1.121	0.195	0.195	(2.095,4.496)	5.757	8887.000	<0.001
Major: Health	0.326	0.225	0.225	(0.892,2.152)	1.452	8887.000	0.147
Major: Vocational/Tech./Prof./Other	0.031	0.175	0.175	(0.732,1.454)	0.179	8887.000	0.858
Major: Business/Mgmt. (Reference)							
Undergraduate GPA	0.004	0.001	0.001	(1.001,1.007)	2.715	731.000	0.007
SAT Score	0.000	0.000	0.000	(0.999,1.001)	0.587	50.000	0.560
Cultural & Social Capital Variables							
Female	-0.193	0.162	0.162	(0.599,1.133)	-1.190	8887.000	0.234
Male(Reference)							
Race: Black, non-Hispanic	1.317	0.391	0.391	(1.733,8.031)	3.366	8887.000	<0.001
Race: Hispanic or Latino	0.575	0.245	0.245	(1.100,2.870)	2.349	8887.000	0.019
Race: Asian	-0.255	0.428	0.428	(0.335,1.792)	-0.596	8887.000	0.551
Race: Am. In./AK or HI Native/Pac. Is.	0.615	0.520	0.520	(0.668,5.122)	1.184	8887.000	0.237
Race: Other	0.083	0.400	0.400	(0.496,2.379)	0.207	8887.000	0.836
Race: White, non-Hispanic (Reference)							

	Coefficient	Standard Error	Odds Ratio	Odds Ratio Conf. Interval	*t*-ratio	Approx. *d.f.*	*p*-value
Cultural & Social Capital Variables							
English not primary language in home	0.897	0.358	2.452	(1.213,4.957)	2.504	431.000	0.013
English primary language (Reference)							
Attended College in state of residence	0.091	0.137	1.095	(0.837,1.433)	0.663	8887.000	0.508
Attended college out-of-state (Reference)							
Parents Highest Education: Some College	0.255	0.150	1.290	(0.960,1.734)	1.696	246.000	0.091
Parents Highest Education: Bachelor's	-0.026	0.157	0.974	(0.714,1.329)	-0.166	105.000	0.868
Parents Highest Education: Master's	0.311	0.191	1.365	(0.937,1.989)	1.626	293.000	0.105
Parents Highest Education: Doctoral	-0.002	0.321	0.998	(0.532,1.874)	-0.006	2037.000	0.995
Parents Edu.: HS or less (Reference)							
Dependent: $30,000-$59,999	-0.216	0.249	0.805	(0.494,1.313)	-0.869	8887.000	0.385
Dependent: $60,000-$99,999	-0.311	0.262	0.733	(0.438,1.226)	-1.184	8887.000	0.236
Dependent: $100,000 or more	-0.170	0.244	0.844	(0.523,1.362)	-0.696	8887.000	0.487
Independent: Less than $19,999	-0.322	0.240	0.724	(0.452,1.160)	-1.343	8887.000	0.179
Independent: $20,000-$49,999	-0.498	0.232	0.608	(0.385,0.958)	-2.143	5393.000	0.032
Independent: $50,000 or more	-0.700	0.278	0.497	(0.288,0.856)	-2.520	2404.000	0.012
Depend.: Less than $29,999 (Reference)							
High School Attended: Private	0.152	0.167	1.165	(0.839,1.617)	0.910	8887.000	0.363
High School Attended: Foreign	-0.439	0.767	0.645	(0.143,2.898)	-0.572	8887.000	0.567
HS attended: Public (Reference)							
Parental Tuition Assistance: Paid Some	0.284	0.200	1.328	(0.896,1.969)	1.417	309.000	0.158
Parental Tuition Assistance: Paid All	0.105	0.162	1.111	(0.808,1.527)	0.649	220.000	0.517
Parental Tuition Assistance: N/A	-0.149	0.187	0.862	(0.594,1.249)	-0.797	86.000	0.427
Parental assistance: None (Reference)							

	Coefficient	Standard Error	Odds Ratio	Odds Ratio Conf. Interval	*t*-ratio	Approx. *d.f.*	*p*-value
Undergraduate Institution Variables							
Attended an HBCU	0.419	0.522	1.520	(0.545,4.242)	0.802	556.000	0.423
Did not attend an HBCU (Reference)							
Graduation Rate	0.007	0.005	1.007	(0.998,1.016)	1.475	556.000	0.141
BA Control: Private	0.134	0.142	1.144	(0.864,1.513)	0.942	556.000	0.347
BA Control: Private-for-profit	-0.598	0.566	0.550	(0.181,1.674)	-1.055	556.000	0.292
BA Control: Public (Reference)							
Carnegie: Masters Institution	0.033	0.142	1.034	(0.782,1.367)	0.235	556.000	0.814
Carnegie: Baccalaureate Institution	-0.219	0.180	0.804	(0.564,1.144)	-1.216	556.000	0.225
Carnegie: Other	-0.777	0.249	0.460	(0.282,0.750)	-3.118	556.000	0.002
Carnegie: Doctoral (Reference)							

Appendix E: Full GHLM: Graduate School Application

	Coefficient	Standard Error	Odds Ratio	Odds Ratio Conf. Interval	*t*-ratio	Approx. *d.f.*	*p*-value
Intercept, β_0	-0.791	0.039	0.453	(0.420,0.489)	-20.469	556.000	<0.001
Human Capital Variables							
Total Debt	0.000	0.000	1.000	(1.000,1.000)	-0.275	281.000	0.783
Major: Humanities & Social/Behav. Sci.	0.681	0.133	1.976	(1.521,2.566)	5.106	8887.000	<0.001
Major: Math & Life/Physical Sciences	1.104	0.158	3.016	(2.211,4.115)	6.965	8887.000	<0.001
Major: Comp./Info. Sci. & Engineering	0.162	0.166	1.176	(0.849,1.629)	0.975	8887.000	0.330
Major: Education	0.100	0.162	1.105	(0.804,1.518)	0.616	8887.000	0.538
Major: Health	0.219	0.191	1.244	(0.856,1.809)	1.145	8887.000	0.252
Major: Vocational/Tech./Prof./Other	-0.059	0.144	0.943	(0.711,1.250)	-0.407	8887.000	0.684
Major: Business/Mgmt. (Reference)							
Undergraduate GPA	0.005	0.001	1.005	(1.002,1.007)	4.242	712.000	<0.001
SAT Score	0.000	0.000	1.000	(1.000,1.001)	1.100	56.000	0.276
Cultural & Social Capital Variables							
Female	0.026	0.082	1.027	(0.874,1.207)	0.320	8887.000	0.749
Male(Reference)							
Race: Black, non-Hispanic	0.750	0.173	2.117	(1.507,2.974)	4.327	8887.000	<0.001
Race: Hispanic or Latino	0.406	0.227	1.501	(0.962,2.340)	1.791	5161.000	0.073
Race: Asian	-0.044	0.249	0.957	(0.588,1.558)	-0.176	2571.000	0.860
Race: Am. In./AK or HI Native/Pac. Is.	-0.075	0.399	0.927	(0.424,2.026)	-0.189	8887.000	0.850
Race: Other	0.183	0.254	1.200	(0.729,1.975)	0.718	8887.000	0.472
Race: White, non-Hispanic (Reference)							

	Coefficient	Standard Error	Odds Ratio	Odds Ratio Conf. Interval	*t*-ratio	Approx. *d.f.*	*p*-value
Cultural & Social Capital Variables							
English not primary language in home	0.252	0.228	1.286	(0.817,2.025)	1.105	73.000	0.273
English primary language (Reference)							
Attended College in state of residence	0.148	0.123	1.160	(0.912,1.476)	1.208	8887.000	0.227
Attended college out-of-state (Reference)							
Parents Highest Education: Some College	0.219	0.146	1.245	(0.934,1.659)	1.496	1986.000	0.135
Parents Highest Education: Bachelor's	0.255	0.132	1.290	(0.996,1.672)	1.929	1220.000	0.054
Parents Highest Education: Master's	0.339	0.158	1.404	(1.029,1.915)	2.145	1905.000	0.032
Parents Highest Education: Doctoral	0.303	0.217	1.354	(0.885,2.073)	1.396	4755.000	0.163
Parents Edu.: HS or less (Reference)							
Dependent: $30,000-$59,999	-0.006	0.183	0.994	(0.695,1.421)	-0.035	8887.000	0.972
Dependent: $60,000-$99,999	-0.133	0.163	0.875	(0.636,1.204)	-0.820	8887.000	0.412
Dependent: $100,000 or more	-0.041	0.183	0.960	(0.671,1.373)	-0.225	8887.000	0.822
Independent: Less than $19,999	-0.285	0.185	0.752	(0.523,1.080)	-1.542	8887.000	0.123
Independent: $20,000-$49,999	-0.141	0.149	0.868	(0.648,1.163)	-0.951	808.000	0.342
Independent: $50,000 or more	-0.672	0.213	0.511	(0.336,0.776)	-3.153	908.000	0.002
Depend.: Less than $29,999 (Reference)							
High School Attended: Private	-0.036	0.127	0.965	(0.752,1.238)	-0.283	2138.000	0.777
High School Attended: Foreign	0.061	0.571	1.062	(0.346,3.263)	0.106	548.000	0.916
HS attended: Public (Reference)							
Parental Tuition Assistance: Paid Some	-0.037	0.136	0.964	(0.739,1.258)	-0.270	1258.000	0.787
Parental Tuition Assistance: Paid All	0.151	0.119	1.163	(0.921,1.468)	1.268	1162.000	0.205
Parental Tuition Assistance: N/A	0.180	0.165	1.197	(0.860,1.665)	1.088	65.000	0.281
Parental assistance: None (Reference)							

	Coefficient	Standard Error	Odds Ratio	Odds Ratio Conf. Interval	*t*-ratio	Approx. *d.f.*	*p*-value
Undergraduate Institution Variables							
Attended an HBCU	0.462	0.247	1.587	(0.976,2.581)	1.867	556.000	0.062
Did not attend an HBCU (Reference)							
Graduation Rate	-0.002	0.004	0.998	(0.990,1.006)	-0.561	556.000	0.575
BA Control: Private	0.201	0.104	1.222	(0.996,1.500)	1.923	556.000	0.055
BA Control: Private-for-profit	-0.321	0.456	0.726	(0.296,1.777)	-0.704	556.000	0.482
BA Control: Public (Reference)							
Carnegie: Masters Institution	0.021	0.105	1.021	(0.830,1.256)	0.202	556.000	0.840
Carnegie: Baccalaureate Institution	-0.336	0.127	0.715	(0.556,0.918)	-2.635	556.000	0.009
Carnegie: Other	-0.697	0.221	0.498	(0.322,0.770)	-3.146	556.000	0.002
Carnegie: Doctoral (Reference)							

Appendix F: Full GHLM: Graduate School Enrollment

	Coefficient	Standard Error	Odds Ratio	Odds Ratio Conf. Interval	*t*-ratio	Approx. *d.f.*	*p*-value
Intercept, β_0	-1.125	0.042	0.325	(0.299,0.353)	-26.499	556.000	<0.001
Human Capital Variables							
Total Debt	0.000	0.000	1.000	(1.000,1.000)	0.237	523.000	0.813
Major: Humanities & Social/Behav. Sci.	0.494	0.139	1.638	(1.246,2.153)	3.540	8887.000	<0.001
Major: Math & Life/Physical Sciences	0.984	0.175	2.676	(1.900,3.768)	5.636	8887.000	<0.001
Major: Comp./Info. Sci. & Engineering	0.158	0.180	1.171	(0.823,1.666)	0.879	8887.000	0.380
Major: Education	-0.073	0.171	0.930	(0.665,1.300)	-0.426	8887.000	0.670
Major: Health	0.187	0.204	1.206	(0.809,1.798)	0.919	8887.000	0.358
Major: Vocational/Tech./Prof./Other	-0.129	0.155	0.879	(0.649,1.191)	-0.832	8887.000	0.405
Major: Business/Mgmt. (Reference)							
Undergraduate GPA	0.006	0.001	1.006	(1.004,1.009)	5.840	1269.000	<0.001
SAT Score	0.000	0.000	1.000	(1.000,1.001)	1.104	57.000	0.274
Cultural & Social Capital Variables							
Female	0.025	0.084	1.026	(0.870,1.210)	0.303	8887.000	0.762
Male(Reference)							
Race: Black, non-Hispanic	0.419	0.174	1.521	(1.081,2.138)	2.409	8887.000	0.016
Race: Hispanic or Latino	0.163	0.234	1.178	(0.745,1.862)	0.699	8887.000	0.484
Race: Asian	-0.148	0.234	0.862	(0.545,1.365)	-0.632	6415.000	0.527
Race: Am. In./AK or HI Native/Pac. Is.	-0.217	0.406	0.805	(0.363,1.785)	-0.534	8887.000	0.593
Race: Other	0.144	0.261	1.155	(0.693,1.925)	0.552	8887.000	0.581
Race: White, non-Hispanic (Reference)							

	Coefficient	Standard Error	Odds Ratio	Odds Ratio Conf. Interval	*t*-ratio	Approx. *d.f.*	*p*-value
Cultural & Social Capital Variables							
English not primary language in home	0.174	0.214	1.191	(0.780,1.816)	0.815	175.000	0.416
English primary language (Reference)							
Attended College in state of residence	0.112	0.120	1.118	(0.884,1.414)	0.932	8887.000	0.352
Attended college out-of-state (Reference)							
Parents Highest Education: Some College	0.111	0.147	1.118	(0.838,1.492)	0.758	1625.000	0.449
Parents Highest Education: Bachelor's	0.221	0.129	1.247	(0.969,1.606)	1.717	1966.000	0.086
Parents Highest Education: Master's	0.315	0.170	1.371	(0.982,1.912)	1.855	3451.000	0.064
Parents Highest Education: Doctoral	0.169	0.191	1.184	(0.813,1.724)	0.883	1572.000	0.377
Parents Edu.: HS or less (Reference)							
Dependent: $30,000-$59,999	0.095	0.178	1.100	(0.776,1.558)	0.536	8887.000	0.592
Dependent: $60,000-$99,999	-0.111	0.170	0.895	(0.641,1.249)	-0.653	8887.000	0.514
Dependent: $100,000 or more	0.058	0.199	1.060	(0.717,1.567)	0.292	8887.000	0.771
Independent: Less than $19,999	-0.204	0.194	0.815	(0.557,1.193)	-1.051	8887.000	0.293
Independent: $20,000-$49,999	-0.074	0.159	0.929	(0.680,1.269)	-0.463	1921.000	0.643
Independent: $50,000 or more	-0.548	0.223	0.578	(0.373,0.894)	-2.465	1249.000	0.014
Depend.: Less than $29,999 (Reference)							
High School Attended: Private	0.091	0.134	1.096	(0.842,1.425)	0.682	3482.000	0.496
High School Attended: Foreign	-0.018	0.572	0.982	(0.320,3.014)	-0.031	8887.000	0.975
HS attended: Public (Reference)							
Parental Tuition Assistance: Paid Some	0.037	0.145	1.038	(0.781,1.378)	0.256	1151.000	0.798
Parental Tuition Assistance: Paid All	0.166	0.123	1.181	(0.927,1.504)	1.347	2605.000	0.178
Parental Tuition Assistance: N/A	0.043	0.160	1.044	(0.759,1.436)	0.270	80.000	0.788
Parental assistance: None (Reference)							

	Coefficient	Standard Error	Odds Ratio	Odds Ratio Conf. Interval	*t*-ratio	Approx. *d.f.*	*p*-value
Undergraduate Institution Variables							
Attended an HBCU	0.437	0.329	1.549	(0.811,2.956)	1.329	556.000	0.184
Did not attend an HBCU (Reference)							
Graduation Rate	0.000	0.005	1.000	(0.991,1.010)	0.086	556.000	0.932
BA Control: Private	0.082	0.113	1.085	(0.869,1.355)	0.725	556.000	0.469
BA Control: Private-for-profit	-0.191	0.460	0.826	(0.335,2.039)	-0.416	556.000	0.678
BA Control: Public (Reference)							
Carnegie: Masters Institution	0.014	0.118	1.014	(0.805,1.279)	0.121	556.000	0.904
Carnegie: Baccalaureate Institution	-0.367	0.136	0.693	(0.530,0.906)	-2.692	556.000	0.007
Carnegie: Other	-0.646	0.258	0.524	(0.316,0.870)	-2.506	556.000	0.012
Carnegie: Doctoral (Reference)							