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Estimating Matriculation with a Focus on Financial Aid and Test Optional Policies: Data from a Liberal Arts Institution in the Northeast

Hillary Morgan
hillary.morgan@student.shu.edu

Estimating Matriculation with a Focus on Financial Aid and Test Optional Policies: Data from a Liberal Arts Institution in the Northeast

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Hillary Morgan

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Mentor:
Dr. Rong Chen _____ 3/14/2016

Committee Member:
Dr. Robert Kelchen _____ 3/14/16

Committee Member:
Dr. Alyssa McCloud _____ 3/14/2016

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ABSTRACT

The climate in college admissions is more competitive than ever, making understanding the college choice factors that contribute to a student's enrollment decision increasingly important. Using admitted student data from a liberal arts institution in the northeast for fall 2008 to fall 2011, and after controlling for student preparedness, government financial aid awards, student and family characteristics, and student level of interest, I examine the relationship between (1) institutional financial aid variables, (2) a dummy variable of being test optional in the admissions process or not, and (3) the interaction between the two.

General findings of multivariate probit regression analysis reveal that admitted students who file a FAFSA positively respond to both merit based and need based institutional aid, meaning that the more institutional money they are awarded, the more likely they are to enroll, ceteris paribus. When interaction terms between the categorical test optional policy variable and the continuous institutional aid variables are included, results show that students who withhold test scores respond more strongly to a $1,000 increase in institutional aid. As a more specific example, in fall 2011 with an additional $1,000 in merit aid, the probability of enrollment for FAFSA filing score submitters is 0.0022, while the probability for those that withhold scores is 0.10346, holding all else constant. For the same group of students but with need based aid instead of merit, score submitters had a 0.0773 probability of enrolling at the institution with $1,000 more in need based aid, compared to 0.11833 for students that withhold scores, ceteris paribus.

This is an important finding for stakeholders interested in test optional policies and suggests that students who withhold their standardized test scores can be influenced

with an incremental increase in institutional awards in a much stronger way than their comparable peers who submit test scores instead. For both FAFSA filing and non FAFSA filing students, an additional $1,000 in institutional award funding could influence their decision to enroll more strongly than an additional visit to campus, something that admissions professionals know tend to help students arrive at their decision to enroll.

This dissertation is dedicated to my family, all of whom contributed in their own ways.

To my dad, Lonnie Morgan, you watched me begin my journey to a PhD more than 10 years ago. While you didn't live to see me complete my goal, and I didn't finish in exactly the way any of us anticipated, you have often been a source of inspiration. You envisioned me as a successful PhD student and I wanted to live up to your confidence in me.

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CHAPTER 1

INTRODUCTION

The world of college admissions is complex and ever evolving, which makes understanding students' enrollment decisions a moving target that needs continual evaluation. In recent years it has become increasingly more competitive for colleges and universities to enroll classes of incoming students that fit institutional goals. The reasons behind it vary. For example, increased competition for high school graduates and tight budgets make things more difficult for virtually all institutions. In addition, a test optional movement is taking hold. The decision to become a test optional institution, or one that does not require applicants to submit standardized test scores in order to be admitted, is a large policy decision that many institutional leaders may be hesitant to make in uncertain times. These seemingly unrelated factors combine to form a competitive and particularly dynamic atmosphere that is challenging for college enrollment professionals to manage.

One of the main ways an institution can entice a student to enroll is by awarding institutional financial aid. Colleges tend to award merit based aid on measures of student preparedness such as high GPA or standardized test scores. If an institution doesn't gather test scores for each admitted student, it could impact the way in which they award merit based aid. Because of the intensely competitive environment for high school graduates, and the scarce literature covering test optional policies as it relates to college choice, a study is needed to help guide enrollment managers' decision making in how they choose to allocate scare institutional financial aid funds. Because institutional aid is often used as an enrollment tool, the interaction between merit aid and test optional

policies is important. Knowledge of how standardized test submitters and non-submitters respond to financial aid can help ease the concern of making a major admissions policy change in the competitive marketplace of student recruitment.

According to projections from the College Board, the number of high school graduates across the United States started decreasing in 2009 and are not expected to return to 2008 levels for another ten years.[1] In addition to this decline, there has also been a demographic shift in the makeup of high school graduates. In 1961, about 7% of all high school graduates were minorities, but today 30% of students are categorized in this way. Furthermore, by 2018 about 45% of public high school graduates will be minority students (Mortenson, 2007). This combination creates intense competition for incoming first year college students, particularly at institutions that fill the majority of their incoming freshman class with non-minorities.

The change in the student population comes at a time where financial factors are causing strain on the college admissions process. Over the last ten years, tuition has increased more rapidly than inflation and family income. However, at private bachelor's colleges, the average institutional grant aid per student has outpaced the growth in tuition and fees, with aid rising 34% from 2002 to 2012 and tuition and fees by only 14% for the same years (Baum et al, 2015). This combination can threaten the financial health of many private institutions, especially those without sizeable endowments (Mulugetta, Saleh & Mulugetta, 1997).

[1] See Number of High School Graduates 1994-2022: United States and Number of High School Graduates 1992-2022: New England from http://professionals.collegeboard.com/data-reports-research/trends/higher-ed-landscape for graphs demonstrating these statistics.

The preferences of college students and their parents are also changing. First, in a report from the National Center for Public Policy and Higher Education, Immerwaher and Johnson (2010) recognize that while increasing proportions of Americans believe higher education is important for success, they also think it is less affordable. Prospective students and families have become acutely aware of college costs, making "free money," or grants and scholarships that do not have to be paid back, more important than ever. Between 2005 and 2011, the proportion of college freshmen indicating that they expected $10,000 or more of their first year educational expenses would come from grants and scholarships grew from 11.9% to 26.8% (Pryor et al, 2005; Pryor et al, 2011).

The expectation of institutional aid from parents and families places pressure on institutions, competing for students to fill available seats in incoming classes, to deliver. According to Brown (2007), the use of merit aid by institutions is as basic as needing to "make the class," a term that college admissions professionals use to describe the attainment of enrolling enough students to meet their institution's goal for that academic year. It is also the most easily modifiable enticement device at an enrollment manager's control. Much of the growth in merit awards has come in the form of "vanity scholarships," or awards given to students, in some cases, for simply being admitted to a college. According to Brown (2007), "It is not uncommon to find some private colleges (some very good ones) with more than 80 percent of their freshman class on some type of merit scholarship. This is before even awarding those with need-based eligibility."

In addition to demographic and financial demands on the college choice process, a test optional movement has taken hold. Beginning in the early 2000s, there has been a shift away from schools that require high school students to submit standardized test

scores as part of the admission application. Schools site a variety of reasons for the change, but most often voice the desire to take a more holistic approach with each student's admissions file. Instead of requiring scores, some institutions require a graded research paper, while others prefer to look only at the student's high school grades, curriculum, and other admission materials. In 2012, over 850 four year institutions offered some sort of flexibility in the submission of standardized test scores and it is realistic to think that this number will continue to grow (see http://www.fairtest.org/). The test optional movement further complicates the enrollment environment, making it more difficult to anticipate students' preferences and, ultimately, their enrollment decisions.

These issues make understanding the enrollment decisions of incoming college students increasingly important. The purpose of this paper is to evaluate the college enrollment decisions of students admitted to a test optional liberal arts institution in the Northeast. More specifically, this study aims to answer the following three research questions by using student level data from a test optional liberal arts University in the northeast. After controlling for variables measuring student, family, and institutional characteristics:

1. How do institutional financial aid awards (institutional scholarships for merit, institutional grants based on need) affect an admitted student's probability of enrollment at the institution?
2. Do students who choose to withhold standardized test scores matriculate at significantly different rates than those that submit them?

3. Do institutional financial aid awards and whether or not the student submits scores interact with one another? That is, do students who withhold their scores react more strongly to institutional aid awards?

Having an in depth understanding of how institutional financial aid impacts the college choice process for admitted students at a test optional University will help guide college enrollment managers as well as major policy decision makers at similar institutions. It will provide guidance to University decision makers that must allocate scarce institutional funds to admitted students in a way that 1) enrolls a class of incoming freshmen that fit the University's goals without 2) awarding so much money that it harms institutional revenue. This study will provide guidance to University decision makers that work at institutions that are test optional as well as those that are at institutions considering making the change. It also adds to the academic literature by combining two areas of study: the impact of financial aid on the college choice process, and the test optional movement.

The rest of this study is outlined as follows. In Chapter Two, I provide a definition of test optional, discuss some standardized testing biases found in the research, and outline some reasons a college may choose to go test optional. I continue Chapter Two by reviewing broad theories of college choice along with existing literature, highlighting Hossler and Gallagher's (1987) three step college choice process where students first go through a predisposition phase, then search, and finally choose to enroll. The choice subsection further covers factors that have been found to influence the college decision process including: student background and characteristics, family characteristics,

institutional characteristics, and finally tuition and financial aid. The relationships between college costs, financial aid and choice are further examined with a break out of studies using macro-level data, mixed-level data, and finally micro-level or student-level data. Chapter Two finishes by discussing gaps in the literature, highlighting that this study can fill both an academic and policy void by combining research about financial aid and college choice, all within a test optional setting.

A conceptual model was developed based on the literature review. Next, in Chapter Three I describe the rich student level data used in this study as well as the methodology, highlighting the need for a multivariate regression model that includes interaction terms between financial aid variables and the student's test optional category. I separate the variable description into groups: student preparedness, institutional and government financial aid awards, student and family characteristics, and student level of interest in enrolling at the institution in question. This section finishes with a discussion of study limitations.

In Chapter Four I present results broken out into the three research questions. In general I find that admitted students who withhold their test scores during the admission process are more likely to enroll at the institution in question. In addition, admitted students who file a FAFSA respond positively to both merit based and need based institutional aid; the more money they receive from the institution the more likely they are to enroll, ceteris paribus. When the categorical test optional policy variable and the continuous institutional merit and institutional need based aid variables are interacted with one another, general results show that graded paper students respond more strongly

to $1,000 increases in institutional funds. Finally Chapter Five presents conclusions and opportunities for future research.

CHAPTER 2

POLICY, THEORY, AND LITERATURE REVIEW

What is Test Optional?

A focus on high quality students and standardized testing has been a part of the college admission process for a very long time. Institutions first increased the use of standardized testing for admissions when more than two million soldiers entered school with the help of the 1945 GI Bill (Thelin, 2004). When the University of California adopted the SAT in 1968, the expansion of standardized testing across the nation was solidified (Epstein, 2009). For a number of years, the SAT was considered the gold standard in the world of testing and college admissions. In 1986, roughly one million students took the SAT, compared to 700,000 taking the ACT. For the first time in 2012, the number of students sitting for the ACT overtook the SAT, with 1,666,017 and 1,664,479 test takers respectively. This was partially because 12 states now require and pay for their public high school juniors to sit for the exam (Lewin, 2013).

It is clear that identifying students who are best prepared and most likely to succeed is an important part of the college admission process. However, there is debate about how to best recognize these students. Admissions counselors often review hundreds or thousands of applications, looking at potential indicators: high school GPA, rigor of high school curriculum, standardized test scores, writing samples, application essays, letters of recommendation, leadership roles, etc. High stakes testing places emphasis on one of many elements of a student's college application. A potential problem with focus on one element is that other parts of the application get less attention.

The test optional movement, sometimes referred to as SAT optional, is an example of the changing landscape of college admissions in the last ten years. While early pioneers of the test optional movement like Bowdoin College and Bates College made the decision in 1969 and 1984, respectively, the larger shift did not begin until the early 2000's. The redesign of the SAT I in 2005 was a likely catalyst. Many schools refrained from making test optional policy decisions during the redesign and once they saw that the SAT was mainly the same with a writing section, they began to withdraw (Epstein, 2009). The media drew attention to the policy changes and each new test optional school was highlighted in industry news articles. To give a sense of the size of the undertaking at the time, between late 2005 and early 2009, over two dozen institutions announced they were going test optional, including public, private, and even technical schools (Epstein, 2009). The shift didn't stop after the 2005 redesign. In 2015 alone, forty-seven college and universities announced test optional policies (Simon, 2015). While those numbers don't suggest a dramatic national shift, the impact of competitors on one another has changed the landscape of selective liberal arts admission and the picture could look even more different if the shift continues. Today 46% of top-tier liberal arts colleges, and a good number of large research universities no longer require standardized test scores as part of the admissions process (Simon, 2015). It has yet to be seen how institutions will respond to the newest SAT redesign released in 2016.

The National Center for Fair and Open Testing (Fair Test) is the leading advocate for test optional policies. Today, over 850 four year institutions do not use the SAT I or the ACT to admit a substantial number of bachelor degree applicants, the majority categorized as non-competitive institutions (see http://www.fairtest.org/). The levels of

institutional prestige of test optional institutions vary. For example, using profiles in *Peterson's Four-Year Colleges* (Oram, 2006), a large number of the schools on the Fair Test list are "non-competitive", meaning nearly anyone who applies will be admitted. About one third are "moderately" selective. These schools generally use tests for placement only and not admission and students are admitted if they have a minimum GPA. Public attention is usually reserved for test optional colleges in third group: selective schools that are traditionally expected to require the submissions of SAT I or ACT scores but have chosen to give applicants flexibility by not requiring students to submit standardized test scores in the application materials.

Among the various tiers of test optional institutions, there are also a variety of levels of test flexibility. Many schools are truly test optional and require no additional documentation from students in their application. Examples of these include: Bates College, Bowdoin College, Dickinson College and St. John's College (MD). A variation is for institutions to accept test scores if the student wishes to submit them. Or, if the student prefers to withhold their standardized test scores instead, the policy allows for the submission of additional academic information like a graded paper or a portfolio of writing instead. Schools in this category include: Drew University, Franklin and Marshall College, Guilford College, Lewis & Clark College, and Muhlenberg College. Finally, some institutions have adopted a "test flexible" policy where the school requires a standardized test, but the exam doesn't have to be the SAT or ACT. Alternatives may include an SAT subject test, Advanced Placement, or International Baccalaureate exam scores. Schools in this category include Middlebury College (VT), Hamilton College (NY) and New York University.

What are the Issues with Standardized Testing?

While recognizing that the SATs are not perfect, some policy makers point out there is nothing better to put in its place because high school grading is not consistent within or across states. In addition, Linn (2000) points out that tests and assessments are relatively inexpensive and results are visible. This visibility allows a postsecondary institution to compare incoming high school students from different states and it allows families to compare different colleges across the country based on average SAT scores. Furthermore, researchers have found that the SAT I, SAT II, and/or ACT scores are predictors of college success, defined in various ways including first year college GPA, overall college GPA, retention rates, graduation rates, etc. (Espenshade & Chung, 2010; Geiser & Studley, 2003; Zwick & Sklar, 2005).

Critics of testing claim that they are an incomplete measure of performance and measure only a subset of the important goals of education. For example, standardized test scores fail to capture creativity or persistence (Tully, 2008) and they do not measure motivation, study habits, and personal or professional goals (Rooney & Schaeffer, 1998). The creators of standardized tests have cautioned the use of them, stating that scores should be used as "specialized, supplementary" information and test scores are not sufficient to provide judgment of institutions (Tully, 2008).

Researchers have consistently found that high school GPA is the best predictor of college GPA, suggesting test scores may not add much value to a student's college application (Astin & Oseguera 2005; Epstein, 2009; Geiser & Studley, 2003; Lawson, 2010; Schaffner, 1985; Syverson, 2010). Brown (2007) even claims that the College

Board itself has stated that a student's the high school record is far more reliable for predictive purposes. Using national data from many institutions, Astin and Oseguera (2005) estimated the likelihood that a student would graduate from college within six years of beginning and find that high school GPA accounts for about 8.3% of variation in the likelihood of graduation. When adding the SAT I, they find it accounts for less than 0.8% of additional variation. In a study using data from Bates College from 1985 to 1989, Hiss (1990) finds that neither the SAT I or SAT II predict GPA with great strength. Together, the math and verbal SAT scores account for 9.6% of the variation in grades, while the SAT II tests account for 12.2%. When the two exams are combined in multiple regression, they together account for only 13.6% variation in cumulative GPA. Sedlacek (2004) also finds that the SAT is a weak predictor of college academic success, especially for nontraditional students.

Before going test optional, institutions typically conduct self-studies to determine how valuable academic factors are in predicting their students' success. Nearly all of them find high school performance to be the best predictor. For example, Providence College identified high school GPA as the strongest single predictor of academic success, retention between first and second years, and graduation after four years (Shanley, 2007). According to Christopher Hooker-Haring, admissions director at Muhlenberg when the institution's trustees unanimously voted to go test optional in 1996, internal studies confirmed that, even with grade inflation and the incredible range of US high schools, grades were still the best predictors of college performance (Rooney & Schaeffer, 1998). Researchers using a few years of data from Franklin & Marshall found that a student's high school record contributed more to a multiple regression equation predicting first

year college grades than either the verbal or math SAT scores (Rooney & Schaeffer, 1998).

Beyond failing to be the strongest predictor of college success, empirical evidence often supports the accusations that standardized tests are biased against certain student groups including women, students of color, nonnative English speakers, low income students, first generation students, and some learning disabled students. For example, Micceri (2010) and Espenshade & Chung (2010) find high stakes testing discriminates against minorities, women, and students who simply do not test well. Micceri (2009) uses data from the University of Florida to find that the use of test scores in the admission process for females of all ethnic groups or underrepresented minorities from any ethnic group discriminates in favor of whites and males. These students may be put in a disadvantage because of one indicator when many other aspects of an admission portfolio suggest the candidate demonstrates potential for success.

Some researchers investigate the details of testing bias by including both race and neighborhood indicators, while others take it further by introducing affirmative action. Lower average standardized test scores of black and Hispanic students can present barrier of admission obstacles to selective colleges (Hacker, 1992; Hedges & Nowell, 1998; Jencks & Phillips, 1998; Phillips, Brooks-Gunn, Duncan, Klebanov, & Crane, 1998; Steele, 1997). Card & Rothstein (2007) find evidence that the black-white test gap is higher in more segregated cities. They also find that the effect of neighborhood segregation is from neighbors' incomes, not specifically through race. Despite the bias in test scores, schools that are allowed to ask affirmative action questions may adjust these numbers for different groups. Espenshade, Chung, and Walling (2004) find that an

African-American applicant gets the equivalent of a 230 point boost in the admission process and an Asian-American gets a 50 point reduction. Rotthoff (2008) finds that even some schools in states that do not allow affirmative action questions during the application process find less efficient measures to continue to give admission boosts to women and minorities.

Existing literature documents a low income disadvantage as well. For example, Zwick (2002) finds that tests scores often correlate primarily with socioeconomic status. Espenshade & Chung (2010) use NSCE data to find a clear positive relationship between social class and performance on the SAT I and SAT II exams, with correlations to be slightly stronger with the SAT I. In addition, disadvantaged students of color and those less affluent do not have the same access to test preparation curriculum in their high schools. These student types are less likely to use test preparation resources and pay to take the exam multiple times (Syverson 2007).

Finally, taking standardized tests multiple times or taking multiple standardized tests, such as the SAT and ACT, is part of the testing environment. Using a logit regression, Thomas (2004) finds that Hispanic, Asian, and male students are less likely to take both the SAT and ACT tests. She also finds that students with marginal grades and test scores are more likely to take both tests. This likely occurs because students feel that if they take both exams, then they have a better chance of standing out from one of the scores. In a qualitative study where the researchers interviewed low income black and Hispanic students, only a handful of students were aware that they could retake a standardized exam and improve their score (Deil-Amen &Tevis, 2010). These same students may be the ones most likely to benefit from a test optional program.

Why Would an Institution go Test Optional?

Colleges and universities that have moved away from using standardized tests to make admissions decisions have done so for a variety of reasons. In some case it was a marketing decision, driven by the hopes that becoming test optional would gain publicity for the school (Syverson, 2007). In other cases, institutions making the change believed that students with higher test scores would submit them while those with lower scores would hold them back. This combination would mean that the overall scores reported to the rankings such as US News & World Report, would present a stronger academic profile for the institution, and in turn perhaps raise the institution's appearance of selectivity, prestige, and perceived value (Syverson, 2007).

Some public universities have deemphasized standardized test scores in the face of affirmative action restrictions and many have found high school performance to be a better way of forecasting academic success in college (Rooney & Schaeffer, 1998). Many selective colleges that have decided to become test optional believe it may attract a more diverse applicant pool (Syverson, 2007). Shanley (2007) discusses Providence College's decision to go test optional, citing the institution's mission of access for first generation students as a contributing factor. All of these institutions have in common serious concerns about the equity and predictive accuracy of standardized test scores (Rooney & Schaeffer, 1998).

Overall, the idea behind a school going test optional is that there are many ways to identify student ability and the potential of success. In institutions where tests are required, the SAT or ACT is used as a proxy for this ability. However, test optional

schools have identified other factors that can effectively predict student success: high school GPA, high school curriculum, activities outside of the classroom, or letters of recommendation.

Schools that have made standardized tests optional for admissions are widely pleased with the results. Many report their applicant pools and enrolled classes have become more diverse without a decrease in academic quality, which holds true at selective private liberal arts colleges such as Bates College as well as at large public institutions like the California State University system (Rooney & Schaeffer, 1998). In a large scale study involving 33 public and private colleges and universities, Hiss and Franks (2014) find that test optional policies help to broaden access to education, finding non-submitters are more likely to be first generation, Pell recipients, minorities, women, and students with learning differences. This same study finds few significant differences between submitters and non-submitters in key outcomes like cumulative college GPAs and graduation rates. In addition, test optional institutions have not experienced particular difficulties recruiting and selecting their incoming classes (Rooney & Schaeffer, 1998).

Theories and Models

Theories

Historically, the college choice process has been described from three perspectives: sociological, psychological, and economic (Paulsen, 1990). The sociological perspective emphasizes college choice as a status attainment process, where individual factors like race and ethnicity (Manski & Wise, 1983), family income (St. John, 1990), parental education (Manski & Wise, 1983), peer groups (Manski & Wise,

1983), parental expectations (Attinasi, 1989; Litten & Hall, 1989), academic achievement (St. John, 1990), and high school curriculum (Borus & Carpenter, 1984; Hearn, 1984) contribute to the decision of whether to attend college and where to go to college. Researchers find that in studies like these, student background characteristics have a significant influence on the development of predisposition and institutional choices (Bergerson, 2009a).

The psychological literature focuses on the climate of the higher education environment and how perception of the environment can influence students' decisions (Paulsen, 1990). Researchers find that institutional characteristics including: tuition, room and board, the availability of financial aid, location, and curriculum contribute to the psychological portion of the college going decision (Manski & Wise, 1983; St. John, 1990; Tierney, 1982). Studies by these same authors find that, as they make institutional choice decisions, low income students weigh financial aid and pricing factors more heavily than curricular offerings (Bergerson, 2009a).

The economic theory behind college choice relies on human capital theory, where students view time spent going to college as an investment in their future (Becker, 1962). Students weigh the costs and benefits of going to college and make a choice of whether or not to attend based on their assessment (Paulsen, 1990). If the expected returns from college (benefits minus costs) surpass the expected net return from all other ways in which the student could spend time, then he or she will attend (Becker, 1990; Clotfelter, 1993). Furthermore, when the benefits from attending college rise, holding all else constant, the theory predicts that the demand for college will rise. Similarly, an increase in the costs of college attendance would lead to a predicted decrease in the number of

students interested in attending a college or university. Research in the economics of college choice often finds that students are sensitive to price; they are less likely to enroll when the college cost of attendance increases or financial aid decreases (Breen & Goldthorpe, 1997; Curs & Singell, 2002; DesJardins, Ahlburg, & McCall, 2006; Heller, 1999; Leslie & Brinkman, 1987). This price sensitivity is even stronger for students from lower socioeconomic backgrounds as well as minority students (Berkner & Chavez, 1997; Choy, 2001; Horn &Nunez, 2000; Lee, 2004; De La Rosa, 2006; St. John & Noell, 1989).

Because students tend to respond to price, tuition discount and pricing strategies developed. "Generally speaking, people are inclined to believe that a more expensive price tag is associated with better quality goods and services" (Olson, 1977). The practice of tuition discounting, or the use of institutional funds awarded to students in the form of grants and scholarships to help pay the cost of college, gained popularity in the 1970s and has become standard in today's admission policies at four year institutions (Davis, 2003). Often the goal of this practice is to shape the profile of the incoming class. Institutions may wish to increase racial diversity or attract high quality students that may not have enrolled in the school otherwise. The National Association of College and University Business Officers (1997) found that fewer than 10% of students actually pay the published tuition price. At many universities, more than 90% of merit awards are "unfunded," meaning they are essentially discounts off the sticker price of tuition (Brown, 2007).

In some cases, a family's ability to pay does not equal their willingness to pay. Families may show different levels of willingness to pay based on their student's

academic achievement, family resources, or reputation of the college (Day, 1997). Within the framework of price elasticity, students with different backgrounds and academic profiles may respond differently to a given college price or a change in that given price. This suggests that colleges and universities can "manage" their enrolling classes by exploiting these differences in price elasticities (Curs & Singell, 2002).

In this scenario, awards may be granted based upon how responsive a student's enrollment probability is when a one unit change in grant aid is offered. The result is a more competitive marketplace where private schools award grants or scholarships based on a variety of factors, including academic achievement, financial need, demographics, and subjective criteria like leadership skills in order to fill the class with students that fit the long terms goals of the university (Mulugetta, Saleh & Mulugetta, 1997).

There are both positive and negative effects from tuition discounting. As a positive effect, Hubbell and Rush (1991) find that the practice has increased the diversity of student populations, granting access to minority, low-income, and middle-income students that wouldn't have been able to afford to enroll in an expensive institution otherwise. Furthermore, St. John and Somers (1997) find that applicants that received scholarships were 23% more likely to enroll at a given institution for each $1,000 granted.

However, others claim that there is a negative impact from tuition discounting. Tuition discounting studies published by College Board find that the average discount rose from 29% in 2000 to 32% in 2007 for private four year colleges and the same figure declined from 21% to 19% for public four years (Baum, Lapovsky & Ma, 2010). A consequence of this trend is that the financial strength of the institutions could decline as

the ration continues to grow. Students may also shy away from applying to institutions with very high "sticker prices" (tuition before any discounts) because they perceive them to be unaffordable (Hubbell & Rush, 1991).

Rather than focusing on one perspective, whether it originates from sociology, psychology, or from the field of economics and pricing, process models have been developed to better understand and explain the procedure students go through to choose a college. It is generally agreed upon that process models are strong because they describe exchanges over time and provide researchers with variables for future research (Cabrera & LaNasa, 2000; Henrickson, 2002; Perna, 2006; Teranishi and others, 2004; Bergerson, 2009c).The most widely cited model of the college choice process is Hossler and Gallagher's three stage model (1987). The model identifies three phases of the college choice process: 1) *predisposition* of students to attend college, 2) *search*, where institutions provide potential students with information and students determine their choice sets and begin applications, and 3) *choice*, where students select an institution and decide to enroll.

Predisposition

The first stage of Hossler and Gallagher's model (1987) is *predisposition*, which involves the development of students' career and college aspirations. Generally beginning in middle school, students in this phase tend to develop the view that attending college will help them achieve professional goals. They secure information about how to finance a college education, often getting upwardly biased information about costs (Grodsky & Jones, 2007). Students receive both motivational parental support by way of

high expectations as well as proactive parental support by discussing college plans (Cabrera & LaNasa, 2000). A number of factors contribute to this phase including: student gender and ethnicity, family socioeconomic status, academic achievement and ability, parental involvement, parental education and expectations, peer support, high school teachers and counselors, interactions with higher education institutions, high school involvement in extracurricular activities, high school quality and curriculum track, career plans, and the relative value placed on attending college (Bergerson, 2009a; Perna & Titus, 2004; Shaw, Kobrin, Packman, & Schmidt, 2009). Research has shown that the characteristics considered during the predisposition stage are present throughout the entire process (Shaw, et al., 2009).

Search

While aspirations for a college education are an important factor in eventual college enrollment (Hossler, Schmit & Vesper, 1999), they must be followed by actions that contribute to the completion of this goal. The second phase of Hossler and Gallagher's model (1987) is *search*, where students form choice sets and determine which institutional characteristics are most important. This step involves gathering information about institutions in order to form a short list of finalists. Students interact with schools by visiting campus, looking at catalogues, talking to friends, etc. They also develop perceptions about the quality of the institution, student life, the availability of majors, and ways to finance education (Cabrera & LaNasa, 2000). The process is influenced by a number of student based factors including: gender, race and ethnicity, socioeconomic status, parental support and encouragement, parental knowledge of

financial aid opportunities, academic performance, participation in high school activities, proximity of institutions to home, and the number and types of higher education institutions to which they apply (Bergerson, 2009c; Shaw, et al., 2009). The institutions play a role in this phase as well. Targeted marketing for certain student segments is common (Rindfleish, 2003); prospective students can be grouped by demographics, geography, attitudes and lifestyle, and knowledge and attitude (Hoyt & Brown, 1999).

Choice

By the eleventh or twelfth grade, students are ready to move to the final stage of the process, *choice* (Cabrera & LaNasa, 2000; Perna, 2006). In this stage, students use information to select an institution and complete the enrollment process. Making this choice is a complicated process, made more so by the amount of information available to students (Briggs, 2006). In order to understand a student's choice of institution, the student's background and characteristics, family situation, and institutional characteristics all need to be taken into account (Chapman, 1981).

The body of literature examining college choice is extensive; highlights below are grouped by student, family, and institutional characteristics, as well as tuition and financial aid. A separate subsection is also reserved for college costs, financial aid and choice, which highlights studies utilizing macro-level, mixed-level, and micro-level sources of data.

Literature Review: College Choice Factors

Student Background and Characteristics

First, student background and other characteristics contribute to college choice. A number of researchers identify academic achievement and overall academic experiences as a strong predictor of college enrollment (Cabrera & LaNasa, 2000; Engberg & Wolniak, 2009; Paulsen & St. John 2002). Students with higher level of achievement also tend to have more postsecondary options (Hurtado, Inkelas, Briggs & Rhee, 1997; Teranishi & Solorzano, 2004) and have more access to information about higher education (Hurtado et al., 1997). Researchers have measured achievement in a number of different ways. For example, as more direct measures of academic preparedness, high school grade point averages (Ellwood & Kane, 2000) as well as standardized test scores (Perna, 2000; Perna & Titus, 2004) both show strong relationships with enrollment in postsecondary education. As less traditional measures, Perna (2000) uses enrollment in a college preparatory track to signal academic achievement. In addition, Perna and Titus (2005) use the highest level of completed math coursework to predict general college enrollment.

Also related to the student is the secondary school that he or she attends. Factors within the school can contribute to the choice of enrollment as well. For example, the overall academic quality of a student's high school setting (Engberg & Wolniak, 2009; Gardner, Ritblatt & Beatty, 2000), the student's high school academic resources (Cabrera & LaNasa, 2000), and types of curricular and college prep courses available (Lucas & Good, 2001; Solorzano & Ornelas, 2004; Teranishi, Allen, & Solorzano, 2004) have all

been found to influence a student's choice. High school counselors can also share a portion of the decision process. Rowan-Kenyon, Bell, and Perna (2008), claim that both the availability of counselors to help with the college planning process, as well as the types of information provided by them can influence students' decisions. The strength of the relationship between the counselor and higher education institutions can also matter (Mullen, 2009; Wolniak & Engberg, 2007).

Related both to the student and the institution he or she chooses, academic and personal "fit" have been found to be important. For example, students are most interested in institutions where their ability closely matches the average ability of the enrolled student body (Toutkoushian, 2001). A student's subjective response to the institution is also found to be important. For example, did the student find the staff friendly and overall approachable (Payne, 2003)? Others also support the sense of "fit" as an important factor in choice (Nora, 2004; Reay, Davies, David & Ball, 2001; Smith, 2007).

Family Characteristics

Researchers have found mixed results when examining the role that family income plays in the choice process. While McPherson and Schapiro (1998) find that student family income impacts the final college destination, Alexander, Pallas, and Holupka (1987), as well as Hearn (1988, 1991) provide evidence of a merit based system where socioeconomic status is not as important of a factor as academic ability, overall college preparation , or educational expectations. The level of analysis and types of controls contribute to the differences between the studies. For example, using student level data from the 1980 High School and Beyond Study, Hearn (1988) finds that the

effect of family income in attending institutions with high tuition decreases when precollege academic variables are taken into account. Enrollment at high cost institutions are most heavily influenced by high school grades, curricular track, and academic ability (Hearn, 1988).

Parental influence contributes in a variety of ways. Hossler, Schmit and Vesper (1999) claim that general parental signals help shape students' institutional choice sets, as well as their eventual enrollment decisions. More specifically, parental influence by way of financial support can have some effect on students (Dixon & Martin, 1991). Furthermore, parental encouragement to attend a particular institution can contribute to the choice (Cabrera & LaNasa, 2000; Soutar & Turner, 2002).

Institutional Characteristics

Finally, a number on institutional factors contribute to a student's decision. Much of the literature identifies the availability of the student's intended major or academic program as an important factor in college choice (DesJardins, Dundar & Hendel, 1999; Hoyt & Brown, 1999; Johnson & Stewart, 1991; Payne, 2003; Sanders, 1990; Soutar & Turner, 2002). Some even identify it as the most important factor. Ingels, Dalton, and LoGerfo (2008) find that in 2004, of the students who intended to go to college after high school, 70% of females and 62% of males in their study said that course availability or curriculum was very important to their college decision. This was higher than school expenses, financial aid, or institutional reputation. Facilities within the intended major are also important. When asked what one facility had the greatest impact on their decision, 30.5% of students indicated facilities within their major over dorms (Reynolds, 2007).

Institutional reputation is another factor that students consider when choosing to enroll at a school (Johnson & Stewart, 1991; McDonough, Antonio, Walpole & Perez, 1998; Smith, 1990; Soutar & Turner, 2002). Wilson and Adelson (2012) find that when students are looking for prestige, they select colleges with higher mean SAT scores. Hoyt and Brown (1999) identify additional reputational qualities including course reputation, the quality of instruction, and the quality of the faculty. Science applicants can be influenced by the research reputation and opportunities for going to graduate school, while gifted students may look for an institution that has honors courses (Szekeres, 2010).

Similar to reputation, Griffith and Rask (2007) find that school choice is responsive to changes in college rankings, independent of other objective measures of quality. This importance has gotten stronger over time and can be different for women, minorities, and the highest ability students (Griffith & Rask, 2007). Since 1995, the portion of students who claim the ratings are very important in their college choice process has increased by more than 50% (Higher Education Research Institute, 2007). In addition, Bowman and Bastedo (2009) find that moving to the front page of the US News rankings provides a substantial increase in the next year's admissions indicators for all institutions. Similarly, Monks and Ehrenberg (1999) find that a one-unit increase in US News ranking is consistent with a 0.4% decrease in acceptance rate, a 0.2% increase in yield, and a 2.8-point increase in average SAT score. Meredith (2004) finds the magnitude of the effects on admissions outcomes from moving up or down in the rankings tend to be larger for public schools than privates, especially for rank in high school class and average SAT scores. A possible explanation for the less significant

coefficients at private institutions is that privates have more pricing flexibility and can adjust net price to compensate for movement in rankings.

Students also seem to be aware of what they plan to do with their college education upon graduation and it impacts their choice. Cabrera and LaNasa (2000) find that students consider their occupational aspirations when choosing an institution in which to study, while Hoyt and Brown (1999) find that outcomes related to jobs contribute to students' choices coming into a school. Business school applicants are influenced by the ability to earn high salaries upon graduation (Szekeres, 2010).

Non-academic factors contribute to choice as well. Many studies find that location and distance from home are both very important to students. (DesJardins, Dundar & Hendel, 1999; Goenner & Pauls, 2006; Hoyt & Brown, 1999; Payne, 2003; Reay, Davies, David & Ball, 2001; Soutar & Turner, 2002; Stewart & Post, 1990). For example, Szekeres (2010) finds that over 50% of students attend a college within 50 minutes of their home. Students with low socioeconomic status and lower academic profiles tend to be the least mobile. Mattern and Wyatt (2009) supports the finding by Szekeres (2010), revealing that the average distance students go to attend college varies as a function of SAT score, high school GPA, parental income, ethnicity and gender. Finally, social opportunities (Nora, 2004), campus atmosphere and the attractiveness of campus (Soutar & Turner, 2002) can all contribute to the overall decision of a student to enroll at a university.

Finally, a large portion of a student's decision about college choice is influenced by pricing and financial aid. These variables will be discussed at length after general tuition discounting and pricing strategies of institutions are discussed below.

Tuition and Financial Aid

Within the third phase of the college going process, choice, there exists a large body of literature covering the effects of financial aid on a student's decision. This section discusses some of the common variables used to measure financial aid in the choice process and the next sections will discuss some of the research studies in more detail.

Research as far back as the 1970s and 1980s has consistently shown a significant and negative relationship between tuition increases and enrollment. Leslie and Brinkman (1988) reviewed twenty five studies examining the relationship between tuition and college enrollment covering both two-year and four-year institutions, as well as public and private ones. They find that all students tend to be sensitive to tuition costs. More specifically, Leslie and Brinkman (1988) estimate that for every $100 increase in tuition, in 1982-1983 dollars, enrollments would decrease between 1.8% and 2.4%. In a review of ten studies by Heller (1997), even when accounting for differences in methods, data, time periods, and types of institution examined, a similar conclusion was reached. Heller (1997) finds that every $100 tuition increase leads to a decline in enrollment between 0.5% to 1.0%. In using more recent studies and with a focus on low socioeconomic status, McPherson and Schapiro (1998) find similar results; a $150 net cost increase, in 1993-1994 dollars, results in a 1.6% decline in enrollment among low income students.

Hossler, Schmit, and Vesper (1999) find that students were not interested in understanding college costs and financial aid issues until the senior year, claiming that paying for college was their parent's responsibility. However, once students arrive at the

choice period, financial considerations (Cabrera & LaNasa, 2000; Hoyt & Brown, 1999) and financial concerns frequently emerge in the literature as contributing factors in postsecondary choice (Callendar & Jackson, 2008; Heller 1997; Heller, 1999; Hossler, 2000; Kim, 2004; Paulsen & St. John, 2002; Reay, Davies, David, & Ball, 2001). Authors also cite price and tuition costs (Breen & Goldthorpe, 1997; Curs & Singell, 2002; DesJardins, Ahlburg, & McCall, 2006; Heller, 1999; Paulsen & St. John, 2002) as important factors in students' enrollment decisions.

Qualifying for student aid is a way that students can make the price of tuition more manageable. Not surprisingly, studies find that it often contributes in a significant way to the final decision of enrollment (DesJardins, Ahlburg, & McCall, 2006; Dynarski, 2002; Dynarski, 2003; Lillis, 2008; Paulsen, 1990; Paulsen & St. John, 2002; St. John, 1994). Types of aid and perceptions of aid can matter as well. For example, Avery and Hoxby (2004) find that the way aid is labeled, "grant" versus "scholarship," makes a difference in students' enrollment decisions. The idea that the type of aid matters is also supported by (Dynarski, 2002; Ikenberry & Hartle, 1998; Perna & Titus, 2004). Finally Paulsen and St. John (2002) claim that debt forgiveness can also impact the choice sequence.

Authors have found that students of different races, ethnicities, and socioeconomic statuses are impacted differently by college cost aspects like state grants, tuition pricing, and financial assistance. Many find that the impacts are deeper for lower socioeconomic backgrounds and students of color (Dynarski, 2003; Ikenberry & Hartle, 1998; Lillis, 2008; McPherson & Shapiro, 1998; Paulsen & St. John, 2002). For example, Heller (1997) finds that both state grant expenditures and tuition prices had greater

enrollment impacts for Asian, black, and Hispanic students when compared to white students. Studies that examine how state and federal policies impact college going behavior find that the trend of increased reliance on loans to fund higher education works against these student groups (Heller, 1997; Heller, 1999; Perna, Steele, Woda, & Hibbert, 2005; Perna & Titus, 2005). Bergerson (2009b) also finds that students from these groups face higher debt aversion and lack information about the availability of financial aid, both of which contribute to reduced likelihood of taking on student loan debt to finance a college education. However, aid can help attract lower income students to schools. Berkner and Chavez (1997), find that while low income students are adversely affected by tuition increases, financial aid can cause them to attend college.

College Costs, Financial Aid, and Choice

Financial Aid Studies

It is clear from the previously described literature that a number of factors contribute to a student's decision to enroll at a particular university. It is also clear that regardless of whether the state, institution, or the student is the level of analysis - or a combination of the three - research consistently shows that college enrollment is related to tuition and financial aid. In addition to varying data sources and units of measure, the outcome variable "enrollment" can also be different. Some studies define enrollment as matriculation into a specific institution, while others use a wider definition and investigate college attendance in a state or at a type of institution (four-year vs. two-year). This section analyzes examples of financial aid based studies by breaking the body of research down into three sections: 1) studies that use macro-level date as the unit of

measure, 2)studies that use mixed-level data and 3) studies that use micro-level, or student level data as the unit of measure.

Macro-Level Studies

The first area of literature uses macro-level analysis. Studies in this group have used overall college attendance rates, enrollment at a type of college and enrollment at a specific college as outcome variables. For example, Dynarski (2000) uses Institutional data from the University System of Georgia, the federal Department of Education and Current Population Survey (CPS) data to evaluate the impact of Georgia's HOPE program on college attendance. Using a set of nearby states as a control group, the author finds that Georgia's program has increased the college attendance rate of all 18 to 19 year olds by 7.0 to 7.9 percentage points, meaning that an additional $1,000 of aid increases the college attendance rate by 3.7 to 4.2 percentage points. The author cautions readers not to generalize the results because Georgia's college going rates were below the national average before the program.

As another example of estimating college attendance rates, Shin and Milton (2006) use IPEDS data for 656 public colleges from 1998, 2000, and 2002 to estimate the impact of competition on students' enrollment choices by modeling enrollment as a function of college-level variables and general economic indicators including tuition, financial aid, competitors' tuition rates, the wage premium, and the unemployment rate. They find that competitive tuition is an important factor in explaining the growth of college enrollment during the time period. One restriction they place on the analysis is

that they only include in-state students. This limits the ability to generalize for out of state students.

As an example of a macro-level study with enrollment at a particular college as the outcome, Hurwitz (2012) uses data from 30 highly selective private institutions within a data sharing consortium, and the differences in how these institutions treat home equity in awarding aid, to estimate the causal impact of grant aid on college choice. In an institution-level analysis, the author investigates how much an additional $1,000 in institutional grant aid increases the probability that the accepted student will choose the aid granting college over other institutions inside or outside the consortium. Using home equity as an instrument and controlling for fixed student factors, fixed college factors, legacy, distance from college, and family income, Hurwitz (2012) finds that an additional $1,000 in grant aid increases the probability that the student chooses that college by 1.66 percentage points. One limitation of this study is that the author restricts the analysis to only include those students who are financially needy. This means his work is not able to explain college choice behavior of students who do not demonstrate financial need. In addition, Hurwitz (2012) points out a common limitation across nearly all studies of this type: the data do not include a complete set of colleges that the student was admitted to.

In another institutional consortium data sharing study, Buss, Parker, and Rivenburg (2004) use institutional data from the Higher Education Data Sharing consortium (HEDS) to examine the effects of cost, quality, and macroeconomic factors on the demand for higher education. Controlling for factors like average student SAT score, average per student expenditures on instruction, average level of aid to students receiving aid, college size, ethnic diversity, and tiers of US News and World report

rankings, they find increases in financial aid have a large positive effect on yield for students who receive aid. However if both tuition and average aid amounts increase by one dollar, there is a reduction in yield, implying that students look beyond the net cost and consider tuition and aid separately. While the results of the study are valuable at the institution level, the authors discuss their lack of detailed financial aid variables. Their findings may be stronger with more detailed information.

Finally, Ehrenberg, Zhang, and Levin (2006) study enrollment decisions at an institution with awareness of the effects scholarships can have on students with different socioeconomic statuses. They focus on the trade-offs of merit scholarships and enrolling low income students. Using institutional level data, they find that ceteris paribus, as merit aid increases, measured by the number of National Merit Scholarship winners attending the institution, enrollment numbers of low income students falls, measured by Pell recipients. Their study is not without some data complications. For example, the authors would prefer to have institutional level data on scholarship amounts, but it was not available to them. They also make some assumptions about measuring Pell recipients on campus, assuming there are no transfer students, each student graduates in four years, etc. More detailed data would make the outcome of their study more convincing.

Multi-Level Studies

Studies with institution-level data allow researchers to examine the importance of school level characteristics, but do not allow for a gain of knowledge on a more detailed student-level basis. Because each student goes through the process individually, and ultimately decides on a school based on their own set of experiences and characteristics,

student-level data or multi-level data is desirable. Multilevel studies often combine two or more levels of data. In the setting of college costs and financial aid, these types of studies often predict overall college attendance rates, the types of colleges students attend, and enrolling in a particular college. For example, Perna and Titus (2002) use multilevel analysis to show that, net of other state-level and student-level variables, neither the state unemployment rate nor the child poverty rate is related to the likelihood of enrolling in college.

As another example of a study investigating overall college attendance, Abraham and Clark (2009) use the District of Columbia Tuition Assistance Grant Program (DCTAG), which allows residents to attend public colleges throughout the country at in state tuition rates, to examine students' college decisions. Using the creation of the new program as an exogenous source of variation in process, a difference-in-difference estimation, and both student and institution level variables, the authors find that students are price sensitive in their application and enrollment decisions. They further find that DCTAG not only increases the likelihood that students apply to and enroll in qualifying institutions, the program also increases college enrollment rates among recent high school graduates. Specifically, the percentage of DC high school graduates who enrolled as college freshmen increased by 3.6% for every $1,000 in aid. Enrollments increased primarily at less selective colleges and universities, with no decrease at more selective schools. One restriction with this study is that their sample is limited to students who took the SAT.

Using student level data from the National Educational Longitudinal Study (NELS:92/94) and state level data from Integrated Postsecondary Education Data System

IPEDS, NCES Digest of Education Statistics NCES State Comparisons of Education Statistics, National Association of State Scholarships & Grant Programs (NASSGAP), and the Current Population Survey (CPS), Perna and Titus (2004) conduct a multilevel analysis to investigate the relationship between state public policies and the type of institution a student chooses to attend. They further investigate by considering the impact of socioeconomic status on college enrollment patterns. Following the literature, the authors control for student-level factors like gender, race/ethnicity, financial resources, factors representing human capital, and factors representing social capital. Examples of human capital factors include a composite reading and math score from NELS 92, as well as the highest level math course completed in high school. Measurement of social capital includes a measure of the frequency of discussion between parents and students about high school course selection, school activities, topics studied, grades, plans to take standardized tests, and applying to college. State-level measurements include direct appropriations to institutions, tuition, financial aid to students, and academic preparation during elementary and high school. Perna and Titus (2004) find that students from low socioeconomic backgrounds are less likely to enroll in any type of college. They also find that academic preparation, measured by math coursework, is the best student level predictor of enrollment in college. Related to financial aid, they find that state need-based financial aid and institutional financial aid promote student choice among different types of colleges and universities.

In another study examining factors influencing the type of institution students choose to enroll in, Kim (2012) explores the relationship between state financial aid policies and college enrollment for high school graduates. Kim (2012) uses multi-level

data from the National Education Longitudinal Study (NELS:88/2000) and additional state policy variables and finds that there is a clear and consistent gap in college enrollment for students of different income and racial groups. Changes in state aid policy significantly impacts the type of institution a student chooses across both income and racial groups.

Studying an individual student's decision to enroll at a particular college has also been conducted in a multilevel setting. DesJardins, Ahlburg and McCall (2006), investigate an integrated student choice process by simultaneously estimating application, admission, and enrollment behavior. The authors use student-level data from the University of Iowa and control for a number of factors throughout the various stages of their model including: student quality (ex: ACT composite score, high school rank percentile, high school GPA, taking AP courses, high school curriculum, intended to major in engineering, whether the students attended private high school, educational aspirations), family characteristics (ex: student race, ethnicity, gender, number of siblings in college, parental education, income, student's home state, marital status veteran status, legacy), institutional preferences, opportunity costs, and the competitive environment. They also include state-level data including yearly unemployment rates and four year public tuition rates. The authors control for the non-random nature of the distribution of aid by estimating the probability that a student will receive aid as well as the amounts of aid students expect to receive if they applied for it. Results show that aid expectations have a powerful and non-linear effect on the probability to enroll. Most importantly, awarding a student less aid then he or she expected can negatively impact their probability of enrollment. They also find enrollment probabilities increase with income,

and vary by race with specific income groups. While extremely thorough, their study is not without limitations. The authors do not use detailed financial aid variables, and instead use the total aid paid to students as a measure. They also only control for public school tuition information but lack private school tuition in surrounding areas.

Building off of the study by DesJardins et al. (2006) that estimated the effect of total financial aid expectations on student college choice, Kim, DesJardins, and McCall (2009) focus on the expectations of different types of aid, including grants, loans, and work study. Using data from students who sent their ACT scores to the University of Iowa in academic years 1997-1998 to 2001-2002, the authors include a number of student-level, institutional, and state-level factors that have been found to influence student college choice including student demographics, academic qualities, socioeconomic information, financial aid, and tuition rates. They find that incoming students respond more to the amount of aid received relative to their expected level of aid, rather than the absolute value of aid awarded. In other words, receiving more aid than expected increases enrollments dramatically, but results vary by race/ethnicity as well as by income. This is another study that is limited to students who submit standardized test scores.

Finally, Kim (2004) analyzed the impact of specific types of financial aid on students' college choice, with a focus on differences in race. Using student-level and institution-level data from the Freshmen Survey of 1994 collected by Higher Education Research Institute (HERI), the author controls for individual student background characteristics (race, gender, academic achievement, parental education, income), college preferences and planning (advice from others, number of college applications),

institutional characteristics (tuition, selectivity), and financial aid packages. The author finds that in general, receiving grant aid or a combination of grants and loans had a positive impact on student selecting his or her first choice school. With a focus on race, findings show that white and Asian students are more likely to attend their first choice school with grant aid or a combination or grants and loans. On the other hand, Hispanic and black students were not influenced. This study could benefit from more detailed student level data including dollar amounts for the financial aid variables, instead of only controlling for aid categories. Additional information on student high school GPA, beyond high, medium, and low grades may also more thoroughly identify differences in college going behavior.

Micro-Level Studies

There is a wide variety of estimation techniques and procedures for the group of research utilizing student level data. One of the main reasons these studies vary greatly is due to the availability of data sources. It is most common for student level studies that investigate the relationship between college costs and financial aid variables to use an outcome variable of student enrollment at a particular institution. The ultimate focus of this type of study is the decision of the individual student.

In general these studies use student level characteristics such as academic achievement in high school (high school GPA, standardized test scores, number of AP courses), the type of high school attended (public/private), socioeconomic characteristics (parental income, parental level of education, number of family members in college, financial need defined by the federal government or the institution), various financial aid

controls (grants/scholarships, loans, work study) and other students characteristics (race, gender, intentions to live on or off campus, distance live from institution (see Braunstein, McGrath & Pescatrice, 1999; Curs & Singell, 2002; Monks, 2009; Nurnberg & Schapiro, 2012; Weiler, 1996)

A couple studies use small samples to identify student preferences, which can create challenges. Hu and Hossler (2000) study the preferences of students in their senior year of high school. Using a relatively small sample of data from a postsecondary choice survey of high school students in Indiana, they find that in addition to student background, family background and student academic characteristics, students react to tuition costs and the availability of financial aid, suggesting that a student's willingness to pay, and not just the ability to pay, plays a direct role in college choice between public or private institutions. More specifically, they find that students who say low tuition is important were 8% less likely to prefer a private school over a public institution. Furthermore, students who say financial aid is more important were 11.2% more likely to want to attend a private institution. In addition to a small sample, the authors are only able to include student GPA ranges, rather than actual values. They also fail to include specific financial aid amounts, only whether or not the availability of aid is important to the student being surveyed.

As another small sample example, Lillis and Tian (2008) examine the relationship between education costs, defined as tuition, room and board, and transportation costs, as well as the decision to enroll at a specific institution over other choices. Using a mixed methods approach, the authors conducted a non-random survey designed to compare students' college going behavior, collecting 289 observations of data. They also

conducted over 100 interviews with students, parents, and administrators to further gather thoughts on the college choice process. Findings suggest that financial barriers for low and middle income groups exist and impact opportunity for college choice. While the qualitative portion of this study adds to the literature that is dominated by quantitative studies, the sample is small and not random, so the findings cannot be generalized.

More commonly authors that conduct student centered analysis seeking to explain enrollment behavior gain access to a specific institution's detailed data. For example, Weiler (1996) examines the probability of matriculation using an institution's Admitted Student Questionnaire (ASQ) survey responses that capture student opinions about their college choice experience. Students ranked how they felt about factors like aid, cost, and available majors. Weiler (1996) includes measures of student preparedness (SAT measures), financial aid (if the student applied for aid) and student & family characteristics (minority, gender, parental income, commuter status, and state of residence). One valuable aspect of the study is that the ASQ survey allows the author to include cross over schools that students have been admitted to, which captures information about the student's feasible options that Hurwitz (2012) said would be valuable. However, the survey does not capture detailed information about the student, so the author is not able to include measures of specific financial aid award amounts. His findings suggest that attendance cost and non-monetary institutional characteristics are both significant factors of institutional choice.

In another institution specific study, Curs and Singell (2002) jointly model the application and enrollment decision for in and out of state freshmen at the University of Oregon. Controlling for factors like race, gender, SAT scores, high school GPA, number

of AP classes taken, high school type (public/private), median household income for student's zip code, age at first contact with institution, tuition of University of Oregon, tuition of other public and private institutions, net price of institution, and unmet need, they find price responsiveness differences between applicants and enrollees, as well as between in and out of state students. Overall, their findings suggest that universities can manage enrollments by taking advantage of different students' price elasticities.

Conducting an econometric analysis of enrollment decisions of admitted students, Nurnberg and Schapiro (2012) use data for Williams College's classes of 2008 through 2012 to estimate a yield model. In order have the ability to use the model to predict admission yield in future years, the authors only use information available at the time of the admission decision. Conditional on the student applying and being accepted by Williams, findings show that a student's standardized test scores, high school GPA, net price (sticker price minus institutional financial aid), race, geographic origin are strong predictors of whether or not the student will matriculate. While this study not causal estimation because there isn't exogenous variation in the data and results are really only generalizable to other highly selective institutions, the authors do an excellent job of describing how their results are useful to admissions professionals hoping to estimate the probability of enrollment for each applicant, or predict a yield on the incoming class.

As another example, Braunstein, McGrath and Pescatrice (1999) analyze the impact of demographic, socioeconomic, and financial characteristics on enrollment decisions of admitted college applicants. Using data from the admitted student pool of Iona College in academic years 1991-1992, 1993-1994, and 1995-1996, the authors control for factors such as: gender, race, ethnicity, high school GPA, standardized test

scores, marital status, number of family members, legacy status, distance from college, intention to live on or off campus, anticipated major in arts & science or business, family income, dollar amount of financial aid offered, type of aid offered including grants, loans or work study. They find that for every $1,000 increase in the amount of aid offered, the probability of enrollment increases between 1.1% and 2.5%. Grants and loans have a positive effect, but work study did not persuade prospective students. Furthermore, upper income students are less likely to enroll in spite of financial aid incentives. One significant issue with this analysis is that the authors assume that all students who do not file a FAFSA are wealthy. While this may have been a safer assumption nearly fifteen years ago when it was published, students apply to many more institutions than they did so many years ago. As a result, a student may file a FAFSA, but only choose to send the financial information to a subset of the institutions he or she applied to. This means that there is a group of students who could qualify for financial aid but are not interested enough in the institution to follow through with the process. In addition, unfortunately there are low income students who don't understand the financial aid process and fail to file a FAFSA, leaving free money like Pell grants on the table (Novak & McKinney 2011; King, 2006). Finally there is a group of wealthy students that don't bother submit a FAFSA because they know they will not qualify for aid. Due to data limitations it is uncertain how large these groups might be but overall, there are three very different groups of students, with potentially different probabilities of enrollment, which this study has assumed will behave the same way.

Finally, Monks (2009) uses a unique financial aid experiment to estimate the effectiveness of merit awards in attracting academically desirable applicants. Using

student-level data from a small, private, most selective liberal arts institution, he randomly chose about 200 top-rated admitted students, who did not receive need based and or other merit based aid, and awarded them $7,000 academic awards while the rest of the group didn't receive one. Controlling for SAT scores, gender, and region of the country, the author finds that merit aid has a statistically significant effect in enrollment on very high ability students. The yield among the award recipients is expected to increase by 2.9 percentage points. Unfortunately, experimental data such as this is very hard to come by in an educational setting. This is the only study of its kind at the college level that I am aware of.

Sometimes, student level studies go beyond the decision to enroll and also incorporate measures of persistence in their analysis. For example, in a "financial nexus" series over a number of years St. John and others investigate college costs, college choice, and persistence. Using a nexus approach, which uses a differentiated price response model to integrate the influence of financial perceptions and the effects of aid and college costs, St. John, Paulsen & Starkey (1996) examine how the financial reason for choosing a college relates to the college experience. They also investigate how financial expectations as well as prices and subsidies influence persistence. In general, the model examines how student background, financial reasons for choosing a college, college experience, aspirations, prices and subsidies, and living costs influence persistence. Paulsen & St. John (2002) expand on the model to investigate how students from different income groups are affected by the changes in college costs. Estimating within year persistence, or reenrollment in the spring semester after enrollment in the fall semester, the authors find that financial variables are significant for both the public and

private schools. Using the same student-level data as the original "nexus" study, from the National Postsecondary Student Aid Survey (NPSAS-87), St. John, Paulsen, & Carter (2005) also expand upon the "nexus" model to include racial differences. The authors find that black students are more likely to choose a college based upon financial aid offers and low tuition. A common concern across the series is that high school grades are not included because they are not available in the dataset. In addition, the NPSAS-87 was more than a decade old at the time of most of their studies, and is more than twenty-five years old today. The overall college admissions environment as well as students' college choice behavior has certainly changed in more than two decades.

Gaps in the Literature

What is missing in the literature is a study that combines the research on financial aid variables and college choice, all within a test optional setting. Thus far, research on the role that standardized testing plays in the college choice process has been limited to quantitative studies measuring the relationship between a student's test score and the likelihood of college enrollment, the level and selectivity of the institution, and other attainment outcomes (Deil-Amen & Tevis, 2010). Various financial aid studies determine whether specific groups of students have different college going behaviors than others including: males and females, minority students and non-minorities, and low socioeconomic status and high socioeconomic status. However, none have studied test optional behavior, and whether or not the student submits test scores (a "submitter") or withholds them (a non-submitter"), as closely as these other special groups.

In a study that examines the move to test optional policies without a focus on financial aid or a focus on overall enrollment, Robinson and Monks (2005) use a probit regression to predict the probability that a student submits their SAT scores. The authors include measurements of student preparedness (high school GPA, high school rank, and SAT scores) and student & family characteristics (minority, expected financial family contribution to the student's education). Their findings suggest that students who 'under-performed' on the SAT relative to their high school GPA were more likely to withhold their scores. The authors do not include specific student financial aid awards from the institution or the government, which leaves room for improvement in the model. To further fit their study to the choice literature, one would also need to include an outcome variable measuring whether or not the student enrolled at the university in question, rather than whether or not the student submitted scores.

This gap in the literature is particularly important to address because colleges tend to award merit based aid on student preparedness measures like high school GPA and standardized test scores. When a school doesn't gather test scores for all of its admitted students, this can change the way in which they award merit based aid. This difference in awarding procedures may influence the student's overall decision to enroll at the institution. Studying that impact can add to the existing body of school choice literature as well as guide policy makers at test optional institutions concerned with how students react to institutional aid and policy makers at institutions considering making the change to become test optional.

Given the current competitive climate for high school graduates, and the scarce literature covering test optional policies as it relates to college choice, the results are

valuable to policy makers from a variety of school types who may consider moving to a test optional admission policy. Knowledge of how test submitters and non-submitters respond to financial aid can help ease the concern of making a major admissions policy change, when it's still a priority to fill a freshmen class of students. More specifically, the following question should be addressed. When controlling for variables measuring student characteristics, family characteristics, as well as institutional and government financial aid awards, do test score submitters matriculate at different rates than non-submitters?

CHAPTER 3

DATA AND METHODOLOGY

Data Source

The institution involved in this study is a small liberal arts school in the northeastern region of the United States. The university is small, with incoming freshmen class sizes fewer than 1,000 students and roughly 95% percent of all students live on campus. Campus is located in a scenic, safe, suburban area and is located outside of a large city. From the Admitted Student Questionnaire conducted for this institution by the College Board in 2009, a typical enrolled student is a white in-state female who lives less than 50 miles from the school.

The decision to alter the admissions process by going test optional is not one that is not taken lightly. The institution decided to go test optional because they believe that factors other than standardized test scores can be better predictors of success in college. Before the adoption of the policy, an internal study showed a student's high school GPA was the most important predictor of success at the school. This information, combined with a holistic approach to the admission process, encouraged policy makers to make the decision to go test optional. Among national liberal arts schools that are test optional, the institution in this study falls in the middle 50% of the rankings.

The data used for this study includes all admitted applicants for the Fall 2008 through Fall 2011 (see Table 1). The time period includes the largest economic downturn in modern U.S. history and students were more than ever in tune to financial aspects when choosing to enroll at an institution. Admitted students in these years were generally

evaluated on the same criteria: the strength of their high school, the rigor of the curriculum, the student's GPA, a standardized test score if submitted, recommendations from guidance counselors or teachers, extracurricular involvement and leadership, etc.[2] Both students who submit standardized test scores and those that that do not are eligible to receive merit scholarships from the institution.

The entire sample for this study includes about 14,000 observations, with each year making up between 21% and 29% of the admitted students in the overall file.[3] The average GPA for the group is 3.37, with a range between 2.0 and 4.0 while the curriculum rating ranges from 1 to 12 with an average of 7.2. Nearly 22% of the admitted pool has chosen to withhold their standardized test scores and a more detailed description of the differences between non-submitters and submitters is included later.

In general, the profile of an admitted student in each separate year is about the same. The average GPA among years ranges between 3.33 and 3.38, while the curriculum rating ranges between 6.8 and 7.8. The percentages for male, commuter, and out of state status are very similar. The only notable differences are in Fall 2011, where 39% of the admitted pool is categorized as minority compared to 26% with all four years combined. This group is also less wealthy, with an average FM need of about $24,000 compared to about $17,000 for the entire group.

[2] This information is based on what was posted on the institution's website at the time. For confidentiality reasons, the link to their website is not included.

[3] This excludes 300 students in special programs unique to the state or school, which have been removed to maintain anonymity. It also excludes 393 admitted international students and 77 tuition exchange observations because they were awarded different institutional awards relative to the rest of the group. Finally, 2 observations with GPA typos, 1 with a missing curriculum rating, 7 with outlier merit awards, and 6 with outlier need awards have all been thrown out of the data. The remaining sample is described in Table 1.

Table 1: Admitted Students, Fall 2008 through Fall 2011 (N = 14,299)

Variable	Mean	Std. Dev.	Minimum	Maximum
GPA	3.37	0.38	2.09	4.00
CurricRating	7.2	2.86	1	12
Score Non-Submitter	21.6%	41%	0	1
InstMeritAward	$12,490	$6,348	$0	$28,200
InstNeedGrant	$2,732	$3,996	$0	$10,000
FedGrant	$717	$1,868	$0	$8,580
WorkStudy	$514	$780	$0	$2,400
FedLoans	$2,566	$2,772	$0	$13,000
Male	35.5%	48%	0	1
Minority	26.3%	44%	0	1
Commuter	5.5%	23%	0	1
OutState	54.2%	50%	0	1
FMNeed	$16,987	$21,277	$0	$58,320
EarlyDecision (ED)	1.0%	10%	0	1
Visits	0.91	1.35	0	10
AppealLetter (AL)	3.5%	18%	0	1
AppealOffered	$105	$803	$0	$12,000
FAFSA-Top3	26.7%	44%	0	1

Methodology

This research is quantitative and I used multivariate regression to simultaneously control for many independent variables. These controls allowed me to use the measured variables to explain a portion of the variation in the probability of enrollment, while focusing on the coefficients of my variables of interest: financial aid variables, the decision of submitting a test score or not, and the interaction between the two.

Because the dependent variable is categorical, and represents the probability of enrollment at the institution in question by showing zero if the student did not enroll and one if the student did, the use of Ordinary Least Squares (OLS) estimation is inefficient

because predicted values are not constrained between zero and one. I therefore used a probit regression within the statistical software Stata. In general, the decision to enroll (or the probability of enrollment at the institution in question) can be described as a function of the following:

P (Enrollment) = f (Student Preparedness, Institutional and Government Financial Aid Awards, Student and Family Characteristics, and Level of Interest)

For the share of the decision making process that can be quantified, I include a description of student level data, with particular focus on institutional financial aid and test optional variables. More specifically, I examine the relationship of financial aid and test optional variables on the probability a student enrolls at the institution in question, contingent upon admission. The equation below answers my third research question, while more simplified versions (without the interaction terms) answer the first two research questions. In all cases, I report the marginal effects:

$$P(\text{Enrollment})_i = \beta_0 + \beta_1(\text{InstMeritAward})_i + \beta_2(\text{InstNeedGrant})_i + \beta_3(\text{ScoreNonSubmitter})_i + \beta_4(\text{ScoreNonSubmitter*InstMeritAward})_i + \beta_5(\text{ScoreNonSubmitter*InstNeedGrant})_i + X_i'B + \varepsilon$$

where the X vector includes measures of student preparedness, federal and state financial aid awards, student & family characteristics, and student level of interest described in the following paragraphs.

Student Preparedness

How well the student is prepared for college level work can be a contributing factor in the decision to enroll. Previous studies have used a variety of variables to control for these characteristics. For example, Ellwood and Cane (2000), Perna and Titus (2004), Desjardins, Ahlburg and McCall (2006), Curs and Singell (2002), Nurnberg and Shapiro (2012) and Braunstein, McGrath and Pescatrice (1999) all control for high school GPA in their choice studies. Prior work also consistently controls for some sort of curriculum rating, or difficulty of courses studied. For example, Lucas and Good (2001), Solorzano and Ornelas (2004), and Teranishi, Allen and Solorzano (2004) include types of curricular and college prep course available to students. Perna and Titus (2004) use the frequency of discussion between parents and their students about high school courses taken as well as topics studied. In the same study from 2004 and again in 2005, Perna and Titus control for the highest level of completed math course completed as a measure of student academics. DesJardins, Ahlburg and McCall (2006) estimate application, admission and enrollment behavior by controlling for the number of AP courses taken and high school curriculum among other factors. Curs and Singell (2002) also control for number of AP courses taken.

In this study student preparedness includes high school GPA *(GPA)*, a curriculum rating *(CurricRating)*, and a dummy variable indicating whether or not the student submitted a standardized test score *(ScoreNonSubmitter).*

Applicants of the institution involved in this study submit a variety of GPAs on various scales. Some students' high schools award additional weights to their GPA for

difficult classes, such as AP or honors, while others taking the same level of classes at another school do not. To make GPAs more comparable across high schools, the admission staff recalculates each applicant's GPA on a non-weighted 4.0 scale *(GPA).* [4] The range of GPAs in this study can theoretically range from 0.0 to 4.0. Students with very strong GPAs have more options available to them, so it is therefore expected that there will be a negative relationship with the probability of enrollment. On the other hand, students with lower GPAs have fewer options and are more likely to be very excited about being accepted to the institution. It is therefore expected that students with lower GPAs will have a positive relationship with the probability of enrollment. Because GPA does not have a linear relationship with the probability of enrollment, I allow for a non-linear relationship by adding a squared term in the regression.

Just as students apply with various GPAs, they also apply with various sets of completed high school curricula. Core courses taken, including courses such as math, English, and science are valued more highly with special attention given to AP and honors courses. When the curriculum is rated, values range between 1 and 12, where 1 is low and 12 is high. An example of a lower rated curriculum could be the minimum requirements to graduate from high school with no honors level type courses. An example of a very highly rated curriculum would be one with four years of math and science, several AP courses taken and nearly all the rest at the honors level. Just as with GPA, students with high academic preparation ratings are attractive to many schools in which they apply and therefore will have more options to choose from. Students with

[4] During the years of this study all grades reported on the high school transcript were included in the college's calculation of each student's GPA. Sometimes only more "academic" courses are included, which can be called an academic GPA. While each admission office may treat the recalculation of high school GPAs slightly differently, the process described for the school in this study is not drastically different from others I am aware of.

lower academic preparation ratings may face fewer options and may be more likely to enroll, under the condition that they have been accepted to the institution in question. I allow for a non-linear relationship by adding a squared term in the regression.

As previously discussed, students at the institution in this study can choose to send their standardized test scores or withhold them instead. In attempt to answer the second research question of whether or not score submitters decide to enroll at different rates than those that withhold scores, I control for a dummy variable, which equals one if the student opts to withhold their SAT or ACT scores and zero if the student submits standardized test scores *(ScoreNonSubmitter).* Recall that some institutions that are test optional require additional admissions materials instead of standardized tests and some do not. The practice at this institution is to require a graded paper. The paper is expected to be more than just the essay included in the application materials; it should be analytical in nature and although not required, could be a research paper. It is realistic to think that students who choose to take advantage of a test optional admissions process feel as though their test scores do not reflect their classroom potential. This means their scores may be lower than those students who freely submit their scores, which is supported by the work of Robinson and Monks (2005). However, because high school GPA scores were found to be a better predictor of success at this school, it is probable that both types of students will succeed at the institution as long as their GPAs are similar. The test optional policy encourages students to apply that may have been hesitant to do so before. The direction of this variable is difficult to anticipate, which is why a study examining this outcome adds important information to the literature. Score submitters could come from wealthier families and find it easier to afford a relatively expensive liberal arts

school and thus are more able to attend, while non-submitters could face fewer options, because not all schools are SAT optional, if in fact their scores are less attractive than score submitters.

Table 2 and Table 3 below show summary statistics for score non-submitters and score submitters, respectively. Students who choose to withhold their scores make up between 18% and 30% of the admitted class in the years of this study. The academic profile of non-submitter admitted students is slightly lower, with an average GPA of 3.3 and curriculum rating of 6.3 compared to 3.4 and 7.5 for score submitters. Furthermore, score non-submitters are less likely to be male (27%), more likely to be minority (37%), have a higher average need ($20,628) and are more likely to apply early decision (2.2%). On the other hand, score submitters are more likely to be male (38%), less likely to be minority (23%), have a lower average need ($15,985), and are less likely to apply early decision (0.7%).

Table 2: Score Non-Submitters (N = 3,085)

Variable	Mean	Std. Dev.	Minimum	Maximum
GPA	3.29	0.37	2.14	4.00
CurricRating	6.3	2.71	1	12
Score Non-Submitter	100.0%	0.00	1	1
InstMeritAward	$10,991	$6,093	$0	$27,200
InstNeedGrant	$3,458	$4,304	$0	$10,000
FedGrant	$1,096	$2,235	$0	$8,580
WorkStudy	$596	$811	$0	$2,400
FedLoans	$2,867	$2,905	$0	$13,000
Male	26.8%	44%	0	1
Minority	37.1%	48%	0	1
Commuter	6.3%	24%	0	1
OutState	55.1%	50%	0	1
FMNeed	$20,628	$22,994	$0	$58,320
EarlyDecision (ED)	2.2%	15%	0	1
Visits	1.0	1.44	0	8
AppealLetter (AL)	5.3%	22%	0	1
AppealOffered	$137	$926	$0	$11,000
FAFSA-Top3	30.3%	46%	0	1

Table 3: Standardized Test Score Submitters (N = 11,214)

Variable	Mean	Std. Dev.	Minimum	Maximum
GPA	3.40	0.38	2.09	4.00
CurricRating	7.5	2.85	1	12
Score Non-Submitter	0.0%	0.00	0	0
InstMeritAward	$12,902	$6,356	$0	$28,200
InstNeedGrant	$2,532	$3,883	$0	$10,000
FedGrant	$613	$1,739	$0	$8,580
WorkStudy	$491	$770	$0	$1,700
FedLoans	$2,483	$2,728	$0	$13,000
Male	37.9%	49%	0	1
Minority	23.3%	42%	0	1
Commuter	5.3%	22%	0	1
OutState	53.9%	50%	0	1
FMNeed	$15,985	$20,668	$0	$58,320
EarlyDecision (ED)	0.7%	8%	0	1
Visits	0.87	1.32	0	10
AppealLetter (AL)	3.0%	17%	0	1
AppealOffered	$96	$765	$0	$12,000
FAFSA-Top3	25.6%	44%	0	1

Institutional and Government Financial Awards

Several studies involving college choice include family finance and financial aid type variables in their work. While they often do not control for financial factors in the exact same way, studies like Leslie and Brinkman (1988), Heller (1997), McPherson and Shapiro (1998), Cabrera and LaNasa (2000), Hoyt and Brown (1999), Callendar and Jackson (2008), Heller (1997), Heller (1999), Hossler (2000), Kim (2004), Paulsen and St. John (2002), Reay, Davies, David, and Ball (2001), Breen and Goldthorpe (1997), Curs and Singell (2002), DesJardins, Ahlburg, and McCall (2006), DesJardins, Ahlburg, and McCall (2006), Dynarski (2002), Dynarski (2003), Lillis (2008), Paulsen (1990),

Paulsen and St. John (2002), St. John (1994), Berkner and Chavez (1997), Buss, Parker, and Rivenburg (2004), Perna and Titus (2004), Kim (2012), Kim (2004), Weiler (1996), Curs and Singell (2002), Nurnberg and Schapiro (2012), Braunstein, McGrath and Pescatrice (1999) all control for financial aid characteristics in their studies. I control for financial aid variables as well as described below.

As outlined in the research questions, the first focus of this study concerns institutional financial scholarship awards and grant awards. Both *InstMeritAward* and *InstNeedGrant* are considered variables of interest when running regressions and conducting analysis. Institutional merit scholarship amounts are awarded based upon a variety of characteristics, mostly pertaining to high school GPA and curriculum rating *(InstMeritAward).* For the academic period 2008 to 2011, this amount ranged from $0 to more than $27,000. In general, it is expected that if a student receives more merit dollars than another student, ceteris paribus, he or she will be more likely to enroll.

The institution involved in this study is committed to aiding students from many financial backgrounds. Once the student and his or her family files the FAFSA, the expected family contribution (EFC) is determined by the federal government which uses a calculation that incorporates financial aspects like family income, savings and investments, family size, and number of family members in college. The school then determines the student's financial need by subtracting the EFC from the institution's cost of attendance (COA). While the school does not meet full "federal methodology" need, or FM need, as defined by the federal government (COA – EFC = FM need), institutional need grants are designed to help students who face higher financial hurdles than other applicants. Based on this level of need, students can qualify for up to an additional

$10,000 as a need based grant from the institution *(InstNeedGrant).* This variable can be considered a proxy for income because the level of need is determined by the family's financial picture, which includes income, savings, investments, etc. This follows the spirit of studies that directly control for family income as in McPherson and Schapiro (1998), DesJardins, Ahlburg and McCall (2006), Kim (2004), Weiler (1996), Braunstein, McGrath and Pescatrice (1999), and Hurwitz (2012). Others control for financial support (Dixon &Martin, 1991), financial resources (Perna & Titus, 2004), and median income by zip code (Curs & Singell, 2002).

Unfortunately, a term referred to by financial aid administrators as the 'gap' for students (the cost of attendance minus the EFC and institutional, federal, and state grants) cannot always be met for every student. In general, it is expected that if a student receives additional institutional need grant money, they may be less likely to attend. The reason is because although these students are receiving more aid, it still may not be enough to close the gap for their families.

Many students are eligible for financial assistance from the federal government and the state, which help them pay for their education. Once they file the FAFSA, students included in this dataset could qualify for federal grants including Pell and SEOG (Supplemental Education Opportunity Grant) with totals of those receiving grants ranging from around $500 to $8500 (*FedGrant*).[5] Students could also qualify for Perkins loans, as well as Subsidized Stafford Loans and Unsubsidized Stafford Loans.[6] Within this study, the total of these three loans range from a few hundred dollars to more than $10,000, with the most common amounts being $3,500 and $5,500 (*FedLoans*). Students can also work

[5] The Academic Competitiveness Grant (ACG) existed for part of this time period as well.
[6] Now called Direct Loans, but called Stafford loans during the time period of this data.

on campus and earn federal Work Study dollars that can go towards paying their bill, with the most common amount in this data being $1,700 of earnings for the academic school year (*WorkStudy*). Students living in the state where the institution is located have access to generous state grants if they qualify financially. While controlled for in my regressions, I will not discuss in detail in order to maintain institutional confidentiality (*StateGrant*).

A third focus of the study involves the interaction between whether or not the student submits test scores and the institutional financial aid variables described above. It is expected that students who withhold their scores will be more responsive to merit aid. Although schools often do not release detailed criteria by which they award merit scholarships, it is realistic to think that many schools that require the submission of test scores award merit money at least in part on the basis of the submitted scores[7]. If this is true, score non-submitters, who most likely have scored lower on the SAT and don't believe it reflects their potential, will be comparing financial aid packages from schools that did not reward them as highly based on their tests. When comparing those packages to the one they receive from the institution in this study, they could be happy with what they receive and be more likely to enroll. Score submitters, on the other hand, may face similar packages from all schools to which they are admitted and therefore be less likely to enroll, relative to their non-score submitting peers.

[7] Scholarship awarding is proprietary information, but anecdotal evidence from a few schools supports this theory.

Student & Family Characteristics

Following the literature, a number of student and family characteristics could impact the probability of enrollment and are included in my regressions. See Perna and Titus (2004), DesJardins, Ahlburg and McCall (2006), Kim (2004), Weiler (1996), Curs and Singell (2002), Braunstein, McGrath and Pescatrice (1999) and Monks (2009) for studies that control for gender. For those that incorporate race or ethnicity into their work see Buss, Parker and Rivenburg (2004), Perna and Titus (2004), DesJardins, Ahlburg and McCall (2006), Kim (2004), Weiler (1996), Curs and Singell (2002), Nurnberg and Schapiro (2012), and Braunstein, McGrath and Pescatrice (1999). Research by DesJardins, Ahlburg & McCall, 2006, Weiler, 1996, Nurnberg and Schapiro (2012), and Monks (2009) control for either state of residence or region the student was from. Studies by Weiler (1996) and Braunstein, McGrath and Pescatrice (1999) include a student's intention to live on campus or off campus.

Gender, race/ethnicity, region of the country and whether or not a student lives on or off campus are all dummy variables. Male *(Male)* equals one when the student is male and zero when the student is female. Minority *(Minority)* equals one when the student is a minority student and zero with the student is non-minority, where minority includes African American, American Indian, Asian, and Hispanic. OutState *(OutState)* equals one when the student lives outside of the state where the school is located and zero when the student lives in state. Commuter *(Commuter*) equals one when the student intends to live off campus and zero if the student intends to live on campus

Several studies covered in the literature include some sort of measurement of family income when predicting probability of enrollment and other student outcomes

(Alexander, Pallas & Holupka, 1987; Braunstein, McGrath & Pescatrice, 1999; Curs & Singell, 2002; DesJardins, Ahlburg & McCall, 2006; Hearn, 1988; Hurwitz, 2012; Kim, 2004; McPherson & Schapiro, 1998; Weiler, 1996). Following studies like these, I control for student financial need, which is the results of a calculation that includes financial information like family income, savings and investments, in addition to family circumstance information like how many people are included in the family and how many are currently attending college (*FMneed*).

Level of Interest

The last group of variables captures the level of interest a student displays. Students may demonstrate interest by applying to the school early, applying to a special program at the school that requires additional documentation, positioning the school code in one of the first spots when filing the FAFSA, or by persistently visiting campus and interacting frequently with the admissions office. Any of these factors could reveal a stronger propensity to attend. While some levels of interest are captured consistently in existing academic literature, others tend to only be found in practice at institutions because of the detailed data necessary to discover them. Because this study utilizes several years of student level data, I am able to test more detailed variables against a student's probability of enrolling at the institution when compared to much of the existing literature covering college choice.

As a dummy variable, I control for whether or not a student applied Early Decision (*EarlyDecision*). This is a method of applying to college that a student can take if he or she is very sure they want to attend that school. From 2008-2011, the Early

Decision group accounts for 1% of the admitted students for this school. The student is supposed to apply to only one school as Early Decision and withdraw their applications from everywhere else. Because of this, it is expected that the coefficient on this variable will be positive and relatively large in magnitude when compared to others in the regressions.

Students tend to visits a number of institutions when deciding where to enroll, but in theory it's a subset of where he or she applied to. I control for the number of visits the student makes during the recruitment period (*Visits*) and allow for a nonlinear relationship by also including a squared term. Visits within this dataset range from zero to ten and include experiences like taking a campus tour, going to an information session, attending an actual class, or going to an Open House hosted by the admissions office, among others.

When a student files his or her FAFSA they can submit the information to up to ten schools at the same time by adding school codes. Institutions have found that while the FAFSA instructions don't ask the student to rank schools in preferential order, they tend to enter school codes in a non-random manner with the schools they are more strongly considering appearing earlier in the list[8]. I include a dummy variable to flag whether students listed the institution in this study in the top three spots on the FAFSA, (*FAFSA_Top3*), and expect to find a positive direction on the coefficient.

Sometimes after a student receives his or her financial aid package from a school, the family decides to submit an appeal asking for additional institutional funds to help the student enroll. A dummy variable for whether or not a student submits an appeal letter

[8] Beginning with the 2016 FAFSA, schools can no longer see where they are positioned on the list, nor the other institutions the student submitted his or her information.

(*AppealLetter*) is included as well as the amount of appeal funding granted if the student was awarded additional funding (*AppealOffered*). Within the data, around 100-125 students appeal for additional funding each year and about 50% of them are granted more money, with the majority receiving less than $5,000 additional dollars.

Finally, some schools have special programs that students can belong to once they become a part of the enrolled class. For example, there might be an honors cohort for the top academic portion of the class, a group for gifted artists, one for those interested in volunteer work, or another for students interested in the sciences. The institution in this study has an honors cohort and one other additional program similar to the ones described, both of which make up around 5-10% of the enrolled class. To insure anonymity, I intentionally keep the details vague. The direction on these coefficients is uncertain. While both are subsets of the larger group and could attract students because they are unique experiences, the students most likely to be selected for these groups likely have more options when deciding where to enroll.

One factor of student interest that is consistently controlled for in the literature is legacy status, where a student's family member graduated from the same school (see Hurwitz, 2012; DesJardins, Ahlburg & McCall, 2006; and Braunstein, McGrath & Pescatrice, 1999). Unfortunately the institution in this study did not consistently track legacy status during the years of included data because they don't experience a large group of legacy students inquiring or applying the school. In more recent years, legacy has been tracked more closely and roughly 5% of the applicant pool has some sort of family connection to the institution. While previous literature finds that legacy status contributes to the decision to enroll, the inability to control for it in this study shouldn't

significantly bias the results because the group of students that might fall into this category is likely very small. Additional limitations to this study are discussed in the next section.

Limitations

A student's decision to enroll at a particular institution is a complex one, where many aspects can be clearly measured and consistently recorded (student GPA, rating of student high school curriculum, financial aid awards, number of visits to campus, etc.), and many more cannot (where the student's friends are enrolling, how they feel when they visit campus, the weather on the day of a college open house, if they made a connection with a professor when they came to sit in on a class, etc). Because every aspect of the decision is not easily measurable, it is possible that the estimates of this study, and any study like it, contain unmeasured error. Researchers must therefore do the best they can with the available set of data.

Although studying the decision to enroll at an institution is a valuable exercise that can shed light on the student choice process, a common omitted variable missing from almost every study that is the set of other schools available to the student because schools often don't know where else their admitted students have been accepted (Hurwitz, 2012), or the knowledge is so incomplete for their set of admits that it is not statistically useful. This particular study faces the same challenge.

Students who choose to submit SAT or ACT scores versus students who do not submit scores may have common unobserved characteristics that are correlated with college enrollment. For example, students who choose not to submit test scores may grow

up in communities that do not encourage their children to take test prep classes or cannot afford for their children take standardized tests multiple times. These same communities may not value advanced education as much as communities who encourage test prep. If these two populations are inherently different, then self-selection bias could impact the study. Controlling for aspects closely related to these community differences like race and income levels (indirectly through institutional need grant levels) can help to alleviate this bias, but it is best to not generalize beyond other test optional colleges.

Other studies have also controlled for factors that will not be included in this study. The most obvious variable is a standardized test score, which is simply not available for around 20% of the admitted students in the years of data being used in this study. While arguably a concern because standardized test scores have contributed to a student's decision to enroll in previous studies (see Braunstein, McGrath & Pescatrice, 1999; Curs & Singell, 2002; Nurnberg & Schapiro, 2012; and Weiler, 1996 as examples), excluding scores and including the submitter vs. non-submitter variable is something that makes this study unique and will provide guidance to future studies of this kind.

Some variables are difficult to measure and require access to opinions of stakeholders that aren't available for this study. As an example of found in previous literature see Payne (2003) for the effects of having a friendly and approachable staff. See Mullen, (2009) and Wolniak and Engberg (2007) for the strength of the relationship between the high school guidance counselor and the college. Finally see Nora (2004) or Soutar and Turner (2002) for how campus characteristics like social opportunities and the feel of campus contribute to matriculation decisions. While valuable, including variables like these is a rare occurrence and not the norm in the literature.

A couple variables that are more commonly used in enrollment studies but not included in this one include intended major (DesJardins, Dundar & Hendel, 1999; Hoyt & Brown, 1999; Johnson & Stewart, 1991; Payne, 2003; Sanders, 1990; Soutar & Turner, 2002; Ingels, Dalton & LoGerfo, 2008; Reynolds, 2007) and institutional reputation or rankings (Bowman & Bastedo, 2009; Buss, Parker & Rivenburg, 2004; Griffith & Rask, 2007; Hoyt & Brown, 1999; Johnson & Stewart, 1991; McDonough, Antonio, Walpole & Perez, 1998; Smith, 1990; Soutar & Turner, 2002; Szekeres, 2010; Wilson & Adelson, 2012). I assume that if the student applies to the institution used in this study then he or she has decided that the school has an acceptable major they are interested in. For rankings or reputation in a study that only includes one school, the information doesn't vary and is therefore not included.

Sometimes studies control for detailed high school variables that haven't been included here. For example, DesJardins, Ahlburg and McCall (2006) control for high school rank percentile when predicting application, admission, and enrollment behavior. I am unable to control for this factor because not enough of the applicant data includes high school rank for this institution. DesJardins, Ahlburg and McCall (2006), as well as Curs and Singell (2002) use whether or not the applicant attended a private high school or not in their work. I am able to control for this variable in this study, but do not find statistically significant results and therefore do not include it in my regressions.

Finally, some studies are able to control for factors that aren't available at this time for this study, but could be opportunities for further research. For example, Perna and Titus (2004) control for high school activities as a form of social capital when studying the relationship of state policies and the type of institution a student decides to

enroll in. Currently the institution of this study notes involvement in high school activities during the application reading process, but it's not consistently rated in a formal enough way to include in regressions. There's a potential there to evaluate the reading process and further study an applicant's activities in high school and hoe those impact the decision to enroll at the institution. Perhaps students involved in theatre, varsity sports, or the science club in high school are more likely to enroll at this college.

Another limitation but also an opportunity for future research includes controlling for the number of family members in college, which is reported when a student files the FAFSA. Studies by DesJardins, Ahlburg and McCall (2006) and Braunstein, McGrath and Pescatrice (1999) both account for these in their research, but I am unable to directly control for it here. While the school in this study collects and stores this information, it proved challenging to report on so further work will be needed to include this factor in future studies using this data. While the number of family members in college isn't directly controlled for, I don't expect the bias to be extremely large because I control for FMneed, which incorporates it into its calculation.

Finally, many studies such as Braunstein, McGrath and Pescatrice (1999), DesJardins, Dundar and Hendel (1999), Goenner and Pauls (2006), Hoyt and Brown (1999), Mattern and Wyatt (2009), Payne (2003), Reay, Davies, David and Ball (2001), Soutar and Turner (2002), Stewart and Post (1990), and Szekeres (2010) account for some sort of distance from college when studying factors that influence matriculation. While distance from college can be calculated using the student's zip code, that process was not done for this study. Instead, I used whether or not the student lived out of state to account for a rough estimate of distance. Future work with a more precise distance

variable may provide further understanding of what contributes to a student's decision to enroll that the school in question.

CHAPTER 4

RESULTS

Overall, results show that admitted students who choose to withhold test scores instead of submitting them are more likely to enroll at the institution in question. In addition, FAFSA filing students are generally responsive to both merit based and need based institutional aid; the more money they receive from the institution the more likely they are to enroll, ceteris paribus. When the categorical test optional policy variable and the continuous institutional aid variables are interacted with one another, general results show that students who withhold scores, or score non-submitters, respond more strongly to $1,000 increases in institutional funds. More detailed analysis follows in this section.

With guidance from my research questions and previous literature, I report the results of the several sets of regressions in this section. In each set, I combine the four years of admitted student data and also list output for each year separately: Fall 2008, Fall 2009, Fall 2010, and Fall2011. In order to control for slight differences across the years of data, I include a dummy variable for Fall 2009, Fall 2010 and Fall 2011 in column one of each set of output, leaving Fall 2008 as the omitted category. I report only the marginal effects of probit estimations and include standard errors in parenthesis below each marginal effect. At the bottom of each chart, Pseudo R-squares are listed along with the number of observations in each regression as well as the definition of the asterisks for different levels of statistical significance. In cases where I use squared terms (GPA, Curriculum Rating, and Visits) I conduct a joint test for significance and include a graph to show where the peak or low point of the curve is, depending on the signs of the coefficients.

I split each sample into FAFSA filers and non-filers for two reasons. First, I am able to control for more variables in the FAFSA filer groups because I have additional information about the student including their financial need, where the school ranks on the FAFSA, and how much federal and state aid he or she qualified for. Second, students that file a FAFSA, even if they know they are from a wealthy family and will only qualify for an unsubsidized federal loan, could be innately different than those students that choose not to file a FAFSA. Separating these two groups allows me to test for differences among them. Across all four years of data in this study roughly 68% of admitted students filed a FAFSA. The lowest percentage was in Fall 2008 with 61% and the highest was in Fall 2011 with 71%.

The first set out output, found in Table 4 and Table 5, addresses my first research question: how do institutional financial aid awards for merit and need affect an admitted student's probability of enrollment at the institution? For non-filers, only one year of data (Fall 2011) shows a statistically significant and negative reaction to institutional merit awards. For admitted students in FA/11, as institutional merit awards increase by $1,000, it decreases the student's probability of enrollment at the institution by 0.01, after controlling for academic, student, and interest type variables ($p<0.01$). The negative coefficient could be because higher merit awards are generally awarded to students with higher academic profiles and these students have more options when selecting a school in which to enroll. When considering this outcome across the entire set of regressions for non FAFSA filers, it doesn't appear as though additional merit aid for this group is a strongly negative deterrent from deciding to enroll at the school. See Table 4 below.

Table 4: Non FAFSA Filers – Question #1 - Institutional Financial Awards

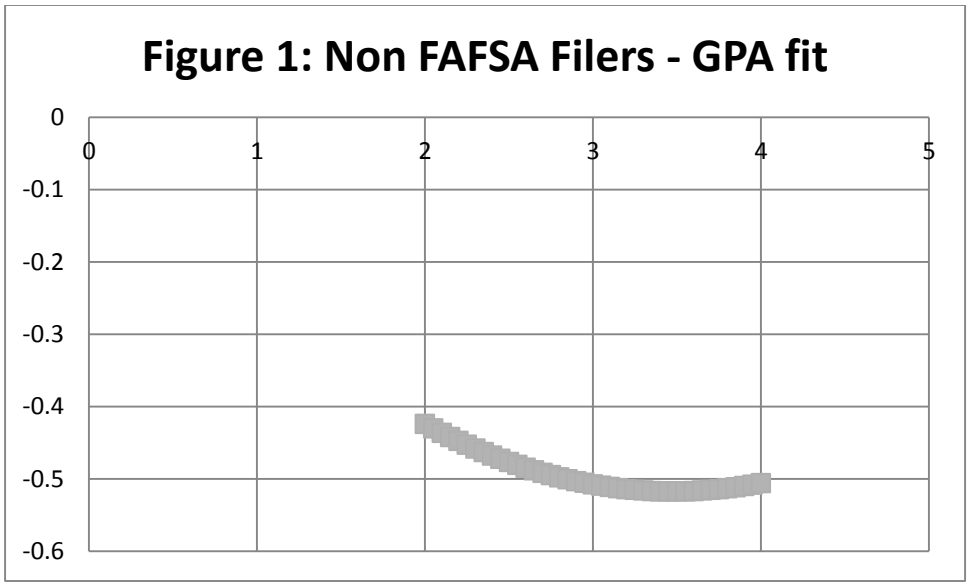
VARIABLES	(1) NonFAFSA-4years-Q1	(2) NonFAFSA-FA08-Q1	(3) NonFAFSA-FA09-Q1	(4) NonFAFSA-FA10-Q1	(5) NonFAFSA-FA11-Q1
GPA	-0.29742***	-0.54658**	-0.17903	-0.15958	0.28758
	(0.089)	(0.220)	(0.171)	(0.122)	(0.283)
GPA2	0.04276***	0.06643*	0.02362	0.02110	-0.01807
	(0.014)	(0.034)	(0.029)	(0.018)	(0.039)
CurricRating	-0.00140	-0.00737	0.00631	-0.00352	0.00850
	(0.004)	(0.010)	(0.009)	(0.005)	(0.010)
CurricRating2	0.00000	0.00014	-0.00074	0.00020	-0.00040
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)
InstMeritAward_th	-0.00063	0.00544	-0.00151	0.00062	-0.01027***
	(0.001)	(0.004)	(0.003)	(0.002)	(0.003)
Male	0.00834	0.00901	0.01083	0.00744	0.00906
	(0.005)	(0.011)	(0.011)	(0.008)	(0.012)
Minority	-0.01610***	-0.04070***	-0.02344**	-0.00628	-0.00182
	(0.006)	(0.010)	(0.011)	(0.009)	(0.012)
Commuter	0.07783***	0.05114	0.13463**	0.05702*	0.06499
	(0.023)	(0.047)	(0.064)	(0.032)	(0.040)
OutState	-0.01988***	-0.01551	-0.01424	-0.02171**	-0.00904
	(0.006)	(0.012)	(0.011)	(0.009)	(0.012)
Early Decision (ED)	0.54747***	0.61373**	0.73780***	0.38651*	0.51754***
	(0.105)	(0.299)	(0.181)	(0.213)	(0.173)
Visits	0.03772***	0.03684***	0.03281***	0.03786***	0.02686***
	(0.004)	(0.009)	(0.007)	(0.007)	(0.009)
Visits2	-0.00306***	-0.00183	-0.00259*	-0.00472***	-0.00124
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Appeal Letter (AL)	0.28921*		0.38588*	0.18525	
	(0.152)		(0.208)	(0.264)	
AppealOffered_th	0.01310	0.01477			
	(0.012)	(0.012)			
HON	-0.01614		-0.00358	-0.00244	-0.02720**
	(0.010)		(0.027)	(0.016)	(0.013)
CVL	0.18368			0.54055**	0.03644
	(0.129)			(0.263)	(0.168)
FA09	-0.00622				
	(0.006)				
FA10	-0.01478**				
	(0.006)				
FA11	-0.00353				
	(0.007)				
Observations	4,818	1,175	1,335	1,356	948
PseudoR-squared	0.229	0.248	0.262	0.278	0.216

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

While not a main focus for this project nor directly related to this research question, a few other notable outcomes appear for this group of students. Nearly across the board for all years, students who intend to commute to campus and those that apply early decision are more likely to enroll at the institution. Students who submit an appeal letter asking for additional financial aid are also generally more likely to enroll, but the data doesn't appear in all regressions because of the small percentage of students that submit a letter of appeal. Minority students, especially in Fall 2008 and Fall 2009, were less likely to enroll. Perhaps the uncertainties of the financial market and paying for an expensive liberal arts degree impacted this group of students more heavily than non-minorities during this time.

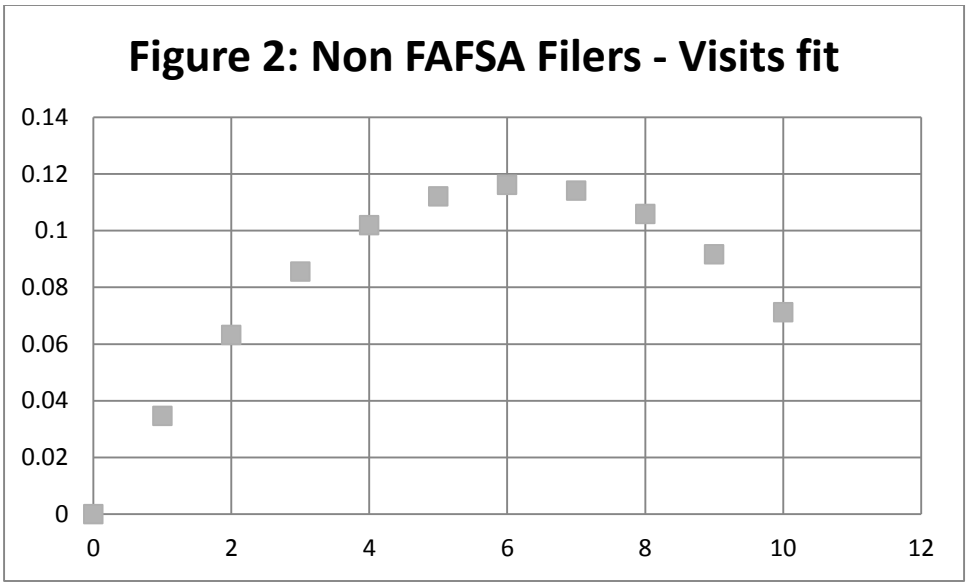
A student's high school GPA and the squared form of high school GPA are jointly statistically significant when using all four years of data (chi2 = 12.12, prob > chi2 = 0.0023). The general relationship between GPA and the probability of enrollment is negative, meaning that as GPA increases the chance the student will enroll at the institution decreases, ceteris paribus. However, the relationship is not entirely linear; the relationship hits a low point when the student GPA is about 3.5, meaning those with that GPA are the least likely to enroll, holding all else constant in the regression equation. See figure 1 below. [9]

[9] Throughout the regressions I control for both GPA and Curriculum rating. While both are academic measures of the student's high school experience, they are not as correlated as one may expect. For the sample of about 14,000, the correlation is 0.2881, which causes no concerns for multicollinearity between the two variables.



Finally, across all years, students who visit campus more are more likely to enroll. The variables Visits and Visits squared are jointly significant (chi2=1.76, prob >chi2 = 0.0023), and the relationship peaks at about 6 campus visits for this group of admitted students (see Figure 2). This means that students who visit up to 6 times increase their likelihood of enrolling, but after that the chance actually decreases, holding all else constant.[10]

[10] Only about 50 students in the dataset visit more than 6 times. It's not a likely enough occurrence that or strong enough outcome to build visit policy decisions around.



As explained before, I am able to control for additional factors in the FAFSA filing regressions, including both institutional merit aid based on academic factors and institutional grant aid based on financial factors in order to directly address research question number one. I am also able to control for federal grants and loans, state grants, and student financial need. This ability directly affects the fit of the models. Note that the pseudo R-squares in the FAFSA filing group range from 0.301 to 0.405, while in the non-filing group they range from 0.216 to 0.278. For FAFSA filers I am able to explain around 30%-40% of the variation in the student's enrollment choice, while for non-filers I am only able to explain 22%-28%.[11]

Output in Table 5 shows that admitted students in the FAFSA filing group respond positively to institutional aid. For example, holding all else constant, for an

[11] When I control only for the variables I'm able to include in the non FAFSA filing set of regressions, but apply it to the FAFSA filing group, I get comparable pseudo R-squares. However, there are differences in coefficients for the variables of interest between the two groups of students for all three research questions. In general, I observe more statistically significant results for the FAFSA filing group of students, which suggests there are innate differences between the student groups and it's not just a difference in variables that are driving results.

admitted student between Fall 2008 and Fall 2011 that filed a FAFSA, an additional $1,000 of need based institutional money increased the probability of enrollment by 0.01 ($p<0.01$)[12]. When considering the same scenario for institutional merit based aid, an increase of $1,000 increased the probability by 0.004 ($p<0.001$).

Some general outcomes appear for the FAFSA filing group of admitted students as well. Similar to the non-filing group, commuters, early decision applicants, and students filing appeal letters are all more likely to enroll, when holding other factors constant. The statistical significance for the minority variable is not present for this group of regressions, but I do find statistically significant and generally negative results for a student's financial need. For a FAFSA filing admitted student between Fall 2008 and Fall 2011, an additional $1,000 of need (FMneed) meant the student's probability of enrollment fell by 0.0008 ($p<0.01$). Another financial variable with statistically significant outcomes and a larger influence on the decision to enroll than FMneed is federal loan amounts. For example, holding all else constant, when a student is offered an additional $1,000 of federal loans the probability that he or she enrolls at the university increases by a range of 0.022 to 0.037, depending on the year in question (all p-values <0.01).[13]

[12] Throughout the regressions for FAFSA filing students I control for both Institutional need based grants and Federal grants. While both are based on a student's financial circumstances, the correlation for the FAFSA filing portion of my sample is 0.553, which does not cause me enough concern about multicollinearity to leave either on of the variables out of the regressions.

[13] Note that this is the offered federal loan amount, and not the accepted amount. During the financial aid process, students are offered federal loans, but they have the option of whether or not they're like to accept that offered amount, a portion of the offered amount, or no federal loans at all.

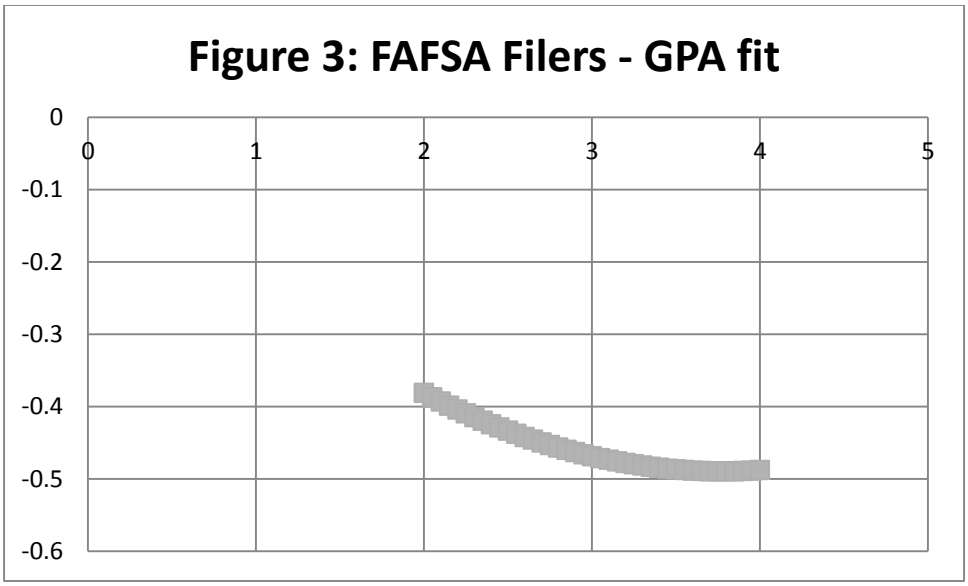
Table 5: FAFSA Filers – Question #1 - Institutional Financial Awards

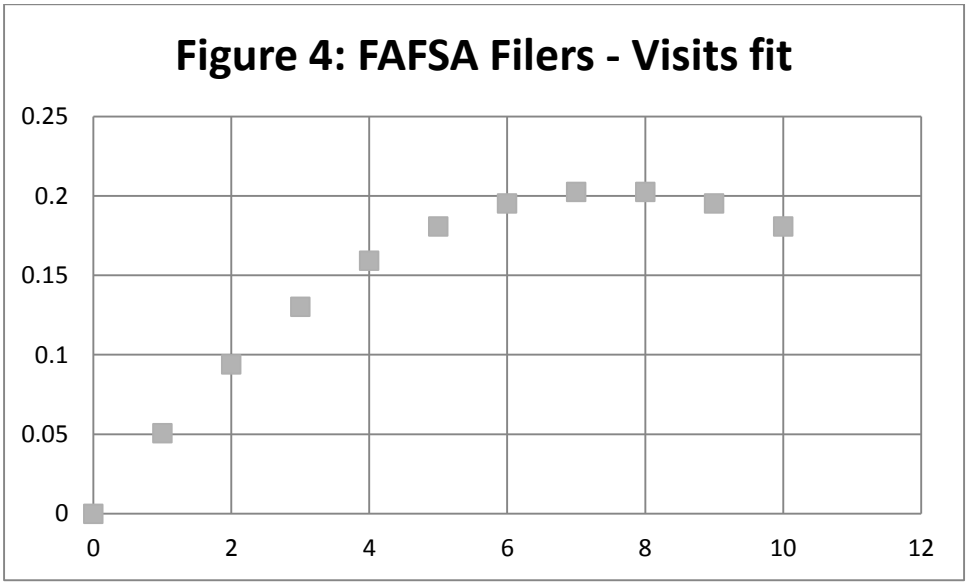
VARIABLES	(1) FAFSA-4years-Q1	(2) FAFSA-FA08-Q1	(3) FAFSA-FA09-Q1	(4) FAFSA-FA10-Q1	(5) FAFSA-FA11-Q1
GPA	-0.25904**	0.09822	-0.41436**	-0.13555	-0.18520
	(0.108)	(0.308)	(0.178)	(0.150)	(0.288)
GPA2	0.03429**	-0.00785	0.04324	0.02019	0.03363
	(0.015)	(0.046)	(0.028)	(0.021)	(0.039)
CurricRating	-0.00023	0.00220	0.00916	-0.00304	-0.00791
	(0.004)	(0.011)	(0.007)	(0.005)	(0.009)
CurricRating2	-0.00022	-0.00016	-0.00107**	-0.00005	0.00043
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)
InstMeritAward_th	0.00406***	-0.00088	0.01002***	0.00129	0.00184
	(0.001)	(0.005)	(0.003)	(0.002)	(0.003)
InstNeedGrant_th	0.01030***	0.01499***	0.00464*	0.00221	0.01798***
	(0.001)	(0.003)	(0.003)	(0.002)	(0.006)
FedGrant_th	0.00205	-0.00115	-0.00097	-0.00110	0.01258***
	(0.001)	(0.004)	(0.002)	(0.002)	(0.004)
WorkStudy	-0.00004***	-0.00004***	-0.00005***	-0.00004***	-0.00002*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
FedLoans_th	0.02729***	0.03701***	0.02529***	0.02175***	0.02942***
	(0.002)	(0.006)	(0.003)	(0.002)	(0.004)
StateGrant_th	0.00518***	0.00361	0.00298	0.00542***	0.00576**
	(0.001)	(0.003)	(0.002)	(0.002)	(0.002)
Male	0.00515	-0.00915	0.01130	-0.00932	0.03582***
	(0.005)	(0.013)	(0.009)	(0.007)	(0.013)
Minority	-0.00541	0.00328	-0.01110	0.00846	-0.01420
	(0.006)	(0.018)	(0.010)	(0.009)	(0.012)
Commuter	0.06281***	0.06832	0.02199	0.05407**	0.08767***
	(0.016)	(0.044)	(0.026)	(0.024)	(0.030)
OutState	-0.02263***	-0.01771	-0.03485***	-0.02411**	-0.00169
	(0.006)	(0.014)	(0.010)	(0.009)	(0.015)
FMneed_th	-0.00083***	-0.00244***	0.00030	0.00116***	-0.00340***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)
Early Decision (ED)	0.33711***	0.49087***	0.65546***	0.06309	0.39041***
	(0.058)	(0.189)	(0.179)	(0.059)	(0.086)
Visits	0.05430***	0.04869***	0.04347***	0.05101***	0.06573***
	(0.004)	(0.009)	(0.007)	(0.007)	(0.009)
Visits2	-0.00362***	-0.00223	-0.00289**	-0.00547***	-0.00360**
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Appeal Letter (AL)	0.14180***		0.14109***	0.16048***	0.20394***
	(0.020)		(0.040)	(0.039)	(0.043)
AppealOffered_th	0.01152***	0.02088***	0.00526*	-0.00019	0.00442
	(0.002)	(0.004)	(0.003)	(0.005)	(0.012)
FAFSA_Top3	0.05778***	0.06485***	0.04160***	0.02945***	0.08513***
	(0.006)	(0.014)	(0.011)	(0.009)	(0.013)

HON	-0.01143		0.00987	-0.00168	-0.05744***
	(0.010)		(0.018)	(0.017)	(0.014)
CVL	-0.00907		0.00248	0.01326	-0.02515
	(0.016)		(0.038)	(0.024)	(0.029)
FA09	-0.03124***				
	(0.007)				
FA10	-0.04044***				
	(0.007)				
FA11	-0.03475***				
	(0.007)				
Observations	9,480	1,858	2,476	2,833	2,313
PseudoR-squared	0.323	0.315	0.405	0.341	0.301

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results for the squared terms for FAFSA filers in this set of regressions are very similar to those for the Non FAFSA filers. For the output using all four years of data, both the GPA and Visits terms are jointly significant with their respective squared terms. (chi2 = 6.29, prob > Chi2 = 0.043 and chi2=510.79, prob > chi2 = 0.0000) Demonstrated in Figure 3 and Figure 4 below, the GPA bottoms out at about 3. 7 and visits peak at about 8.





Found in Tables 6 and 7, the next set of output addresses the second research question: do students who choose to submit standardized test scores matriculate at significantly different rates than those that withhold scores instead? In order to test for this I include a dummy variable (*ScoreNon-Submitter*) that equals one for admitted

students who decide to withhold their standardized test scores and zero otherwise. I had anticipated finding a statistically significant and positive relationship between this variable and the likelihood on enrollment, supposing that students who don't submit scores have fewer options. The only year I find a significant result for non FAFSA filers is for Fall 2010, where admitted students utilizing the test optional opportunity are 0.03 points higher than that for students who submit standardized scores, ceteris paribus ($p<0.01$).

When comparing these results to the non-filer group in the first set of output, there are no major changes to address. There is minimal, negative, statistical significance for institutional merit awards for Fall 2011. There are similar signs and magnitudes for commuters, early decision students, those that file appeals, and minority students. The same stands for high school GPA and visiting campus. The curve for GPA bottoms out at a similar point and visits peak at a similar point. Furthermore, other than the slight increase in pseudo R-square for Fall 2010 from 0.278 to 0.293, which reflects the significant findings of *ScoreNonSubmitter* for that year, there is little change in explanatory power to any of the models.

Table 6: Non FAFSA Filers – Question #2 – Test Optional

VARIABLES	(1) NonFAFSA-4years-Q2	(2) NonFAFSA-FA08-Q2	(3) NonFAFSA-FA09-Q2	(4) NonFAFSA-FA10-Q2	(5) NonFAFSA-FA11-Q2
GPA	-0.29649***	-0.53380**	-0.18269	-0.16391	0.28381
	(0.089)	(0.219)	(0.170)	(0.117)	(0.281)
GPA2	0.04263***	0.06470*	0.02423	0.02195	-0.01764
	(0.014)	(0.034)	(0.029)	(0.017)	(0.039)
CurricRating	-0.00127	-0.00746	0.00579	-0.00242	0.00806
	(0.004)	(0.010)	(0.009)	(0.005)	(0.010)
CurricRating2	-0.00000	0.00012	-0.00071	0.00016	-0.00036
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)
Score Non-Submitter	0.00573	-0.01765	-0.00724	0.03082**	0.01376
	(0.007)	(0.011)	(0.010)	(0.015)	(0.015)
InstMeritAward_th	-0.00061	0.00542	-0.00162	0.00064	-0.01008***
	(0.001)	(0.004)	(0.003)	(0.002)	(0.003)
Male	0.00895*	0.00665	0.00961	0.00863	0.00981
	(0.005)	(0.011)	(0.011)	(0.008)	(0.012)
Minority	-0.01635***	-0.03961***	-0.02279**	-0.00568	-0.00225
	(0.006)	(0.010)	(0.011)	(0.009)	(0.012)
Commuter	0.07683***	0.05123	0.13873**	0.05726*	0.06055
	(0.023)	(0.047)	(0.065)	(0.032)	(0.039)
OutState	-0.01989***	-0.01546	-0.01397	-0.02091**	-0.00949
	(0.006)	(0.012)	(0.011)	(0.009)	(0.012)
Early Decision (ED)	0.54061***	0.60060**	0.74808***	0.34931*	0.50772***
	(0.105)	(0.300)	(0.176)	(0.199)	(0.173)
Visits	0.03759***	0.03661***	0.03301***	0.03510***	0.02758***
	(0.004)	(0.009)	(0.007)	(0.007)	(0.009)
Visits2	-0.00306***	-0.00160	-0.00265*	-0.00443***	-0.00145
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Appeal Letter (AL)	0.27738*		0.40593*	0.11878	
	(0.151)		(0.213)	(0.211)	
AppealOffered_th	0.01315	0.01460			
	(0.011)	(0.012)			
HON	-0.01588		-0.00310	-0.00108	-0.02683**
	(0.010)		(0.028)	(0.016)	(0.013)
CVL	0.18342			0.56482**	0.04219
	(0.128)			(0.260)	(0.176)
FA09	-0.00657				
	(0.006)				
FA10	-0.01492**				
	(0.006)				
FA11	-0.00390				
	(0.007)				
Observations	4,818	1,175	1,335	1,356	948

PseudoR-squared	0.229	0.251	0.262	0.293	0.218

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Demonstrated in Table 7 below, when all four years of data are combined, FAFSA filing admitted students who withhold test scores, have a 0.039 points higher probability of enrolling at the institution when compared to a test score submitter with the same characteristics ($p<0.01$). Statistically significant results for this variable and comparable magnitudes of the probability difference ranging between 0.038 and 0.065 hold across the years individually, except for Fall 2010, which is the year that non-filers demonstrated statistical significance. Overall, results suggest that admitted non-score submitters are more likely to enroll at this university, holding all else constant. [14]

As with the non-filing group in this set of output, results for the FAFSA filing group tend to hold across other variables as well. For example, the same direction and magnitude hold for variables like commuter, early decision applicants, students who file a letter of appeal, students with financial need, and those that receive federal loans. The same is true for student GPA and numbers of visits to campus, with similar peaks and valleys on squared terms. Slight improvements to the pseudo R-square are demonstrated within the FAFSA filing group for these regressions, which now range from 0.31 to 0.414 depending on the year.

[14] Similar coefficients on the test score variable hold even if financial aid variables are left out of the regression, suggesting those variables are not driving the results.

Table 7: FAFSA Filers – Question #2 - Test Optional

VARIABLES	(1) FAFSA-4years-Q2	(2) FAFSA-FA08-Q2	(3) FAFSA-FA09-Q2	(4) FAFSA-FA10-Q2	(5) FAFSA-FA11-Q2
GPA	-0.27417**	0.08389	-0.41658**	-0.14273	-0.16138
	(0.107)	(0.307)	(0.173)	(0.151)	(0.283)
GPA2	0.03688**	-0.00646	0.04496*	0.02129	0.03110
	(0.015)	(0.046)	(0.027)	(0.021)	(0.039)
CurricRating	0.00133	0.00376	0.01169	-0.00273	-0.00649
	(0.004)	(0.011)	(0.007)	(0.005)	(0.009)
CurricRating2	-0.00027	-0.00022	-0.00117**	-0.00006	0.00045
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Score Non-Submitter	0.03931***	0.03758**	0.04660***	0.00589	0.06471***
	(0.007)	(0.018)	(0.013)	(0.009)	(0.017)
InstMeritAward_th	0.00421***	-0.00028	0.00990***	0.00132	0.00185
	(0.001)	(0.005)	(0.003)	(0.002)	(0.003)
InstNeedGrant_th	0.01010***	0.01479***	0.00474*	0.00219	0.01741***
	(0.001)	(0.003)	(0.003)	(0.002)	(0.006)
FedGrant_th	0.00162	-0.00160	-0.00102	-0.00115	0.01098***
	(0.001)	(0.004)	(0.002)	(0.002)	(0.004)
WorkStudy	-0.00004***	-0.00004***	-0.00005***	-0.00004***	-0.00002
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
FedLoans_th	0.02710***	0.03694***	0.02478***	0.02174***	0.02896***
	(0.002)	(0.005)	(0.003)	(0.002)	(0.004)
StateGrant_th	0.00524***	0.00363	0.00305*	0.00545***	0.00595**
	(0.001)	(0.003)	(0.002)	(0.002)	(0.002)
Male	0.00820	-0.00556	0.01546*	-0.00906	0.04082***
	(0.005)	(0.013)	(0.009)	(0.007)	(0.013)
Minority	-0.00973*	-0.00091	-0.01478	0.00757	-0.02113*
	(0.006)	(0.018)	(0.009)	(0.009)	(0.012)
Commuter	0.06145***	0.06203	0.02419	0.05326**	0.09086***
	(0.015)	(0.043)	(0.026)	(0.024)	(0.030)
OutState	-0.02241***	-0.01726	-0.03321***	-0.02425***	-0.00180
	(0.006)	(0.014)	(0.010)	(0.009)	(0.015)
FMneed_th	-0.00086***	-0.00242***	0.00015	0.00115***	-0.00336***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)
Early Decision (ED)	0.31807***	0.47702**	0.61840***	0.06192	0.36310***
	(0.057)	(0.193)	(0.186)	(0.058)	(0.085)
Visits	0.05272***	0.04695***	0.04159***	0.05078***	0.06351***
	(0.004)	(0.009)	(0.007)	(0.007)	(0.009)
Visits2	-0.00348***	-0.00211	-0.00278**	-0.00544***	-0.00341**
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Appeal Letter (AL)	0.13667***		0.13674***	0.15910***	0.19051***
	(0.020)		(0.039)	(0.039)	(0.042)
AppealOffered_th	0.01180***	0.02089***	0.00522*	-0.00003	0.00762
	(0.002)	(0.003)	(0.003)	(0.005)	(0.012)

FAFSA_Top3	0.05800***	0.06521***	0.03958***	0.02971***	0.08576***
	(0.006)	(0.014)	(0.010)	(0.009)	(0.013)
HON	-0.01095		0.00936	-0.00157	-0.05821***
	(0.010)		(0.017)	(0.017)	(0.013)
CVL	-0.00940		0.00274	0.01286	-0.02011
	(0.015)		(0.037)	(0.024)	(0.030)
FA09	-0.03178***				
	(0.007)				
FA10	-0.03911***				
	(0.007)				
FA11	-0.03495***				
	(0.007)				
Observations	9,480	1,858	2,476	2,833	2,313
PseudoR-squared	0.328	0.318	0.414	0.341	0.310

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The third and final research question of this study asks whether institutional financial aid awards and the test optional decision interact with one another. More specifically, do students who withhold their scores react more strongly to institutional aid awards? In this study, finding a significant coefficient on the interaction term between the dummy variable *ScoreNonSubmitter* and continuous variable *InstMeritAward*, would suggest that the combination of the two variables has a different effect on the decision to enroll than each of the variables alone. Furthermore, if the coefficient on the interaction term *SNS_InstMeritAward* is found to be jointly significant with the two stand-alone variables, the slope of the line representing institutional merit awards and the probability of enrollment is different for score non-submitters and standardized test score submitters. The same could be true for the interaction between score non-submitter and institutional need grant awards.

Results for non FAFSA filers and FAFSA filers can be found in Table 8 and Table 9 below. For non FAFSA filing admitted students, joint significance tests show statistical significance between *ScoreNonSubmitter, InstMeritAward*, and the interaction between the two for Fall 2010 and Fall 2011. (chi2 = 8.26, prob > chi2 = 0.041 and chi2=17.77, prob > chi2 = 0.0005). The most interesting outcome is for Fall 2011. Students who chose to submit scores that year, and have a zero value for the *ScoreNonSubmitter* variable, had a negative response to merit aid. More specifically, non FAFSA filing admitted students who chose to submit test scores in Fall 2011 have a negative 0.009 probability of enrolling when they received an additional $1,000 in merit money ($p<0.01$).[15] Students who withhold scores on the other hand, had a 0.03897 probability of enrolling with an additional $1,000 in merit money because the three coefficients in question combine:

0.05107 ScoreNonSubmitter - 0.00911 InstMeritAward - 0.00299 SNS_InstMeritAward = 0.03897

This is not only a statistically significant outcome, but an important finding in the world of college admissions and test optional policies. Students who chose to withhold their standardized test scores in this year reacted positively to incremental changes in their merit awards when their peers that submitted scores do not. Furthermore, there is an order of magnitude difference in the level of their reactions (negative 0.009 compared to positive 0.03897). This suggests that for non FAFSA filers, institutional merit dollars

[15] The interaction term falls out in this interpretation because the score non-submitter variable equals zero for score submitters.

have a better chance of influencing a score withholder's decision to enroll at the institution, and in a much larger way when compared to a similar student who submitted test scores instead. There appears to be an inherently different way in which test score submitters and non-submitters behave when considering merit awards and their enrollment decision.

To give further emphasis on the magnitude of this finding, compare the 0.03897 result to an incremental change in the number of times a student visits campus in Fall 2011 in Table 8 below. When combining the two visit coefficients (0.02676-0.00215=0.02551), it can be seen that an increase of $1,000 in merit money to a test score withholder does more to increase the student's probability of enrollment than an additional visit to campus. Admissions professionals who anecdotally know the impact a visit to campus can have on a student's decision to enroll will be impressed by this statistical finding.

Table 8: Non FAFSA Filers – Question #3 – Interacting Institutional Aid and Test Optional

VARIABLES	(1) NonFAFSA-4years-Q3	(2) NonFAFSA-FA08-Q3	(3) NonFAFSA-FA09-Q3	(4) NonFAFSA-FA10-Q3	(5) NonFAFSA-FA11-Q3
GPA	-0.28217***	-0.53027**	-0.11845	-0.16399	0.32005
	(0.089)	(0.219)	(0.165)	(0.117)	(0.281)
GPA2	0.04020***	0.06404*	0.01397	0.02196	-0.02358
	(0.014)	(0.034)	(0.028)	(0.017)	(0.039)
CurricRating	-0.00107	-0.00734	0.00568	-0.00242	0.00904
	(0.004)	(0.010)	(0.009)	(0.005)	(0.010)
CurricRating2	-0.00002	0.00011	-0.00070	0.00016	-0.00043
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)
Score Non-Submitter	0.02751*	-0.00829	0.03618	0.03107	0.05107
	(0.015)	(0.029)	(0.032)	(0.026)	(0.034)
InstMeritAward_th	-0.00006	0.00562	-0.00036	0.00064	-0.00911***
	(0.001)	(0.004)	(0.003)	(0.002)	(0.003)
SNS_InstMeritAward_th	-0.00192*	-0.00118	-0.00481*	-0.00001	-0.00299*
	(0.001)	(0.003)	(0.002)	(0.001)	(0.002)
Male	0.00975*	0.00685	0.01056	0.00864	0.01186
	(0.005)	(0.011)	(0.010)	(0.008)	(0.012)
Minority	-0.01585***	-0.03919***	-0.02166**	-0.00568	-0.00068
	(0.006)	(0.010)	(0.011)	(0.009)	(0.012)
Commuter	0.07736***	0.05031	0.14449**	0.05730*	0.05837
	(0.023)	(0.047)	(0.066)	(0.032)	(0.038)
OutState	-0.01931***	-0.01590	-0.01189	-0.02090**	-0.00786
	(0.006)	(0.012)	(0.010)	(0.009)	(0.012)
Early Decision (ED)	0.54618***	0.59714**	0.75922***	0.34949*	0.51916***
	(0.106)	(0.299)	(0.171)	(0.200)	(0.179)
Visits	0.03729***	0.03617***	0.03221***	0.03511***	0.02676***
	(0.004)	(0.009)	(0.007)	(0.007)	(0.009)
Visits2	-0.00299***	-0.00145	-0.00262**	-0.00443***	-0.00125
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Appeal Letter (AL)	0.28019*		0.38595*	0.11905	
	(0.152)		(0.212)	(0.212)	
AppealOffered_th	0.01308	0.01472			
	(0.011)	(0.012)			
HON	-0.01756*		-0.00794	-0.00111	-0.02875**
	(0.009)		(0.024)	(0.016)	(0.011)
CVL	0.17943			0.56444**	0.03415
	(0.128)			(0.262)	(0.158)
FA09	-0.00718				
	(0.006)				
FA10	-0.01545**				
	(0.006)				

FA11	-0.00509 (0.007)				
Observations	4,818	1,175	1,335	1,356	948
PseudoR-squared	0.231	0.251	0.269	0.293	0.225

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

As with the output answering the first two research questions, FAFSA filers in the regressions in Table 9 generally demonstrate more responsiveness to institutional financial aid. Throughout nearly all of the academic years included in this study, I find joint significance in both combinations of interactions between score non-submitters and institutional merit awards as well as score non-submitters and institutional need grant awards. The only cases where the coefficients are not jointly significant are merit awards for Fall 2008 and neither merit or need awards for Fall 2010. Regression output can be found in Table 9.

Following Table 9, Table 10 below shows the sums of the three coefficients in all cases where they are jointly significant. For example, the value of 0.06436 in the top left of the chart for SNS_Merit and 4 years is the sum of three coefficients from Table 9 above: *ScoreNonSubmitter* (0.06072), *InstMeritAward* (0.00448) and their interaction *SNS_InstMeritAward* (-0.00085). When comparing the score withholding students to score submitting students within an institutional aid type, those that don't submit scores are consistently more responsive to a $1,000 increase in aid.[16]More detailed analysis follows Table 9.

[16] The only circumstance where this is not the case is Fall 2008, where only the interaction between the score non-submitting dummy variable and institutional need awards was found to be jointly significant and

Table 9: FAFSA Filers – Question #3 – Interacting Institutional Aid and Test Optional

VARIABLES	(1) FAFSA-4years-Q3	(2) FAFSA-FA08-Q3	(3) FAFSA-FA09-Q3	(4) FAFSA-FA10-Q3	(5) FAFSA-FA11-Q3
GPA	-0.26126**	0.03872	-0.36962**	-0.14105	-0.13348
	(0.108)	(0.307)	(0.175)	(0.150)	(0.286)
GPA2	0.03490**	0.00042	0.03743	0.02095	0.02715
	(0.015)	(0.046)	(0.027)	(0.021)	(0.039)
CurricRating	0.00150	0.00216	0.01220*	-0.00270	-0.00630
	(0.004)	(0.011)	(0.007)	(0.005)	(0.009)
CurricRating2	-0.00028	-0.00011	-0.00121**	-0.00006	0.00043
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Score Non-Submitter	0.06072***	-0.01373	0.09660**	0.01906	0.10239**
	(0.020)	(0.038)	(0.041)	(0.028)	(0.052)
InstMeritAward_th	0.00448***	-0.00135	0.01082***	0.00143	0.00220
	(0.001)	(0.005)	(0.003)	(0.002)	(0.003)
InstNeedGrant_th	0.01036***	0.01474***	0.00493*	0.00239	0.01773***
	(0.001)	(0.003)	(0.003)	(0.002)	(0.006)
FedGrant_th	0.00168	-0.00180	-0.00089	-0.00111	0.01108***
	(0.001)	(0.004)	(0.002)	(0.002)	(0.004)
WorkStudy	-0.00004***	-0.00004***	-0.00005***	-0.00004***	-0.00002
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
FedLoans_th	0.02712***	0.03686***	0.02474***	0.02173***	0.02916***
	(0.002)	(0.005)	(0.003)	(0.002)	(0.004)
StateGrant_th	0.00524***	0.00369	0.00312*	0.00544***	0.00594**
	(0.001)	(0.003)	(0.002)	(0.002)	(0.002)
SNS_InstMeritAward_th	-0.00085	0.00387	-0.00233	-0.00036	-0.00113
	(0.001)	(0.003)	(0.002)	(0.001)	(0.002)
SNS_InstNeedGrant_th	-0.00102	0.00056	-0.00092	-0.00105	-0.00179
	(0.001)	(0.004)	(0.002)	(0.002)	(0.004)
Male	0.00840	-0.00605	0.01592*	-0.00910	0.04137***
	(0.005)	(0.013)	(0.009)	(0.007)	(0.013)
Minority	-0.00938	-0.00191	-0.01421	0.00762	-0.02044*
	(0.006)	(0.018)	(0.009)	(0.009)	(0.012)
Commuter	0.06066***	0.06149	0.02382	0.05239**	0.09018***
	(0.015)	(0.043)	(0.026)	(0.024)	(0.030)
OutState	-0.02206***	-0.01753	-0.03173***	-0.02417***	-0.00106
	(0.006)	(0.014)	(0.010)	(0.009)	(0.015)
FMneed_th	-0.00087***	-0.00242***	0.00016	0.00115***	-0.00334***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)
Early Decision (ED)	0.31873***	0.47442**	0.62427***	0.06083	0.36606***

not the interaction with institutional merit awards. Perhaps that is the reason the result differs from the other years of output.

	(0.057)	(0.192)	(0.185)	(0.058)	(0.085)
Visits	0.05265***	0.04707***	0.04180***	0.05066***	0.06334***
	(0.004)	(0.009)	(0.007)	(0.007)	(0.009)
Visits2	-0.00348***	-0.00211	-0.00280**	-0.00542***	-0.00340**
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Appeal Letter (AL)	0.13682***		0.13713***	0.15954***	0.18945***
	(0.020)		(0.039)	(0.039)	(0.042)
AppealOffered_th	0.01178***	0.02109***	0.00525*	-0.00011	0.00808
	(0.002)	(0.004)	(0.003)	(0.005)	(0.012)
FAFSA_Top3	0.05767***	0.06542***	0.03831***	0.02960***	0.08536***
	(0.006)	(0.014)	(0.010)	(0.009)	(0.013)
HON	-0.01135		0.00705	-0.00154	-0.05817***
	(0.010)		(0.017)	(0.017)	(0.013)
CVL	-0.00964		0.00408	0.01308	-0.02132
	(0.015)		(0.038)	(0.024)	(0.030)
FA09	-0.03209***				
	(0.007)				
FA10	-0.03921***				
	(0.007)				
FA11	-0.03497***				
	(0.007)				
Observations	9,480	1,858	2,476	2,833	2,313
PseudoR-squared	0.328	0.320	0.415	0.341	0.311

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

As demonstrated in Table 10 below, for Fall 2011, FAFSA filing admitted students who withheld standardized test scores had a 0.10346 points higher probability of enrolling at the institution with an additional $1,000 in merit money, holding all else constant. This compares to 0.0022 probability of enrollment for score submitters, ceteris paribus. While the difference in direction demonstrated in the non FAFSA filing group doesn't hold for FAFSA filers, the order of magnitude continues to hold between test score submitters and non-submitters. Again, findings suggest a very strong conclusion for admissions professionals; students who withhold test scores react much more positively

to incremental changes in institutional merit awards than their peers that submit standardized test scores.

When relating this outcome to visits to campus, results continue to leave a lasting impression. Compare the Fall 2011 merit interaction outcome of 0.10436 to the combination of the two visit coefficients (0.06334-0.00340=0.05994). The impact of an additional $1,000 of institutional merit money to a student who withholds his or her standardized test scores does more to influence the probability of enrollment than nearly two campus visits. Similar findings in terms of the order of magnitude difference between score submitters and non-submitters, as well as the comparison to campus visits, can be seen for Fall 2009 and all four years of data for the interaction between test score submission and merit awards.

Students react similarly to the interaction between their test score submission category and institutional need awards as well. For example, FAFSA filing admitted students in Fall 2011 who withheld standardized test scores had a 0.11833 higher probability of enrolling at the institution with an additional $1,000 in merit money, ceteris paribus. For score submitters the probability of enrollment is 0.01773, holding all else constant. As with the merit interactions, the need interactions experience an order of magnitude difference among test score submitters and non-submitters. Results continue to send a clear message to decision makers in college admissions; students who withhold standardized test scores react much more positively to incremental changes in institutional need awards when compared to their peers that submit standardized test scores.

Table 10: FAFSA Filers – Interaction Results

	4 years	FA08	FA09	FA10	FA11
SNS_Merit	0.06436	-	0.16509	-	0.10346
SAT_Merit	0.00448	-	0.01082	-	0.0022
SNS_Need	0.07006	0.00157	0.10061	-	0.11833
SAT_Need	0.01036	0.01474	0.00493	-	0.01773

CHAPTER 5

CONCLUSIONS

Summary

The climate in college admission is more competitive than ever before, which makes understanding the factors that contribute to a student's decision to enroll at a particular institution that much more important. Changing demographics of high school graduates, tight university budgets, and increased interest from students and families about affordability all demand attention from enrollment managers. Introducing a major policy change like going test optional, or no longer requiring standardized test scores from applicants, can cause additional uncertainty and strain on university decision makers.

As a unique contribution to the literature, this study combines research on institutional financial aid variables as well as the impact of being test optional. By shedding light on how students respond to institutional aid awards, the differences in choice outcomes between students who submit standardized test scores and those that decide to withhold them, as well as the interaction between these two types of variables, this research can provide guidance to stakeholders that must decide how to allocate institutional funds to admitted students in order to enroll a class of incoming freshmen that fit the University's goals without harming institutional revenue.

Following the extensive college choice literature, I control for academic preparedness characteristics like high school GPA and curriculum ratings, as well as financial aid variables like institutional merit awards, institutional need grants, federal

grants, and federal loans. I also control for student and family characteristics like gender, ethnicity, the student's intention to live on or off campus, whether the student lives in or out of state, and financial need, and finally include student interest variables like the timing of application and number of visits to campus during the recruitment period.

Overall, findings show that admitted students who choose to withhold standardized test scores are more likely to enroll at the college. When all four years of data are combined, the probability for FAFSA filing admitted students who do not submit scores is 0.039 points higher than it is for test score submitters with the same characteristics ($p<0.01$). Statistically significant results for this variable and comparable coefficients ranging between 0.04 and 0.06 hold across the years individually, except for Fall 2010, which is the year that non-filers demonstrated statistical significance.

Admitted students that file a FAFSA positively respond to both merit based and need based institutional aid, meaning that the more institutional money they are awarded, the more likely they are to enroll, ceteris paribus. For example, holding all else constant, when FAFSA filing admitted students between Fall 2008 and Fall 2011 are awarded an additional $1,000 of need based institutional money, it increased the probability of enrollment by 0.01 ($p<0.01$). When considering the same scenario for institutional merit based aid, an increase of $1,000 increased the probability by 0.004 ($p<0.01$).

When the interaction terms between the categorical test optional policy variable and the continuous institutional aid variables are included, results show that score withholding students respond more strongly to a $1,000 increase in institutional aid. More specifically, in Fall 2011, non FAFSA filing admitted students who chose to submit test scores had a negative 0.009 probability of enrolling when they received an additional

$1,000 in merit money ($p<0.01$), suggesting that the most highly qualified students chose the enroll at other institutions. Score non-submitters on the other hand, had a 0.03897 probability of enrolling with an additional $1,000. This is an important finding for stakeholders interested in test optional policies and suggests that non FAFSA filing students who withhold their standardized test scores can be influenced with an incremental increase in merit awards in a much stronger way than their comparable peers who submit test scores instead. For this particular group of students, an additional $1,000 in merit money could influence their decision to enroll more strongly than an additional visit to campus, something that admissions professionals know tend to help students arrive at their decision to enroll.

These results hold for FAFSA filing students as well, except both the score submitters and non-submitters are more likely to enroll with additional institutional merit or need based money. For example, in Fall 2011 with an additional $1,000 in merit aid, the probability of enrollment for FAFSA filing score submitters is 0.0022, while the probability for those that withhold scores 0.10346, holding all else constant. For need based aid, admitted students in Fall 2011 who withheld test scores but filed a FAFSA, had a 0.11833 probability of enrolling at the institution with an additional $1,000 in need based institutional money, ceteris paribus. For score submitters the probability of enrollment is 0.01773, holding all else constant. Again, findings suggest a very strong conclusion; the impact of an additional $1,000 of institutional merit or institutional need based money to a FAFSA filing student who withholds standardized test scores, relative to a comparable peer that submits scores, does more to influence the probability of enrollment than nearly two campus visits.

Findings like these are extremely valuable. Understanding that students who withhold test scores face college choice decisions differently than their test score submitting peers adds understanding to a group of students that hasn't been studied much. Detailed information discovered in this study suggests that once a student that withholds his or her standardized test scores is admitted at the institution, he or she is more likely to attend when compared to a similar student that chooses to submit standardized scores. Furthermore, that student is likely to respond more strongly to changes in financial aid packages. While results like these are promising, there is always more than can be analyzed, especially in an area that is continuing to develop, like the world of test optional admissions.

Implications for Future Research

Beyond the limitations discussed earlier including unobserved variables such a student legacy status, student involvement in high school extracurricular activities, directly controlling for the number of family members in college, and utilizing zip code in order to investigate the relationship between precise measurement of distance from campus and the probability of enrollment, further analysis related to financial aid, college enrollment, and the test optional movement can be and should be conducted.

For further work directly related to this study, future research may want to examine the relationship between a student's need gap, rather than the actual award amounts the student was offered. In other words, the researcher could control for the ratio of gift aid relative to tuition instead of controlling for straight dollar amount of merit or need based aid. Researchers could also expand upon this study by examining whether or

not results of the interaction findings vary by income or race. For example, do wealthier non-test score submitting students react differently to an increase in aid when compared to less wealthy non-test score submitting students? Do these results differ for minority students?

Beyond direct work with the dataset utilized in this study, nearly all institutions could benefit from an individualized study on their own admitted student college choice behavior. Braunstein, McGrath & Pescatrice (1999) suggest that at the end of each academic year representatives from institutional research, admissions, and financial aid get together to analyze the role of financial aid in the most recent conversion effort. It is necessary to continually analyze this because the results of strategic leveraging of financial aid may vary over time and is especially critical for tuition driven institutions.

Outside replicating an existing study in multiple different institutions, different ways of measuring the impact of finances on enrollment decisions can be expanded. Some evidence exists that families capable of saving for college have not saved enough by the time their children are ready to enroll in college (Day, 1997). In cases like these, it would be interesting to study the impacts of financial planning on these families. Perhaps an intervention during the predisposition phase could follow the student through the rest of the college choice steps. Of course rich data, following the student and family for a number of years, would be needed to complete a study such as this one.

Also related to finances, enrollment managers and financial aid officers are increasingly finding the need to negotiate packages with families (Asinof, 1997). Many institutions offer a formal appeal process, where students and families submit a letter describing their financial circumstances and why they should receive additional

scholarship money from the university. While this study controlled for the submission of an appeal letter and appeal award amounts if granted, a more thorough need exists for a study that measures the impacts of these appeals for additional funds from the institution. Do students who appeal to the institution for more money enroll at higher rates than those that do not? Do the effects vary by socioeconomic status, financial need, levels of merit money awarded, or race?

It would also be beneficial to the understanding of financial aid and enrollment behavior to have more studies with randomly awarded scholarships like the study by Monks (2009). Studies such as the one by Monks, with awards that have been randomly assigned, are the gold standard in measuring student behavior without the necessary caveat that merit awards and need based grants are not randomly awarded and are therefore not exogenous. If more enrollment managers and institutional policy makers ran experiments with awarding, researchers could have a more thorough understanding of the effects of the awards.

Studies of student choice could also expand beyond the enrollment phase of the process. For example, Paulsen and St. John (1997) as well as St. John, Paulsen, and Starkey (1996) promote the study of college choice well beyond enrollment, including choice of major, persistence to graduation, and choosing to attend graduate school. Researchers could follow the effects of financial aid through all of these phases, as well as measure the differences between test score submitters and non-submitters.

Finally, in order to truly understand the three well known steps of college choice, as well as additional decisions beyond enrollment such as persistence, graduation, and enrollment in graduate school, better student level data is required. A national level

dataset, which follows students, families and teachers from middle school through graduate school or first position of full time employment, that includes detailed information of stop outs, drop outs, and transfers between schools, would significantly broaden the scope of the studies researchers can conduct. The recent political discussion of the potential "unit record" database administered by the Education Department would be a step in the right direction for policy makers (Nelson, 2013).

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