Essays on the Economics of Student Financial Aid

by

Michael S. Kofoed

(Under the Direction of David B. Mustard)

Abstract

American higher education faces challenges with affordability given the recent volatility of endowments in the stock market and declining state subsidies. Given these circumstances, student financial aid has become an integral part of how students make college choices and whether they persist to graduation. This dissertation focuses on how scarce financial aid resources are distributed given student and institutional characteristics. In Chapter 1, I study the how financial aid is allocated in the ever-expanding for-profit higher education industry compared to traditional colleges. Chapter 2 focuses on which characteristics influence a current college student's decision to complete FAFSA and how much aid a non-applicant forgoes. Chapter 3 investigates how the amounts and sources of a student's financial aid package changes with fluctuations in the business cycle. These chapters should help economists and policy makers better understand how colleges distribute aid and the impacts it has on the cost of higher education.

Index words: Economics of Higher Education; For-Profit Higher Education, Student Financial Aid, Price Discrimination, FAFSA Completion; Business Cycle Fluctuations, Labor Market Conditions, Federal and State Public Finance.

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My desire to study higher education originated during a year working as an intern under Brad Mortensen, Vice President of University Advancement at Weber State University. Brad gave me an excellent opportunity to interact with college administrators

and state legislators that inspired me to apply economics to issues in higher education. This experience allowed me to "hit the ground running" when I got to UGA.

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Chapter 1

For-Profit and Traditional Colleges: Institutional Control and Financial Aid Allocation

1.1 Introduction

Policymakers and education experts have long debated the implications of the growth of the for-profit education sector. Some argue that for-profit schools are more flexible for working, non-traditional students who might otherwise not obtain any higher education (Christensen and Eyring 2011, pp. 351). While others criticize the for-profit sector for high tuition prices, allegedly low quality of education, and deceptive recruiting practices especially among military veterans (Helderman 2012).

Despite the debate surrounding for-profit colleges, little theoretical or empirical research analyzes this sector. Research focuses mainly on labor market outcomes of for-profit students.[1] Becker's (1964) model of human capital investment predicts that

[1]The results from these studies are mixed. Deming, Goldin, and Katz (2012) find that graduates from for-profit universities default on student loans at higher rates, are less likely to find employment, and earn

students will not only consider the potential benefits of education, but costs as well. This study focuses on the differences in net prices between the for-profit and traditional sectors charged to the student as a result of price discrimination[2] via financial aid[3] allocation. My paper's main contributions are that, first, I developed a theoretical framework that models how for-profit universities compete with traditional universities by offering financial aid and, second, I test the implications from the model using data from the National Postsecondary Student Aid Study. As an additional contribution to the financial aid literature I control for self-selection of students into institution type and adjust the estimated coefficients for the skewness of the data by estimating an exponential non-linear least squares model combined with a polychotomous choice model. I find that estimates that neglect self-selection underestimate the effect of observables on financial aid allocation while not correcting for the non-linear data overestimates the effect of these observables on financial aid.

This study contributes I model how for-profit and traditional universities compete for students using financial aid in a two stage game. In the first stage, a university's governing board (e.g. board of trustees, state legislature, or board of regents, etc.) sets a "sticker price" tuition that all students must pay regardless of personal characteristics or welfare concerns. In the second stage, an admissions or scholarship committee receives the "sticker" tuition and allocates financial aid given the student's academic and personal characteristics in accordance with the university's objective function. I assume that for-profit universities maximize profits while traditional universities maximize social welfare given a budget constraint. The model predicts that as a university exhibits a higher degree

less than comparable students. Cellini and Chaudhary (2012) and Lang and Weinstein (2012) however, find that for-profit students earn incomes comparable to community college graduates.

[2]Price discrimination is defined in the industrial organization literature as charging different consumers different prices for the same good based on observable characteristics.

[3]Financial aid allocation is an important question within the economics of higher education because student aid affects a number of education outcomes including the decision to matriculate into college (Leslie and Brinkman 1987; Van der Klaauw 2003) and persistence to graduation (Bettinger 2004).

of profit maximizing behavior, the net price that the student pays increases while the amount of financial aid decreases. This result implies that students at for-profit universities will pay more out of pocket then their peers at a traditional private or public institutions. Also, as the student's price elasticity of demand increases, for-profit universities will increase the amount of financial aid to compete against traditional institutions.

I then test the predictions from the theoretical model using data from the 2003-2004 and 2007-2008 waves of the National Postsecondary Student Aid Study (NPSAS). I selected these two waves because there are more for-profit universities present because of the rapid growth of the sector. The NPSAS contains a nationally representative sample of students attending Title IV eligible institutions across sectors. I consider how universities allocate various types of financial aid including institutional aid, Pell Grants, and student loans conditional on a given student's personal and academic characteristics. There are two empirical issues, that I overcome in my estimations. First, I use a polychotomous discrete choice selectivity model proposed by Lee (1983) to correct for the self-selection of students into types of institutions. Second, I combine the self-selection routine with an exponential regression to correct for the large number of students who receive no financial aid. I find that students at for-profit universities receive $1,361.95 less in institutional aid, $171.36 more in subsidized student loans, and $1,286.13 in unsubsidized student loans than comparable students at a private, non-profit university. These results imply that students at for-profit universities pay $3,002.39 annually out of pocket than if they would have attended a traditional university.

Studies regarding for-profit universities focus primarily on how financial aid programs contribute to the growth of for-profit universities and generally use institution instead of student level data. Cellini (2010) and Cellini and Goldin (2012) find that increasing amounts of federal aid encourages for-profit universities to enter the market since these funds can be used at any Title IV institution. Cellini (2009) finds however that

as funding for community colleges increases, many students substituted away from for-profit universities.

Turner (2012), however, does use student level data from the NPSAS to compare financial aid allocation using a regression kink method. The author uses this technique to compare students slightly below and above the Pell Grant eligibility cutoff and compares how different types of institutions alter the amount of institutional aid that Pell Grant recipients receive to increase revenues. She finds that for-profit universities' strategic behavior is no different from non-selective traditional universities, which is intuitive because the Federal Government only considers financial need, not institutional control when allocating Pell Grants. However, this result may not hold for other types of aid such as institutionally funded grants. Also these results only apply to Pell Grant recipients and not all students. My study differs because I not only examine Pell Grants but how student loans, institutional need, and net prices differ between the two sectors.

The remainder of the paper is organized as follows. Section 2 describes both the history and growth of the for-profit higher education sector. Section 3 presents the theoretical model that describes differences in financial aid and price discrimination. Section 4 describes the data. Section 5 presents the empirical models, Section 6 discusses the empirical results, and Section 7 concludes.

1.2 For-Profit Higher Education

1.2.1 Brief History of For-Profit Higher Education

For-profit higher education is not new and has historically not been as controversial as in recent decades. The first example of higher education in the United States was the College at Henrico that was founded in 1617 in the colony of Virginia. In Europe, for-profit higher education has existed since 1494 to teach double column bookkeeping (Kinser 2006, pp.

13). For-profit colleges generally were confined to teaching technical and business subjects while liberal arts, medicine, and the sciences were generally reserved for more prestigious, non-profit universities.

One of the largest expansions of role of the federal government funding higher education occurred in 1862 when Congress passed the Morill Land Grant College Act (Thelin, 2004, pp. 104). While Congress had previously assisted states to create colleges, this bill allocated federal lands to fund one college per Representative in the state's delegation. Along with classical languages and philosophy (the prevailing subjects of the day), the curriculum at these new colleges focused on agricultural and mechanical education.

With the introduction of agricultural and mechanical curriculum into higher education, other vocational and business subjects began to appear on traditional campuses as well. In 1881, the departments of history, government, and economics at the University of Pennsylvania petitioned to join the College of Liberal Arts and were rejected. These departments, along with other subjects, formed the Wharton School of Business which provided the first undergraduate business education on a university campus. In 1908, Harvard created the Graduate School of Business and introduced a new degree called the Master of Business Administration (Watson, 2001, pp. 79).

This change in the curriculum in the traditional sector of higher education and the passage of new compulsory secondary schooling laws meant that students could receive similar training from a for-profit colleges but now coupled with the prestige of attending a prestigious private or public university such as Harvard (Kisner 2006, pp. 20). In response, for-profit universities adjusted their curriculum, making it more practical and focused on recruiting students in industrial, manufacturing, and cosmetology vocations.

The for-profit sector has re-surged during the last twenty years. Among the most well-known for-profit institutions is the University of Phoenix (UOP). Founded in 1976 by

John Sperling, UOP avoided many of the traditional aspects of higher education including the academic school year, academic rank and tenure, and the need for students to relocate to a physical campus. These adjustments (particularly the lack of the traditional academic calendar) are appealing to many working professionals because it allowed them to more easily balance work and family commitments with academic pursuits. Also by hiring primarily professionals in the business world to serve as adjunct faculty, UOP claims to deliver more "practical" education at a significantly lower marginal cost (Breneman 2006). UOP has also become a pioneer in online education. Previously students were required to meet at an UOP building at least one weekend a month, but with the advent of the Internet, UOP can serve students anywhere (Breneman 2006).

While the for-profit model may not serve all students well, they have the potential to serve those who are on the margin between choosing higher education and participating in the workforce directly after high school. Christensen and Eyring (2011) suggest that the for-profit model may threaten traditional higher education if for-profit universities provide comparable education outcomes at a lower marginal cost. While the for-profit sector still has considerable room for improvement regarding outcomes, Christensen and Eyring claim that new technologies may close the gap between the sectors and future for-profit universities may become serious competitors to even the most prestigious traditional colleges.

1.2.2 Trends in the For-Profit Sector

The for-profit sector has seen rapid growth during the past two decades. Figure 1.1 plots the percentage of students who matriculated into each of the three sectors from 1990 to 2011. During the last two decades, the share of students who have attended private, non-profit institutions remained relatively constant around 19 percent, while students who attend public colleges decreased from almost 80 percent to 71 percent. The growth of the

for-profit sector is quite striking. The share of students attending for-profit universities in 1990 was negligible, but during the last twenty years, this share has grown from around one percent to ten percent of all college students.

In addition to the increased share of enrollment, the number of students who graduate from a for-profit university has also increased. The highest number of degrees granted by for-profit universities are Associate's degrees. The number of Associate's degrees granted by a for-profit increased from 70,150 in 2000 to 162,66 for an increase of 131.88 percent compared to 42.74 and 0.73 percent growth in the public and private sectors respectively. For-profit universities have also expanded the number of Bachelor's degrees awarded at their institutions by 387.45 percent compared to 29.38 percent and 23.64 percent in the public and private sectors.

While not the focus of this study, the number of graduate degrees conferred by for-profit institutions has also increased. The number of Master's degrees (primarily MBA and M.Ed.) increased by 587.53 percent compared to 32.52 and 43.01 percent in the public and private sectors. The number of doctoral degrees also increased by 315.96 percent compared to 29.88 and 31.93 percent in the public and private sectors. The percentage change in graduate degrees appears to be quite large, but may be because for-profit universities granted in 1,109 doctoral degrees in 2000 compared to 60,655 and 56,972 by public and private universities. The majority of these graduate degrees are applied in nature and focus on business, health care, and education fields.

Figure 1.2 plots the average tuition price for the three different sectors from 2003-2012. The average price at a for-profit university is greater than public universities, but less than traditional non-profit colleges. The average price for private non-profit and public institutions has steadily increased over the last decade, while tuition at for-profit universities have remained relatively constant; even decreasing during the last two years.

These results might be evidence of the move from traditional physical facilities to online education in the for-profit sector.

1.3 Intuitive Framework to Understand Pricing Differences Across Sectors

1.3.1 Overview of Model

When universities allocate financial aid, they are practicing third degree price discrimination,[4] however universities do have an advantage over other firms because students reveal extensive information about their willingness or ability to pay during the application process. Student characteristics such as own/parents' household income, academic ability, race, gender, and proposed major allow the university to tailor a specific price to each student. While application information is not always a perfect predictor about the student's willingness to pay, the extent of the information gives the university an advantage other classic price discriminators such as movie theaters or airlines.

Classical theories of price discrimination assume that the firm maximizes profits. While profit maximization may explain the behavior of for-profit universities, it is inadequate for the traditional higher education sector. I develop a theoretical framework to gain intuition regarding how for-profit and traditional universities allocate financial aid differently to match their respective objective functions. Figure 1.3 is a flow chart that outlines the model. Universities differ from other institutions with market power because universities first set a baseline price that represents the maximum price that a prospective

[4] The literature regarding price discrimination mostly focuses on third degree price discrimination; when a monopolist offers different prices to groups of consumers with similar characteristics and elasticities of demand for the same product. Examples of third degree price discrimination include gasoline (Shepard, 1991), automobiles (Ayers and Siegelman, 1995; Goldberg, 1996), airlines (Borenstein and Rose, 1994), and Broadway musicals (Leslie, 2004).

student could pay. This price is set by a governing board[5] that does not take into account individual student welfare but anticipates that the admissions office will later offer financial aid to students according to the school's institutional mission. Since every student is required to pay the baseline amount, if the admissions board wants to offer financial aid, then the admissions board must pay the difference between the baseline price and the individual price. I model how the governing board's behavior by assuming that they set the baseline price to compete for students in a Hotelling differentiated products framework.

In the second stage, the admissions office, who estimates willingness to pay from the student's application, offers financial aid to the student as a discount from the baseline price. The university determines financial aid by maximizing a social welfare function,[6] where profit maximization is a special case, against a budget constraint where financial aid packages must be less than or equal to the university's endowment, government subsidies, and tuition revenue. I find that as a university maximizes profits or if the university's students are more price inelastic, financial aid decreases and the net price to the student increases. Since the university incorporates the behavior of the admissions board when setting the baseline tuition, I will solve the model through backwards induction by solving the second stage first.

1.3.2 Second Stage: Out of Pocket Price by Admission Board

In the second stage, the baseline tuition rate for University j (denoted $\bar{P}_j$) is passed down from the governing body to the admissions office for implementation. The admissions office observes parents' and students' characteristics such as income, grades, or alumni status of

[5]Examples include Boards of Regents for state sponsored universities and Boards of Trustees at many private, non-profit institutions.

[6] Models of price discrimination where institutions maximize a given social welfare function against a budget constraint have been used in previous studies most notably Feldstein (1972a and 1972b), LeGrand (1975), and Steinberg and Weisbrod (2005). Fethke (2011) and Turner (2012) use similar models to describe how universities set tuition. This study is unique in that it uses two stages to describe the differences in objectives in setting the baseline tuition rate and how universities use financial aid to price discriminate.

parents that allow the institution to determine an individual student's willingness and ability to pay. The universities use this information to tailor a scholarship offer to the student.

I assume that a university maximizes the following social welfare function:

$$W_j = f(w_{ij}; u_{ij}) = \int_{i=1}^{I} w_{ij} u_{ij}(S_{ij}(P_{ij}))di \tag{1.1}$$

where w_{ij} is the weight that university j places on an individual's utility u_{ij} according to its institutional mission. The welfare weight is a function of observable characteristics such as demographics, income, and academic ability. For example, public universities may weigh the utility of in-state students greater than their out-of-state classmates or a school may offer a greater financial aid package to a poorer student than his equally meritorious (but more well off financially) peer. The student's utility function is a function of the quantity higher education consumed (S_i) and numeraire. Assume that S_{ij} is decreasing with respect to the final individual tuition price (P_{ij}) that is paid by student i to university j.

The university faces the following budget constraint:

$$\int_{i=1}^{I} ((\bar{P}_j - P_{ij})S_{ij}(P_{ij}))di \leq rE_j + G_j, \tag{1.2}$$

where $\bar{P}_j$ is the "sticker price" set by the Governing Board in the first stage. The budget constraints states that the total amount of financial aid ($\bar{P}_j - P_{ij}$) allocated to students cannot exceed the university's rate of return on endowment (rE_j), government subsidies (G_j), and tuition revenue ($P_{ij}S$).

The university's maximization problem is:

$$\max_{P_{ij}} \mathcal{L} = \int_{i=1}^{I} w_{ij} u_{ij}(S_{ij}(P_{ij}))di + \mu \left(E_j + G_j - \int_{i=1}^{I} (\bar{P}_j - P_{ij})S_{ij}(P_{ij})\ di \right). \tag{1.3}$$

The optimization problem yields the following result after rearranging the first order condition and invoking the Envelope Theorem that $\partial u_i / \partial p_{ij} = -S_{ij}$.

$$\frac{\bar{P}_j - P_{ij}}{P_{ij}} = -\left(\frac{1}{\epsilon_{ij}}\right)\frac{w_{ij} - \mu}{\mu}. \tag{1.4}$$

Equation (4) is an augmented version of the classic Lerner Index which shows the inverse relationship between the spread between price and marginal cost and the consumer's price elasticity of demand (ϵ_{ij}). The left hand side is augmented with an expression for the tradeoff between welfare weight (w_{ij}) and shadow price of tuition revenue (μ). If the university values an extra dollar of revenue at the same rate as it values the welfare of a given student, then the university will not offer any financial aid[7].

For-profit universities are a special case within the augmented Lerner Index. For-profit universities simply set $w_{ij} = 0$. Thus, for the case of for-profit universities, Equation (3) simplifies to traditional profit maximization where financial aid represents the cost of recruiting students to the university. Equation (4) will also simplify to the traditional Lerner index and the for-profit university will set financial aid such that marginal revenue is always positive and it will depend only on the student's elasticity of demand.

I then solve for P_{ij}:

$$P_{ij} = \frac{\bar{P}_j}{\xi_{ij}}, \tag{1.5}$$

[7]An alternative way of constructing the budget constraint is to consider the financial aid package as the cost of recruiting students and have a separate $P_{ij}S_{ij}(P_{ij})$ term to represent tuition revenue. The augmented learned index is thus:

$$\frac{P_{ij} - F_{ij}}{P_{ij}} = \left(\frac{1}{\epsilon_{ij}}\right)\frac{w_{ij} - 2\mu}{\mu},$$

where $F_{ij} = \bar{P}_j - P_{ij}$. This alternative specification allows the university to gain a positive marginal revenue with some students and use this extra revenue to cross-subsidize other students who the institution wishes to attract. While this cross-subsidization is quite common at prestigious universities, it is less common at community colleges and for-profit universities.

where

$$\xi_{ij} = \left(1 - \frac{w_{ij} - \mu}{\epsilon_{ij}\mu}\right) \tag{1.6}$$

I assume that the admissions board is not allowed to force the student to pay a price greater than $\bar{P}_j$. A traditional monopolist marks up the price above marginal cost until it equals the inverse of the consumer's elasticity of demand. In the case of higher education, however, the Governing Board does not allow the net price to exceed $\bar{P}_J$. Thus I assume that $\frac{(w_{ij}-\mu)}{\epsilon_{ij}\mu} > 1$.

1.3.3 First Stage: Setting the Sticker Tuition Price by Governing Board

In the first stage, I assume a traditional Hotelling linear city where students are distributed uniformly across product space of unitary distance. Two universities are located on either side of this line. University 1 is considered to be more prestigious than University 2 by all students and the utility of attending the less prestigious university u_{i2} is discounted by a factor of $\alpha \in (0, 1)$. Assume that u_{ij} is large enough that the entire market is served regardless of $\alpha > 0$.

All of the students who lie between these universities have already been accepted and thus face a decision regarding which university the student will ultimately enroll. Once the student decides, switching costs are high enough to prevent transferring to another school. Students however do face a transport cost. This transport cost can be attending a university that is not the students' first choice, to which the student does not have strong ties (i.e. parents are not alumni), or extra costs due to room and board as opposed to living at home and attending the university that is geographically closer.

In the first stage, tuition prices are set by a governing body (such as a state legislature, Board of Regents, trustees, administration of an individual university, etc) that

cannot observe the individual students' welfare and thus will base their pricing decision on a the indifferent student. Also assume that policy makers price to maximize profits so that public subsidies and investments from endowments are held to a minimum. University 1 chooses its baseline tuition price to maximize:

$$\max_{\bar{P}_1} (\bar{P}_1 - c) \left(\frac{(1-\alpha)\hat{u} - P_{i1} + P_{i2} + t}{2t} \right)$$

and University 2:

$$\max_{\bar{P}_2} (\bar{P}_2 - c) \left(\frac{(\alpha-1)\hat{u} - P_{i2} + P_{i1} + t}{2t} \right)$$

Assuming that governorship boards are forward looking, they will anticipate that the admissions board will offer financial aid to prospective students, thus we incorporate the individual price determined in equation (8). This is done by substituting $\xi_j P_{ij}$ for $\bar{P}_j$ into each universities' objective function.

Taking the first order conditions and solving the reaction functions yields the following:

$$\bar{P}_1 = \frac{(1-\alpha)\hat{u} + 3t + (2\xi_1 + \xi_2)c}{3\xi_1} \tag{1.7}$$

$$\bar{P}_2 = \frac{(\alpha-1)\hat{u} + 3t + (2\xi_2 + \xi_1)c}{3\xi_2} \tag{1.8}$$

The financial aid package offered to students by a university is:

$$F_{ij} = \bar{P}_j - P_{ij} = \xi_j P_{ij} - P_{ij}. \tag{1.9}$$

Proposition 1 *As the weight that the institution assigns to the utility of its students increases, then final tuition rate will decrease, and the financial aid package increases.*

This result is shown by taking the first derivative of P_{ij} and F_ij with respect to w_{ij}.

$$\frac{\partial P_{ij}}{\partial w_{ij}} = \frac{(1-\alpha)\hat{u} + 3t}{\xi_j^2 \epsilon_{ij} \mu} < 0 \tag{1.10}$$

$$\frac{\partial F_{ij}}{\partial w_{ij}} = \left(\frac{2}{3}c + \frac{(1-\alpha)\hat{u} + 3t}{\xi_{ij}^2}\right)\left(\frac{-1}{\epsilon\mu}\right) > 0 \tag{1.11}$$

If a university exhibits profit seeking behavior, then w_{ij} will decrease. These results imply that a for-profit university would charge the particular student a higher final tuition price and offer less financial aid than a comparable traditional university.

Proposition 2 *As an individual's price elasticity of demand for the University becomes more inelastic, the final tuition rate will increase, and the financial aid package offered by the university will decrease.*

This proposition is also simple to prove by taking the first derivative of P_{ij} and F_{ij} with respect to ϵ_{ij}.

$$\frac{\partial P_{ij}}{\partial \epsilon_{ij}} = \left(\frac{(1-\alpha)\hat{u} + 3t}{\xi_j^2}\right)\left(\frac{w_{ij} - \mu}{\epsilon_{ij}^2 \mu}\right) > 0. \tag{1.12}$$

$$\frac{\partial F_{ij}}{\partial \epsilon_{ij}} = \left(\frac{2}{3}c + \frac{(1-\alpha)\hat{u} + 3t}{\xi_{ij}^2}\right)\left(\frac{-w_{ij} + \mu}{\epsilon_{ij}^2 \mu}\right) < 0 \tag{1.13}$$

These results imply that as a student becomes more sensitive to the tuition price, universities will be more likely to award the student additional financial aid and lower the effective tuition price for the student. Profit seeking behavior will dampen the magnitudes of these changes and thus universities will be less willing to offer financial aid.

In conclusion, the theoretical model gives two testable hypothesis to measure differences in price discrimination and financial aid allocation between for-profit and traditional higher education. First, for-profit higher education places a higher weight on

revenue instead of student utility, thus for-profit universities should offer lower amounts of financial aid for similar students attending comparable institutions. Second, students who are less sensitive to an increase in tuition price for a particular institution should receive less financial aid and pay more out of pocket for their college education.

1.4 Data

1.4.1 Description of Data

This study uses data from the National Postsecondary Student Aid Survey (NPSAS). These data contain information from many sources including student interviews, student responses to the Free Application for Federal Student Aid (FAFSA), and surveys completed by college and university administrators about their institutions. Data contained in the NPSAS describe student characteristics such as grades, standardized test scores, and parents' income. NPSAS also identifies the college or university that the student attends and provides data about enrollment size, institutional control, and tuition pricing. The National Center of Education Statistics (NCES), a subsidiary of the United States Department of Education, updates the NPSAS with a new cross section every four years. I use the 2007-2008 and 2003-2004 waves of the data. I have restricted my sample to undergraduates who attend institutions that are considered open admission or minimally selective which should model institutions that are most likely to be in the choice set of students considering enrolling at a for-profit university.

Every four years, NCES complies the NPSAS by a random sample of both institutions and students. The goal of the NPSAS is to create a representative sample of typical college students for each of the fifty states, the District of Columbia, and Puerto Rico. Each institution of higher education that is eligible for federal student aid (i.e. Title IV compliant) is assigned a sampling probability and sampled with replacement so that the

NPSAS creates a representative sample of the college student population in each state. Further, to create a nationally representative sample, the following states are over-sampled to compensate for their comparative size: California, Georgia, Illinois, Minnesota, New York, and Texas. After the number of observations per institution is determined, NCES randomly samples students such that the sample would represent of the student body with regards to demographic information, types of financial aid, and major.

1.4.2 Summary Statistics

Overall Summary Statistics

Table 1.2 displays summary statistics for all exogenous and financial aid variables aggregated across the three education sectors (private for-profit, private non-profit, and public). The average household income of my sample is $48,810. In the NPSAS, the income variable depends on the dependency status of the student. If the student is considered a dependent[8] (independent), then parents' (student's) income is reported. Dependent students comprise 48.0 percent of my sample. The average GPA of my sample is 2.99. Demographically, 17.2 percent of students sampled are African-American, 14.3 percent are Hispanic, and 3.2 percent are Asian. Also, roughly 37.9 percent of the students in this sample are pursuing four year degrees, 52.4 percent are pursuing a two year degree, and 9.7 percent are pursuing a certificate that should take less than two years to complete.

In addition to the demographic characteristics of the individual students, the NPSAS provides information regarding institutional characteristics that help to understand how institution control affects financial aid allocation. In this sample, 12.8 percent of students are studying at a for-profit university, while 68.4 are studying at a public institution and 18.8 percent are at a private, non-profit college. The average "sticker" price

[8]Students are generally considered independents if they are over 24 years of age, married, veterans, have children, and/or are orphaned.

or the price charged by an institution before any type of financial aid is $5,410 per year and the average enrollment size is 9,040[9].

Regarding financial aid outcomes, students received, on average, $1,090 in Pell Grants, $640 in institutional aid, $1,260 in federally subsidized student loans, and $1,260 in unsubsidized student loans. After grants students paid, on average, $8,570 of tuition out of pocket or using loans.

Summary Statistics by Sector

Table 1.3 compares summary statistics for personal and institutional characteristics between the three sectors. One key institutional difference between the private for-profit sector and traditional colleges and universities is that 31.9 percent of students at for-profit universities are considered to be dependent on their parents, while 51.1 percent and 55.1 percent of students at public and private non-profit respectively are considered dependent. Many for-profit universities tailor their curriculum to serve the needs of working adults who are more likely to be older, married, and have children than students at traditional universities. Since students at for-profit universities are more likely to be independent, the NPSAS reports only the student's income and thus the average income at for-profit universities is $32,110 compared to $51,800 and $57,390 for students at the public and private, non-profit sectors respectively.

There are other differences between the sectors regarding demographics. Students at for-profit universities are more likely to be female with 66.0 percent of their student body, compared to 59.1 percent and 60.7 percent of student bodies at public and private non-profit universities. Student bodies at for-profit universities are also more likely to be more racially diverse with 27.0 percent of for-profit students are black and 24.5 percent are Hispanic. In the public sector, only 15.1 percent and 11.1 percent of students are black and

[9]The NPSAS reports this variable as fall headcount

Hispanic; while of the students attending private, non-profit universities 13.8 percent are black and 16.0 percent are Hispanic. The racial diversity of for-profit universities has been controversial. Critics accuse for-profits of deceptive techniques designed to recruit minority students, while for-profits claim that they are simply enrolling students from minority populations who have traditionally been excluded by the traditional sector. Academically, students have similar GPAs across the three sectors.

Tuition prices at for-profit institutions also differ from the traditional sector as institutions. The average sticker price at for-profits universities is $10,500 which actually less than a private non-profit university tuition price of $11,970, but more than the average baseline tuition price of public universities of $2,490. One explanation for these summary statistics is the practice of "high-tuition high-aid" among many private, non-profit universities. These institutions set very sticker tuition prices and then use their large endowments to offer large financial aid packages to their students.

Table 1.4 displays financial aid summary statistics across sectors. Students at for-profit universities receive, on average, $9,950 in total aid which is less than students at private non-profit universities, but more than students at public universities. However, this statistic is misleading because it is an aggregate of grants and loans. Parsing out the different components of the financial aid package reveals a more accurate comparison across sectors. While students at for-profit universities only receive, on average, $270 in institutional aid, which is significantly less than their peers at private institutions, for-profit students receive significantly higher amount of federally funded student aid. For-profit students generally receive $1,740 in Pell Grant aid compared to $890 at public colleges and $1,200 at private colleges. Students at for-profit universities took on $2,150 in subsidized student loans and $4,110 in unsubsidized students loans which is significantly greater than the other two sectors. On average, students at for-profits pay more out of pocket for their

educations (around $14,730 per year) than students at public universities (average of $6,230 per year), but still less than students at private, non-profit universities (average of $12,560).

Figure 1.4 shows histograms of the sample by each component of a student's financial aid package. One area of concern is the long left hand tail of zeros that represent a corner solution by the university to offer no financial aid to the student. In the theoretical model, this result is modeled by setting the welfare weight w_{ij} equal to zero.

1.5 Empirical Models

1.5.1 Correction for Self-Selection using Polychotomous Choice Model

As evident in Table 1.3, the student populations across the sectors differ greatly. This result implies students are not randomly assigned to institutions, creating a situation where unobservables may be driving the decision to enroll at a particular university (Chung 2012). Heckman (1979) proposes a two stage method to correct for self-selection bias based on the Roy (1951) model. This well-known method describes a situation where the dependent variable in the selection equation is dichotomous (for example, whether a worker selects into the labor force). However students in this study have three choices. They can attend either a public, private non-profit, or a private for-profit university. Lee (1983) proposes a self-selection correction routine for situations involving more than two choices. Berger (1988), Brewer, Eide, and Ehrenberg (1999), Strayer (2002), and Willis and Rosen (1979) apply this routine to a situation where agents can self-select into various outcomes such as college majors.

Following the logic of Lee (1983), assume a selection equation where a student chooses a school from among the three education sectors. I express the student's maximum

utility given each of the alternatives as:

$$V_{ij}^{*} = \alpha X + \delta Z + \nu_{ij}, \tag{1.14}$$

where X is the matrix of personal, academic, and institutional characteristics used in the first, and Z are instruments used for identification in the selection equation. I use the student's father's education attainment as an instrument. I use this instrument for identification because if a student's father has attended college, then the student will be less likely to matriculate at a for-profit college, but the level of father's education does not enter the federal formula for financial aid.

The student will choose University J when:

$$S_{ij} = J \text{ iff } V_{ij}^{*} > Max\ S_{ik}^{*} (j \neq k) \tag{1.15}$$

and

$$u_{ij} = max\ V_{ij}^{*} - \nu_{ij}. \tag{1.16}$$

If ν_{ij} is independently and identically distribution with a type I extreme value distribution, then the selection equation can be estimated as a multinomial logit model

$$Pr(u_i < \alpha X + \delta Z) = Pr(S_j = j) = \frac{exp(\alpha X + \delta Z)}{\sum exp(\alpha X + \delta Z)} \tag{1.17}$$

To calculate the selection correction term, I use the predicted log odds of choosing school type J $\hat{S}_j$ and then transform these predicted probabilities using an inverse cumulative standard normal distribution such that:

$$H(\hat{S}_{ij}) = \Phi^{-1}(\hat{S}_{ij}) \tag{1.18}$$

I then insert these transformed predicted values into the inverse mills ratio,

$$\lambda_i = \frac{\phi(H(\hat{S}_{ij})}{\Phi(H(\hat{S}_{ij}))}, \tag{1.19}$$

and include the selection equation term as into the regression model and estimate the following:

$$Aid_i = X\beta_1 + \alpha_1(profit) + \alpha_2(public) + \alpha_3\lambda_i + \epsilon_i. \tag{1.20}$$

The addition of the self-selection term corrects previous estimates for the selection of students into a for-profit university. The estimated parameter values are now consistent, but do not account for the the unique distribution of the data.

1.5.2 Correcting for Non-linearity of Data using Exponential Regression

Figure 1.4 displays histograms for each aid category. One concern is that for each aid category, many studentsreceived no aid. While estimating ordinary least squares with the self-selection correction will yield consistent results, the model will not account for the different functional form and thus the predicted values may be negative. In the context of financial aid, negative predicted values have no practical interpretation. Also, the number of students who receive zero financial aid is too large to ignore.

Table 1.5 summarizes each aid category including the percentage of the students who did not receive a given type of aid, the mean of each aid category with and without zeroes. The number of students who receive no financial aid ranges from 25.32 percent in total aid (which includes all types of aid including loans and grants) to 83.67 percent in institutional aid. These observations make a large impact of the mean for each category.

For example, the mean of institutional aid with the zeroes is $640, but without the zeroes this mean increases to $3,920. Clearly fitting a traditional regression line to this distribution would be inappropriate.

Traditionally, a Tobit or hurdle model would be excellent choices for this situation. However, the section bias outlined in the previous section makes estimating these models problematic. While Smith and Blundell (1986) propose a test for endogeneity in the Tobit model and then create a maximum likelihood routine to correct for this endogeneity, it only works for continuous dependent variables. The endogeneity of discrete variables cannot be estimated in a two stage process because it would be an example of the "forbidden regression" (Wooldridge 2010, pp. 685): attempting to fit predicted values derived from one non-linear distribution into another non-linear distribution. Angrist (2001) and Tezra (1998) propose an alternative to full maximum likelihood for this situation.[10] They propose that instead of estimating a maximum likelihood to use non-linear least squares with the following for for the first stage:

$$E[y|\mathbf{x}, \epsilon] = e^{\{\mathbf{x}\beta+\epsilon\}} \tag{1.21}$$

where $\mathbf{x}$ is a matrix of demographic characteristics and $E[\epsilon|\mathbf{x}] = 0$. In the presence of self-selection the estimates from 1.21 would still be inconsistent without correction. Coulson *et al.* (1995) and Terza (1998) propose using the polychotomous choice model proposed by Lee (1983) that was outlined previously. Combining the exponential function and the self-selection method will yield the following model:

$$E[y|\mathbf{x}, \epsilon] = e^{\{\mathbf{x}\beta+\alpha\lambda+\epsilon\}} \tag{1.22}$$

[10]Coulson (1995) *et al.* use this model to estimate the effect of moral hazard of insured patients on the number of visits to the doctor. This situation is analogous to financial aid because there exists a large mass of zeroes indicating patients who did not visit the doctor in a given week, but the assignment of insurance plans is not random.

that will simultaneously account for the observations that receive zero aid and correct for self-selection of students into type of institution.

1.6 Results

1.6.1 Baseline Ordinary Least Squares (OLS)

Full Sample

Table 1.6 displays the results from the baseline OLS regression for all students contained in my sample. Recall that Proposition 1 from the conceptual framework predicts that as a university places a smaller weight on their students' welfare, the amount of financial aid decreases and the net price increases. This result seems to be confirmed by the estimates in Table 1.6 which imply that total aid and institutionally funded Column (1) shows the regression results using total aid as the dependent variable. Total aid is comprised of all federal, state, and institutional grant aid, veteran benefits, and subsidized student loans. The omitted institution control variable in all results is the dummy variable for private non-profit universities. Compared to the private non-profit sector, students at for-profit and public institutions tend to receive $451.07 and $910.12 less in total financial aid.

Columns (2)-(5) show how different components of a student's financial aid package changes differ between sectors. Students at for-profit universities receive $2,330.86 less in institutional aid, and take on $460.74 and $2,440.24 more in subsided an unsubsidized student loans than similar students at private, non-profit universities. The lack of financial aid implies that students at for-profit universities pay nearly $3,299.68 more in net price compared to students at private non-profit universities. The previously cited literature regarding the lower labor market outcomes for students who graduate from for-profit

universities implies that the net present value of graduating from a for-profit university is dramatically less than a traditional university.

Students at public institutions receive $1,079.02 less in institutional aid than private non-profit universities but receive $66.78 more in Pell Grant dollars from the federal government. Public university students also take on $90.52 more in subsidized and $596.46 in unsubsidized student loans. For-profit university students receive $2,330.86 less in institutional aid than similar students at non-profit universities, and take on $460.74 and $2,440.24 more in subsidized and unsubsidized student loans respectively. One surprising result is that students at public universities pay a higher net price of $1,957.53 than students at private universities. This result may be because of declining tuition subsidies from state legislatures that contribute to rapidly increasing tuition prices at state universities. These results serve as useful baselines to help estimate the amount of bias when one does not account for self-selection or the non-normality of the data.

Subsamples by Degree Programs

Next, I conduct the same analysis using subsamples of the following degree program: four year degrees, two year degrees, and less than two year degrees (certificate programs). The for-profit sector has grown quickly in all types of degree programs, particularity graduate degrees where for-profits had only a small presence. However, private non-profit institutions have all but yielded the associate degree and technical certificate markets to for-profit institutions and public community colleges. Thus financial aid and net prices will be very different in the lower end of the degree market. The second section of Table 1.6 shows results for students completing four year programs. The results from this table are very similar to the results from the pooled sample. For-profit universities provide $576.52 less total aid and $2,577.80 less institutional aid to their students than the private, non-profit universities. Students at for-profit universities also take out $329.20 and

$2,688.86 more in subsidized and non-subsidized student loans compared to those at private non-profit universities. Net of grants, students at for-profit pay $4,215.60 more for their four year degree than students at private, non-profit universities.

The third section of Table 1.6 displays results for students earning only two-year associate degrees. Traditionally, for-profit universities have specialized in vocational training including associate degrees and certificates. The results for two-year degrees are quite similar to four year degrees, but the magnitudes are smaller. Two-year degree seekers accumulate less student loan debt than four year students, but for-profit students borrow $383.24 more in subsidized student loans and $922.41 more in unsubsidized loans. The net price paid by students at for-profit universities is $401.39 greater than nonprofit, private universities.

The fourth section of Table 1.6 shows the results for students pursuing a less than two year degree or a technical certificate. Students pursing a technical certificate at a for-profit university receive $248.98 (although the result is not statistically significant) more in total financial aid than at a private college, but the bulk of this aid appears to be in both subsidized and unsubsidized loans since students at for-profit colleges take on $366.66 more in subsidized loans and $962.66 in unsubsidized loans. Students at for-profit colleges receive $89.21 less in institutional aid and $421.36 less in Pell Grants. Despite the increases in loans, for-profit colleges cost less net of financial aid than private colleges by $1,044.71. This finding may be a result of the small number of nonprofit, private universities that offer technical certificates. Only 3 percent of students at private non-profit colleges are pursuing a technical certificate and only 16.8 percent are studying for an associate's degree. 39.1 percent of students at for-profit universities are pursuing technical certificates.

1.6.2 Baseline Exponential Results

Table 1.7 displays the estimates from the basic exponential regression without the self-selection correction. While these estimates are inconsistent, they show how the change in functional form of the regression model affects the coefficient estimates. In most cases, estimating non-linear least squares dampened the magnitudes of the coefficient estimates compared to the results in Table 1.6 because the exponential regression places a higher weight on the mass of zeroes than does fitting a line through ordinary least squares. The signs on the coefficients are usually are the same. Students at for-profit universities receive $417.84 less in total aid. However this aid category includes all types of aid including grants and loans. Among the differing aid categories, students at for-profit institutions receive $1,459.10 less in institutionally funded aid, and take on $140.76 and $935.71 more in subsidized and unsubsidized loans respectively. This aid allocation results in a net price that is $2,739.41 higher for students at for-profit universities than similar students at traditional, private institutions.

Two main exceptions is that the effect of attending a for-profit university on Pell Grant aid is now a negative effect of $75.79 and the effect of attending a public university on total aid and student loans. The coefficient on Pell Grants is not robust across model specifications is not surprising because Pell Grants are determined by an aid formula that accounts for the financial need of the student and the student's family, but the federal government does not account for the type of institution, only that the college is Title IV eligible.

The effect of attending a public university on total aid changed from $-910.12 to $-2,750.38 when I fit the data nonlinearly. This change may seem dramatic, but recall that the total aid variable includes both loans and grants. This new result is probably driven by the new coefficients showing the effect of attending a public university on the student loan debt that a student receives. When I fit the student loan debt with the exponential model

(columns (4) and (5)), I find that the students at private universities take on $250.71 and $1,080.29 less in student loans than students at nonselective, private universities. However, these results do not account for self-selection and thus are inconsistent.

1.6.3 First Stage Multinomial Logit Results

Table 1.8 displays the results from the first stage multinomial logit estimate of student and institutional characteristics on the student's choice of the type of college to enroll. As an instrument for identification, I include the student's father's level of education. Father's education is a useful instrument because the choice of college is strongly correlated with the student's family background. If a given student's family has experience with the college application process or has a tradition of attending college, then the student is more likely to attend a college similar to his or her parents. Family education background, however, is not considered in the federal financial aid formula. While education achievement of parents is correlated with other factors that may affect financial aid (such as family income, student GPA, etc.) using the rich data from the NPSAS, I can control for these factors. Thus the exogenous variation of father's education level can help identify the choice of college separate from financial aid offering conditional on variables such as income and GPA. I thus expect students whose parents have no higher education experience to be more likely to attend a for-profit university, while students whose parents have either attended or graduated from college are less likely to choose a for-profit university because parents may steer their children into a traditional institution.

Table 1.8 displays results for demographic characteristics for the multinomial logit model where private, non-profit college is omitted. The multinomial results reflect findings from Chung (2012). The results show that when a student pursues a Bachelor's or Associate's degree the probability that a student chooses a for-profit university decreases by 24.3 and 19.7 percentage points. These large magnitudes reflect how traditional

universities have essentially yielded the technical certificate market to the for-profit universities. Higher family income decreases the probability that a student attends a for-profit university by a very small amount while being a dependent student decreases the choice of a for-profit by 8.1 percentage points. One strategy of for-profit universities is to market to working adults with children. This strategy is evident in the results because being married and having children increases the probability of choosing a for-profit university by 0.80 and 0.30 percentage points. Also racial minorities tend to be more likely to choose a for-profit university; where Asian, blacks, and Hispanic students are 2.9, 6.8, and 6.5 percentage points more likely to choose a for-profit.

Table 1.9 displays results from the various levels of father's education that serve as instruments. The committed category is the student's father being a high school graduate. While not attending any form of college does not increase the probability of attending a for-profit university in a statistically significant fashion, once a student's father attends any form of college, then the probability of the student attending a for-profit university is reduced dramatically. Even if a student's father attends less than two years of college, the probability that a student attends a for-profit college decreases by 19.7 percentage points and if a student's father graduates with a Bachelor's degree the probability drops by 42.8 percentage points. If the father holds a graduate degree then the probability of choosing a for-profit drops by even more with a masters, professional, and doctorate degree decreasing the probability by 41.10, 59.0, and 58.1 percentage points.

1.6.4 OLS Results Corrected for Self-Selection

One problem with comparing financial aid outcomes across colleges with differing institutional control is that students do not randomly sort into colleges. However there may be a variety of characteristics that contribute to the type of college a student may attend that is unobservable to the researcher. Thus any empirical model that fails to

correct for self-selection will yield inconsistent estimates. Table 1.10 displays results from an ordinary least squares model with the self-selection correction routine.

First, the coefficient on the inverse mills ratio or λ is statistically significant for all types of aid thus implying that self-selection is present and the correction was needed. In most cases, the self-selection correction amplifies the magnitude of the coefficient estimates meaning that if one controls for unobservables that influence the student to choose a certain type of college, institutional control has a larger effect on the amount of aid that a student receives. Thus not controlling for self-selection on unobservables biases estimates downwards.

While the magnitudes are affected, the model predicts similar results regarding the allocation of aid as the baseline OLS. Students at for-profit universities receive $2,284.24 less in institutionally funded financial aid than comparable peers at private, non-profit colleges. Students at for-profit universities make up for this lack of institutional grant aid, by financing their education through student loans. On average, students at for-profit universities incur $508.21 and $2,254.50 more in subsidized and subsidized student loan debt than similar students at private colleges. While these estimates are consistent after correcting for self-selection, the predicted values yield aid packages that are negative. Thus a model that accounts for self-selection and the unique functional form is needed for accurate results.

1.6.5 Results from Exponential Regression with Self-Selection

To allow for a more flexible functional form and to correct for self-selection of students into institutions, I combine the exponential regression with the multinomial logit self-selection correction. Table 1.11 displays the results from this empirical strategy. Recall that the magnitudes from the coefficient estimates from these two modifications change in opposite directions from the baseline OLS estimates. The exponential functional form shrinks the

magnitudes of the coefficient estimates because the exponential regression allows more flexibility in weighting the coefficient towards the large mass of zeroes. The self-selection correction, however, increases the magnitude of the coefficient estimates showing that students who attend a private, non-profit college are positively selecting into these institutions. The net results using the combined model depend on how many observations of zero aid are in each aid category. The magnitudes associated with aid categories with smaller numbers of observations with zeroes (such as total aid or net price) do not deviate significantly from the baseline self-selection estimates, while those aid categories with significant numbers of zeroes (institutional aid and unsubsidized student loans) are similar to the baseline exponential results.

These results show that institutional control has a large and statically significant effect on how financial aid is allocated to the student. Students at for-profit universities receive $204.15 less in total aid including both grants and loans. Compared to private colleges, for-profit universities on average give their students $1,361.95 less in institutional funded financial aid. For-profit universities substitute federal funded aid for institutional aid to attract students. This result is evident in column (3) where the coefficient estimates indicates that students at for-profit universities receive $35.23 less in Pell Grants and $171.36 more in subsidized student loans from the Federal Government. While the federal aid formula does not treat students at for-profit universities differently than students at traditional universities, these results (particularly regarding subsidized student loans) give evidence to anecdotes describing how for-profit universities push their students to complete FAFSA at higher rates. The reduced amounts of grant aid at for-profit universities force the students to substitute towards loans to finance their education. Students at for-profit universities take on $171.36 and $1,286.13 more in subsidized and unsubsidized student loans. These loans and reduced grants result in a net price that is $3,002.39 more compared to similar students at private universities.

The results for public universities are similar, but the magnitudes are considerably smaller. Students at public universities receive $210.81 less in institutional aid, but $306.14 more in Pell Grant Aid. Students at public universities also take on $424.22 more in subsidized loans, but take out $134.39 less in unsubsidized loans than comparable students at private institutions.

1.7 Robustness Checks

1.7.1 Limiting Sample to FAFSA Applicants

One concern about the results from the previous section is that differences in FAFSA completion affect the differences in financial aid by higher education sector. One unique aspect of many for-profit universites is the intense focus on ensuring that students complete FAFSA. FAFSA is the gateway to many forms of financial aid including Pell Grants, subsidized student loans, and federally backed unsubsidized student loans. One striking attribute of the for-profit higher education sector is that they strongly encourage all of their students to complete FAFSA. Kantrowitz (2009) estimates that 98.9 percent of students seeking a two-year degree at a for-profit university complete FAFSA. In my sample, 90.98 percent of students at a for-profit university complete FAFSA, while 78.22 percent of students at a private, non-profit institution and 65.80 percent of students at a public university complete FAFSA. There is also concern that income is only observable to the university when a student completes FAFSA. This concern does have some merit, but many institutions either require students to report their or parent's household income on the application form or when applying for institutional aid.

I estimate the exponential model with the self-selection correction by, first, limiting the sample to only students who complete FAFSA, and, second, adding a dummy variable for whether a student completed FAFSA and interact this dummy variable with institution

control and income to check for robustness of the results given differences in FAFSA completion.

The first robustness check is to limit the sample of students to those who completed FAFSA. By completing FAFSA, needy students gain access to Pell Grants, federally subsidized student loans, and some forms of unsubdized student loans. Thus by limiting the sample to those who complete FAFSA, I test whether the previous results are affected by higher rates of FAFSA completion at for-profit universities.

Table 1.12 displays the results from the exponential model with the self-selection correction using data with only students who completed FAFSA. With few exceptions, the results using the full sample are robust even when considering only students who completed FAFSA. One key exception is the difference between Pell Grant amounts between for-profit universities and traditional, private colleges. Magnitudes for Pell Grant and subsidized student loans are economically significant which may be because the federal government does not distinguish between traditional and for-profit universities and the positive result in the full sample is probably because of higher FAFSA completion rates at for-profit universities. Another significant difference between the full sample and the subsample of FAFSA completers is that the differential in institutional aid between for-profit institutions and private colleges is greater in magnitude in the subsample. This result may point to the capitalization of federal financial aid where for-profit universities may substitute institutional aid for Pell Grant aid when designing a student's financial aid package.

1.7.2 Dummy Variable for FAFSA Completion

An additional test to examine the effect of FAFSA completion on the allocation of financial aid, I include a dummy variable for whether a given student completed FAFSA. I re-estimate the exponential regression model with the self-selection correction for total aid, institutional aid, unsubsidized student loans, and net price. I do not re-estimate the model

for Pell Grants and subsidized student loans since FAFSA completion is required to receive these types of aid and thus all students with positive aid must have completed FAFSA in the estimated model. This test is also helpful to see if institutions substitute institutional grant aid for federal loans as a form of price discrimination. Table 1.13 displays the results from including the FAFSA completion dummy. Including the FAFSA completion dummy does not affect the coefficients on institutional control. This finding may be because the federal government and many other need-based aid funds do not distinguish colleges by institutional control. However students who complete FAFSA do receive more aid than comparable students who do not apply for federal aid. These estimates show that an average student who completes FAFSA receives $9,122.52 more in total aid, $346.33 more in institutional aid, $4,387.12 more in unsubsidized student loans, but pays a higher net price (tuition minus grants) of $432.60. These results are similar to those found by Kofoed (2013). This higher net price may be evidence that colleges substitute federal loan money for other types of institutionally backed grant aid.

1.7.3 FAFSA Interacted with Institutional Control and Income

Finally I interact the FAFSA completion dummy with the institutional control dummies to see if for-profit universities treat students who complete FAFSA differently than other colleges. Table 1.14 displays the results with the interaction terms. When a student who completes FAFSA attends a for-profit institution; they receive less institutional aid and unsubsidized student loan aid. This result gives evidence to the theory that for-profit universities capitalize on federally funded student aid by offering less institutional aid and substituting it with Pell Grant and federal student loans. Public universities also capitalize on federal grant aid, but at a smaller extent ($701.37 at a for-profit versus $330.90 at public university). Thus any additional grant aid that a student would receive from the federal government is netted out in the student's out of pocket costs by institutions

decreasing their own institutional aid. This result is different regarding unsubsidized student loans where students who attend public institutions take out more unsubsidized student loans when they complete FAFSA than at private institutions.

I also interact the FAFSA completion dummy with the income variable and its square. One concern with using the NPSAS data is that perhaps institutions cannot observe student income if they do not complete the FAFSA. This concern may not be valid in all cases because some institutions require students to report own or parent income as part of the admissions process or to apply for institutional aid. The coefficients associated with these interaction terms are statistically significant for all three categories that may be indirectly affected by FAFSA completion: total aid, unsubsidized student loans, and net price. The coefficient on institutional aid is not economically or statistically significant. This result is interesting because institutional aid could be considered the most "independent" from the FAFSA form. Thus when determining institutional aid, colleges are using other forms or application process to observe student or family income and FAFSA completion does not affect the way that colleges adjust institutional aid in response to differences in income.

1.7.4 Role of Large Chain Schools

One concern with the findings proposed in the paper is that the variation in student financial aid packages could be a results of large chain schools with market power that can more easily access federal financial aid and may signal that they are more prestigious than a community college of non-selective private to attract students who are willing to pay more. Each for-profit university must incorporate in the state that the university has a presence. This expansion gives some universities a national presence and brand name.

To test if the results are robust to inclusion of large, chain universities, I estimate the exponential model with self-selection correction without and without the largest and

most common for-profit university, and with and without the top three chain schools. Table 1.15 displays these results by group.

The results from Table 1.15 show that the main results from the paper are robust when the the largest chain schools or the three large chain schools are omitted from the sample. The results of are robust when comparing the main results to samples omitting the large chain schools. In many cases, the coefficients differ by a small percentage. Omitting the large chain schools does decrease the amount of "extra Pell Grant, subsidized student loans, and unsubsidized student loans. The net price differential between for-profit and traditional private universities also narrows when I omit the large chain schools. This robustness check indicates that including schools such as the University of Phoenix does not alter the results significantly.

However, when I only compare large, chain schools to traditional colleges and universities, some of the results do change. First is the institutional aid variable which is still economically significantly, but not statistically significant. This result may arise because of the wide disparity of aid at these larger for-profit universities. To encourage more meritorious students, these schools have begun to offer generous grant aid, but to only the very top of the academic distribution. Also the net price is much higher when considering only the large chain universities which may represent higher tuition prices for these more established institutions.

1.8 Conclusion

There has been much discussion regarding the role of the emerging for-profit sector in higher education. Unfortunately, there has been little theoretical and empirical evidence regarding education outcomes and costs in this sector. This paper proposes a two-stage theoretical model that explains differences in price discrimination between a profit

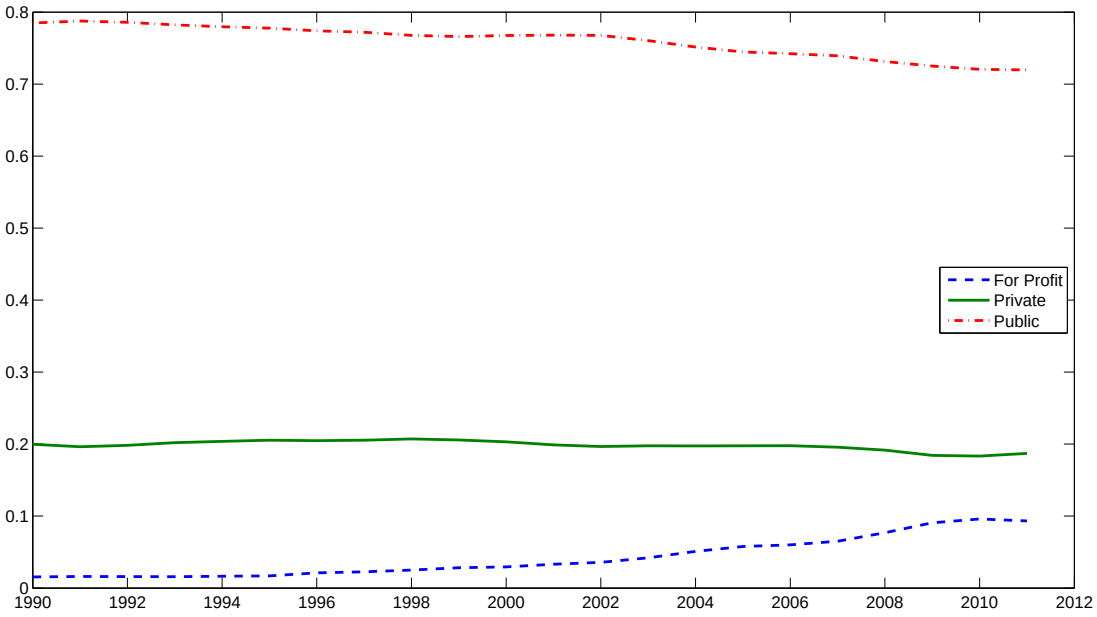
maximizing university and a welfare maximizing university. I find that as a university maximizes profit and places a smaller weight on student welfare it will be less likely to award financial aid and the final price that a student pays will increase.

Next, I tested the hypotheses from the theoretical model using the National Postsecondary Student Aid survey. I combine the self-selection model with an exponential regression to correct for both self-selection of students in types of institution and the large mass of observations where students receive no financial aid. This empirical strategy allows me to yield consistent estimates within a function form that accounts for the linearity of the data. I find that accounting for self-selection increases the magnitudes of the coefficents, while correcting for the non-linearity of the data dampens the estimates. Regarding financial aid allocation, I find that students at for-profit universities receive $1,359.75 less in institutional aid, take on $192.30 and $1,283.57 more in subsidized and unsubsidized loans, and pay of net price that is $3,002.93 higher than a traditional, private institution. These findings give evidence to the theoretical propositions that as a institution decreases how much it weighs student welfare against an extra dollar of revenue and students become less sensitive to price, then financial aid will decrease and net price will increase.

I conduct two robustness checks to ensure accuracy of results. First to test whether increase FAFSA completion is driving the results, I estimate the final empirical model using a subsample of students who completed FAFSA. The coefficient estimates were robust with the exception of Pell Grants attained by for-profit students which changed signs but was not economically significant. I also estimate the model for total aid, institutional aid, unsubsidized loans, and net price and find that many for-profit universities substitute institutional aid for federally backed unsubsidized student loans which effectively increase the net price for their students. As a final robustness check, I estimate the final model on subsamples that do not contain observations from large chain universities. I find that not including these institutions does not affect the results in a significant way.

These results are important because an ever increasing amount of financial aid dollars are allocated each year to students at for-profit universities. While these students are receiving comparable amounts of aid as students at universities in other sectors, for-profit universities are less generous in their price discriminating behavior. Combined with evidence from the literature regarding lower education outcomes at for-profits, the net present value for an education at a for-profit university may be lower. Thus these universities may be attractive to students with little or no outside option. However, for-profit higher education, as education outcomes improve, for-profit universities may become an intriguing option for higher achieving students and may be a possible solution for boosting the number of college graduates in an increasingly competitive labor market.

Figure 1.1: Change in the Enrollment Share of Bachelor's Degree Students Across Sectors



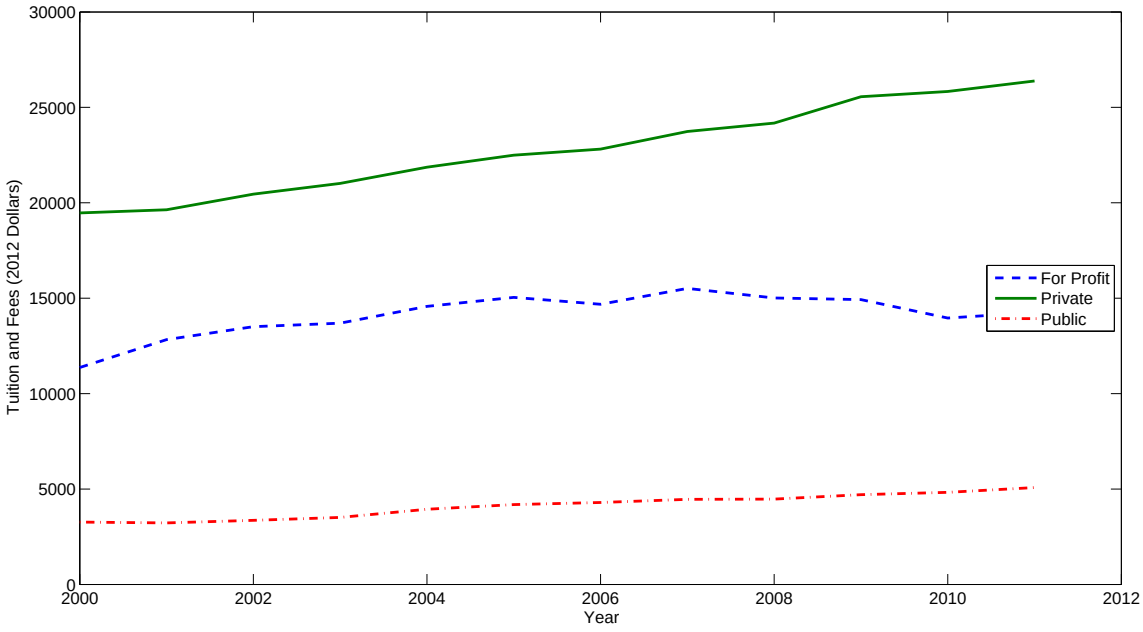
Note: Data comes from the 1990-2011 IPEDS

Table 1.1: Change in Degrees Conferred and Market Share by Sector

	Degrees Conferred			Market Share		
	For-Profit	Public	Private	For-Profit	Public	Private
Associate's						
1999-2000	70,150	448,446	46,337	12.42	79.38	8.20
2009-2010	162,666	640,113	46,673	19.15	75.36	5.49
Percent Change	131.88	42.74	0.73	54.19	-5.06	-33.05
Bachelor's						
1999-2000	20,062	810,855	406,958	1.62	65.50	32.88
2009-2010	97,793	1,049,057	503,164	5.93	63.58	30.49
Percent Change	387.45	29.38	23.64	266.05	-2.93	-7.27
Master's						
1999-2000	10,308	243,157	209,720	2.23	52.50	45.28
2009-2010	70,871	322,243	299,911	10.23	46.50	43.28
Percent Change	587.53	32.52	43.01	358.74	-11.43	-4.42
Doctoral						
1999-2000	1,109	60,655	56,972	0.93	51.08	47.98
2009-2010	4,613	78,779	75,166	2.91	49.68	47.41
Percent Change	315.96	29.88	31.93	212.90	-2.74	+1.19

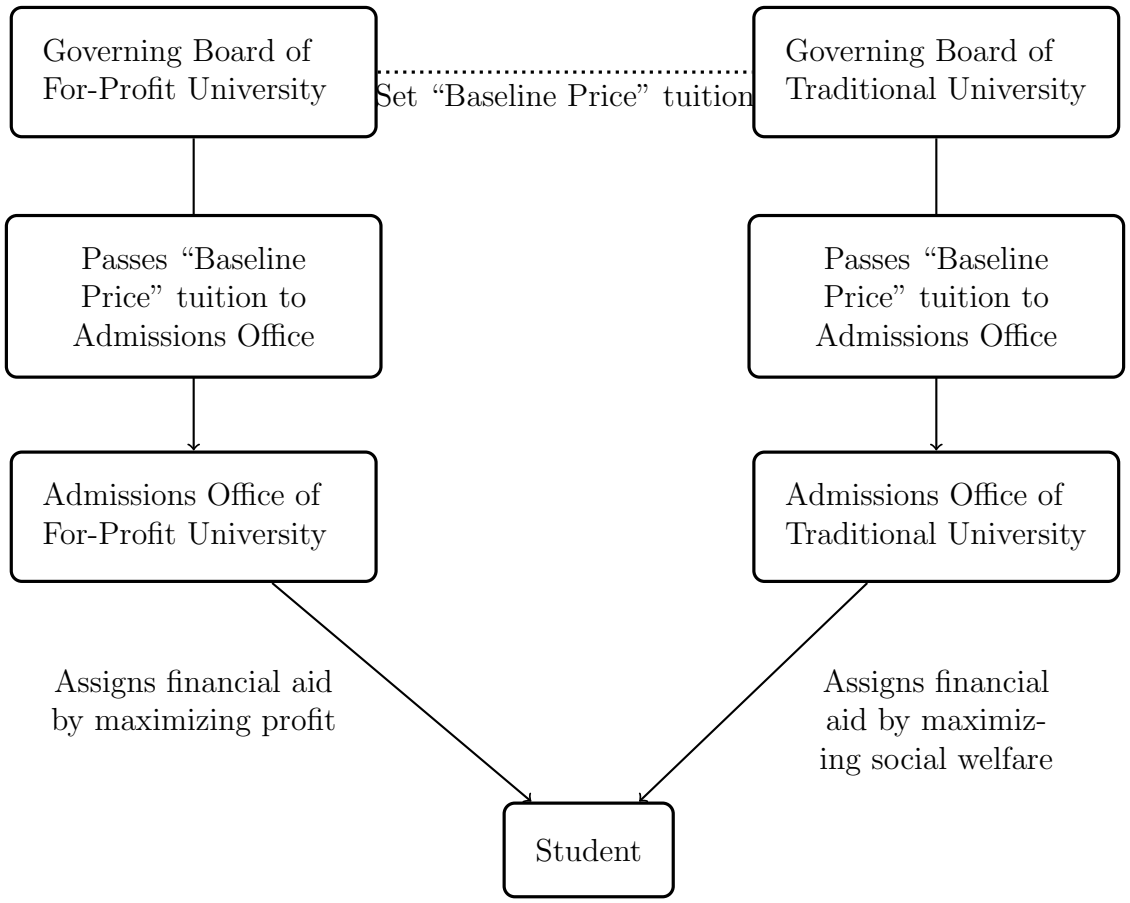
Note: Data comes from IPEDS.

Figure 1.2: Change in Tuition Rate Across Sectors (2012 dollars).



Note: Data comes from the 1990-2011 IPEDS

Figure 1.3: Outline of Conceptual Framework



Note: This figure gives an overview of the conceptual framework used to understand differences in financial aid allocation between the for-profit and traditional higher education sectors. In the first stage, the governing boards of each university compete for students to sets the baseline tuition price. In the second stage, admissions offices allocate financial aid to each student given the institution's objective function

Table 1.2: Summary Statistics for All Sectors-Nonselective and Minimally Selective

Variable	Mean	Std. Dev.	Observations
Student Demographics			
Income	$48,810	48,350	133,020
Dependent	0.480	0.500	133,020
Female	0.606	0.489	133,020
Married	0.216	0.411	133,020
Children	0.603	1.100	133,020
GPA	2.99	0.807	133,020
Asian	0.032	0.177	133,020
Black	0.172	0.377	133,020
Hispanic	0.143	0.350	133,020
Age	25.99	9.067	133,020
Resident	0.909	0.287	133,020
Institutional Characteristics			
Private For-Profit	0.188	0.391	133,480
Public	0.684	0.465	133,480
Private Non-Profit	0.128	0.334	133,480
4-year	0.379	0.485	133,480
2-year	0.524	0.499	133,480
Less 2-year	0.097	0.296	133,480
Tuition	$5,410	6,220	105,230
Enrollment Size	9,040	13,580	133,020
Types of Financial Aid			
Total Aid Package	$6,210	7,170	133,480
Pell Grant	$1,110	1,600	133,480
Institutional Aid	$640	2,400	133,480
Subsidized Student Loans	$1,260	1,930	133,480
Unsubsidized Student Loans	$1,680	3,500	133,480
Net Price	$8,570	8,060	133,480

Note: This table displays the mean, standard deviation, and number of observations of the demographic and institutional for the entire sample.

Table 1.3: Summary Statistics by Sector

Variable	Public	Private Non-Profit	Private For-Profit
Institutional Characteristics			
4 year	0.303	0.796	0.370
	(0.460)	(0.403)	(0.483)
2 year	0.669	0.168	0.239
	(0.471)	(0.374)	(0.426)
Less 2 year	0.027	0.036	0.391
	(0.163)	(0.187)	(0.488)
Tuition	\$2,490	\$11,970	\$10,500
	(2,460)	(8,010)	(6,740)
Enrollment Size	11,330	3,310	4,630
	(9,260)	(3,820)	(24,390)
Student Demographics			
Income	\$51,800	\$57,390	\$32,110
	(49,070)	(53,850)	(36,640)
Dependent	0.511	0.552	0.320
	(0.500)	(0.497)	(0.466)
Female	0.591	0.607	0.660
	(0.492)	(0.488)	(0.474)
GPA	2.94	3.05	3.10
	(0.820)	(0.736)	(0.793)
Asian	0.034	0.027	0.030
	(0.181)	(0.162)	(0.170)
Black	0.151	0.138	0.270
	(0.358)	(0.345)	(0.444)
Hispanic	0.111	0.160	0.245
	(0.314)	(0.367)	(0.430)
Age	25.82	25.33	27.05
	(9.172)	(8.850)	(8.746)
Resident	0.939	0.800	0.874
	(0.239)	(0.400)	(0.331)
Number of Observations	91,290	17,030	25,160

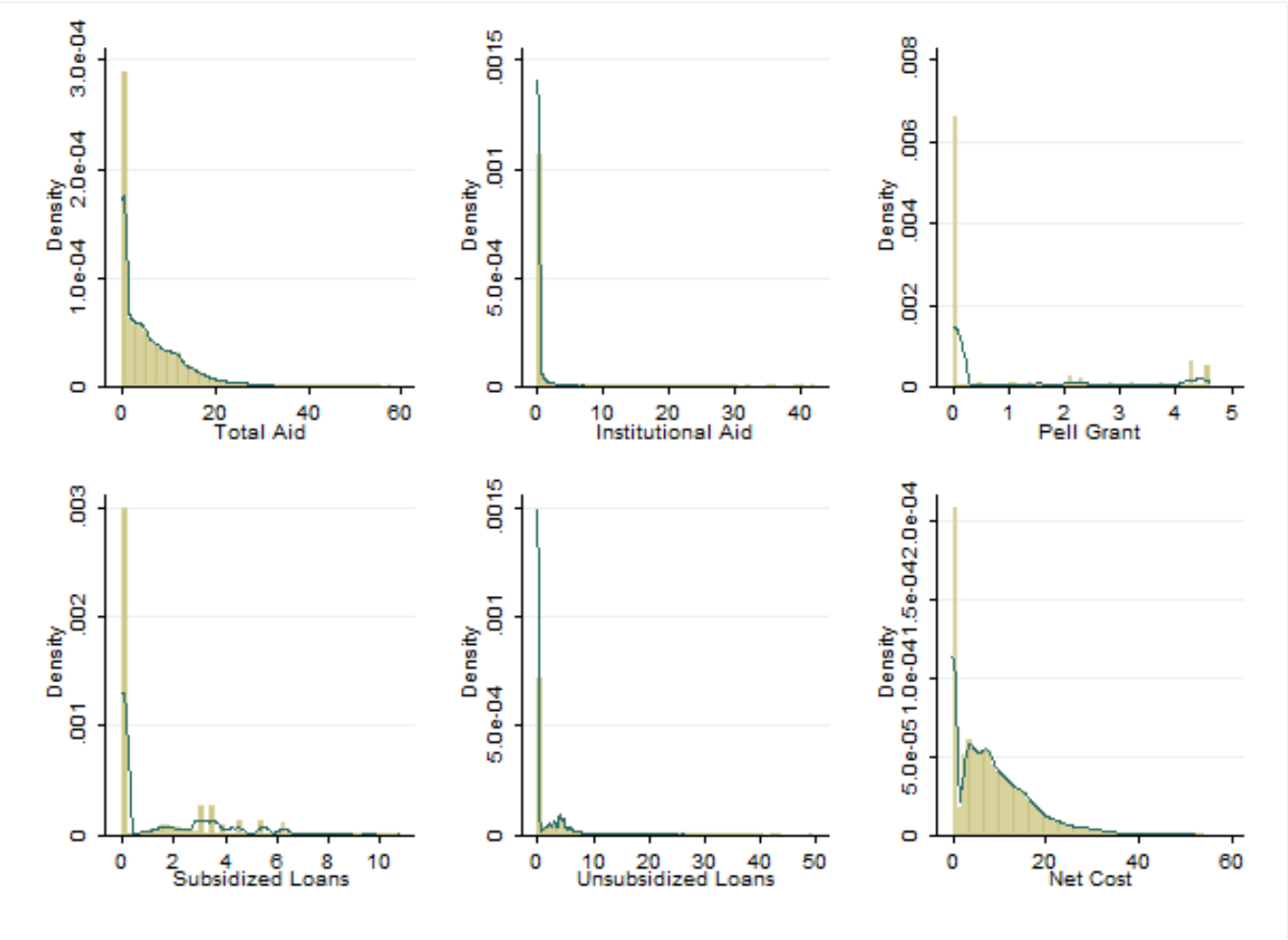
Note: This table displays the mean with standard deviations in parentheses.

Table 1.4: Financial Aid by Sector

Variable	Public	Private Non-Profit	Private For-Profit
Total Aid	\$5,040	\$13,650	\$9,260
	(6,200)	(11,900)	(7,310)
Pell Grant	\$830	\$940	\$1,630
	(1,450)	(1,540)	(1,700)
Institutional Aid	\$490	\$4,450	\$240
	(1,880)	(6,330)	(1,380)
Subsidized Loans	\$1,120	\$2,130	\$2,050
	(2,020)	(2,570)	(1,890)
Unsubsidized Loans	\$1,220	\$2,670	\$3,600
	(2,940)	(5,160)	(4,750)
Net Price	\$5,870	\$11,640	\$9,250
	(5,980)	(12,370)	(8,220)

Note: This table displays the mean with standard deviations in parenthesis.

Figure 1.4: Histograms By Financial Aid Component ($000)



The panels include the large mass of zeroes which must be accounted for to avoid fitting a linear model on a non-linear distribution. I include a kernel density estimation to smoothly approximate the distribution.

Table 1.5: Summary Statistics for Financial Aid Variables

Variable	(1) Percent zero	(2) Mean w/ zeroes	(3) Mean w/o zeroes	(4) Percent Change from w/ zeroes to w/o zeroes
Total Aid	25.32	6,210	8,310	33.82
		(7,170)	(7,160)	
Pell Grant	60.11	1,090	2,740	151.76
		(1,600)	(1,390)	
Institutional Aid	83.67	640	3,920	512.50
		(2,390)	(4,710)	
Subsidized Student Loans	63.52	1,260	3,460	174.60
		(1,930)	(1,620)	
Unsubsidized Student Loans	67.80	1,680	6,020	258.33
		(3,500)	(4,410)	
Net Price	21.66	8,570	10,950	27.78
		(8,060)	(7,550)	

Note: The first column of this table shows the percentage of students who do not receive a particular type of financial aid. The second column shows the average amount of financial aid including observations with a zero value. The third column shows the average amount of financial aid a student received not including observations with a zero value.

Table 1.6: Baseline OLS estimates by Institutional Level

VARIABLES	(1) Total Aid	(2) Institutional Aid	(3) Pell Grant	(4) Subsidized Loan	(5) Unsubsidized Loan	(7) Net Price
Pooled Sample						
For-Profit	-451.07***	-2,330.86***	42.10***	460.74***	2,440.24***	3,299.68***
	(85.083)	(37.142)	(16.58)	(22.79)	(49.64)	(69.59)
Public	-910.12***	-1,079.02***	66.78***	90.52***	596.46***	1,957.53***
	(79.57)	(34.16)	(11.89)	(22.33)	(43.04)	(58.54)
Four Year	3,956.53***	83.75***	-95.40***	1,239.76***	1,415.02***	-2,039.32***
	(61.76)	(21.45)	(16.08)	(17.55)	(37.57)	(66.27)
Two Year	1,077.29***	83.97***	-309.72***	261.99***	551.21***	-1,176.22***
	(59.11)	(20.34)	(16.01)	(15.86)	(35.67)	(61.56)
Four Year						
For-Profit	-576.52***	-2,577.80***	-47.91***	329.20***	2,688.86***	4,215.60***
	(117.96)	(47.07)	(21.46)	(33.21)	(76.48)	(95.92)
Public	-561.47***	-1,174.076***	122.66***	229.20***	746.54***	1,878.09***
	(106.59)	(47.52)	(19.52)	(30.62)	(55.99)	(74.85)
Two Year						
For-Profit	-395.78**	-804.02***	-228.02***	383.24***	922.41***	401.39***
	(166.48)	(63.84)	(36.00)	(38.92)	(85.07)	(116.64)
Public	-1,847.25***	-696.74***	-76.76**	-263.59***	-68.99	1,843.37***
	(145.87)	(50.55)	(34.27)	(34.43)	(76.36)	(102.06)
Less Than Two Year						
For-Profit	248.98	-89.21*	-421.36***	366.66***	962.66***	-1,044.71***
	(177.89)	(50.35)	(63.49)	(55.36)	(97.52)	(194.26)
Public	-445.70**	-108.34**	-261.65***	179.51***	215.08**	114.86
	(202.82)	(54.69)	(70.35)	(60.70)	(104.92)	(216.46)

Controls include income, dependency status, female, race, married resident, GPA, SAT, age, number of students enrolled, and tuition
Robust Standard Errors in parentheses
*** p < 0.01, ** p < 0.05, * p < 0.1

Table 1.7: Differences in Financial Aid by Sector-Exponential Regression

VARIABLES	(1) Total Aid	(2) Inst. Aid	(3) Pell Grant	(4) Sub Loan	(5) Unsub Loan	(6) Net Price
For-Profit	-417.84**	-1,459.10***	-75.79***	140.76***	935.71***	2,739.41***
	(39.44)	(35.13)	(9.47)	(11.55)	(17.68)	(39.94)
Public	-2,750.38***	-532.02***	36.13***	-250.71***	-1,080.29***	-452.86***
	(47.41)	(12.60)	(10.48)	(13.39)	(25.51)	(45.09)

Controls include income, dependency status, female, race, married resident, GPA, SAT, age, number of students enrolled, and tuition
Delta Method Standard Errors in parentheses
*** p < 0.01, ** p < 0.05, * p < 0.1

Table 1.8: Multinomial Logit Results for Choice of Institution Type (Marginal Effects)

VARIABLES	(1) Public	(2) For-Profit
Bachelor's Program	0.052***	-0.243***
	(0.003)	(0.002)
Associate's Program	0.109***	-0.197***
	(0.003)	(0.003)
Income ($000)	4.23e-4***	-5.567e-4***
	(4.650e-5)	(4.940e-5)
Income^2	-4.22e-10**	6.050e-10***
	(1.92e-10)	(2.130e-10)
Dependent	0.074***	-0.081***
	(0.003)	(0.003)
Female	-0.016	4.884e-4
	(0.002)	(0.002)
Married	-0.030***	0.008**
	(0.004)	(0.004)
Children	-0.003***	0.003***
	(9.047e-4)	(9.242e-4)
Asian	-0.030**	0.029***
	(0.006)	(0.005)
Black	-0.042***	0.068***
	(0.002)	(0.002)
Hispanic	-0.110***	0.065***
	(0.002)	(0.002)

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

Note: Dropped outcome is private, non-profit institutions. Controls include degree type, year dummies, and residency status.

Table 1.9: Multinomial Logit Results for Choice of Institution Type (Marginal Effects)

VARIABLES	(1) Public	(2) For-Profit
Father's Educ: Unknown	-0.264***	0.059
	(0.045)	(0.043)
Father's Educ: No High School	0.035	-0.015
	(0.044)	(0.043)
Father's Educ: Technical Cert.	0.207***	0.014
	(0.068)	(0.066)
Father's Educ: Less Two Years College	0.102	-0.197***
	(0.061)	(0.061)
Father's Educ: Bachelor's	0.156***	-0.428***
	(0.044)	(0.045)
Father's Educ: Master's	0.119*	-0.410***
	(0.060)	(0.060)
Father's Educ: Professional	0.062	-0.590***
	(0.128)	(0.122)
Father's Educ: Doctorate	0.111	-0.581***
	(0.110)	(0.108)

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

Note: Dropped outcome is private, non-profit institutions. Controls include degree type, year dummies, and residency status. High School Graduate is the omitted father's education variable.

Table 1.10: Differences in Financial Aid by Sector with Self-Selection Correction

VARIABLES	(1) Total Aid	(2) Inst. Aid	(3) Pell Grant	(4) Sub Loan	(5) Unsub Loan	(6) Net Price
For-Profit	-191.92***	-2,284.24***	79.86***	508.21***	2,254.50***	3,501.21***
	(73.22)	(34.20)	(19.41)	(19.83)	(54.83)	(70.28)
Public	425.53***	-838.78***	261.39***	335.15***	755.57***	2,996.23***
	(68.02)	(31.98)	(18.63)	(21.82)	(52.93)	(52.56)
λ	-2,623.93***	-471.96***	-382.32***	-480.59***	-695.14***	-2,040.56***
	(78.19)	(23.77)	(15.02)	(21.01)	(54.42)	(52.28)

Controls include income, dependency status, female, race, married resident, GPA, SAT, age, number of students enrolled, and tuition

Bootstrap Standard Errors in parentheses

*** p < 0.01, ** p < 0.05, * p < 0.1

Table 1.11: Differences in Financial Aid by Sector-Exponential Regression with Self-Selection Correction

VARIABLES	(1) Total Aid	(2) Inst. Aid	(3) Pell Grant	(4) Sub Loan	(5) Unsub Loan	(6) Net Price
For-Profit	-204.15***	-1,361.95***	-35.23***	171.36***	1,286.13***	3,002.39***
	(37.12)	(32.12)	(9.22)	(15.71)	(22.42)	(38.55)
Public	170.32***	-210.81***	306.14***	424.22***	-134.39***	1,933.39***
	(55.21)	(13.63)	(11.38)	(21.20)	(39.64)	(53.52)
λ	-3,746.47***	-504.29***	-787.58***	-1,210.47***	-1,249.91***	-2,895.52***
	(46.71)	(13.22)	(10.01)	(18.21)	(28.99)	(39.24)

Controls include income, dependency status, female, race, married resident, GPA, SAT, age, number of students enrolled, and tuition

Bootstrap Standard Errors in parentheses

*** p < 0.01, ** p < 0.05, * p < 0.1

Table 1.12: Completed FAFSA Only-Exponential Regression with Self-Selection Correction

VARIABLES	(1) Total Aid	(2) Inst. Aid	(3) Pell Grant	(4) Sub Loan	(5) Unsub Loan	(6) Net Price
For-Profit	-578.21***	-1,744.85***	-105.18***	170.67***	1,584.04***	3,142.87***
	(48.77)	(43.33)	(13.07)	(15.71)	(31.68)	(46.49)
Public	491.06***	-291.31***	443.95***	422.95	77.79***	1,515.53
	(70.72)	(19.20)	(15.75)	(21.22)	(52.81)	(67.78)
λ	-3,817.93***	-562.40***	-525.48***	-782.05***	-1,161.92***	-2,390.93***
	(60.31)	(18.98)	(13.77)	(18.17)	(39.39)	(50.58)

Controls include income, dependency status, female, race, married resident, GPA, SAT, age, number of students enrolled, and tuition
Delta Method Standard Errors in parentheses
*** p < 0.01, ** p < 0.05, * p < 0.1

Table 1.13: FAFSA Completion Dummy-Exponential Regression with Self-Selection Correction

VARIABLES	(1) Total Aid	(2) Inst. Aid	(3) Unsub Loan	(4) Net Price
For-Profit	-434.89***	-1,388.39***	1,166.59***	2,974.54***
	(32.44)	(32.00)	(20.39)	(38.64)
Public	344.90***	-202.28***	60.86*	1,928.38***
	(46.95)	(13.47)	(33.76)	(53.51)
FAFSA	9,122.52***	346.33***	4,387.12***	432.60***
	(107.07)	(10.31)	(107.88)	(35.63)
λ	-2,906.46***	-485.05***	-876.07***	-2822.12***
	(40.09)	(13.21)	(25.27)	(39.59)

Controls include income, dependency status, female, race, married resident, GPA, SAT, age, number of students enrolled, and tuition
Delta Method Standard Errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 1.14: FAFSA Completion Interactions-Exponential Regression with Self-Selection Correction

VARIABLES	(1) Total Aid	(2) Inst. Aid	(3) Unsub Loan	(4) Net Price
For-Profit	39.84	-728.00***	2,011.72***	1,501.93***
	(276.90)	(87.82)	(260.70)	(83.74)
Public	-2535.74***	90.58***	-1,225.66***	155.91*
	(256.84)	(24.50)	(364.31)	(83.74)
FAFSA	8924.92***	354.62***	2,386.53***	-2,326.90***
	(307.42)	(25.38)	(290.45)	(93.97)
FAFSA × For-Profit	-474.47*	-701.37***	-854.08***	1,778.52***
	(277.97)	(94.32)	(261.42)	(97.66)
FAFSA × Public	2,907.20***	-330.90***	1,290.10***	2,202.44***
	(255.20)	(24.69)	(364.10)	(81.87)
FAFSA × Income ($000)	-38.49***	0.61	30.96***	27.00***
	(7.21)	(0.468)	(6.00)	(1.20)
FAFSA × Income^2 ($000)	2.18e-4***	-2.94e-07	-8.89e-5	-8.71e-5***
	(4.23e-5)	(6.30e129)	(4.12e-5)	(4.39e-6)
λ	-2874.90***	-494.76***	-868.82***	-2,759.28***
	(39.90)	(1.16)	(25.17)	(39.54)

Controls include income, dependency status, female, race, married resident, GPA, SAT, age, number of students enrolled, and tuition
Delta Method Standard Errors in parentheses
*** p < 0.01, ** p < 0.05, * p < 0.1

Table 1.15: Robustness Check-Chain Universities

VARIABLES	(1) Total Aid	(2) Institutional Aid	(3) Pell Grant	(4) Subsidized Loan	(5) Unsubsidized Loan	(6) Net Price
Largest Chain						
For-Profit	-381.67***	-4,474.96	-34.78	68.79***	442.31***	6,332.71***
	(107.28)	(10,979.54)	(32.19)	(26.46)	(43.03)	(73.31)
Public	726.90***	-241.83***	304.9*5***	391.20***	150.30***	1,814.57***
	(49.50)	(32.19)	(10.30)	(13.55)	(28.06)	(51.58)
IMR	-3,045.47***	-581.52***	-625.24***	-628.98***	-696.01***	-2,558.46***
	(45.90)	(68.19)	(11.31)	(13.21)	(25.42)	(44.90)
No Largest Chain						
For-Profit	-115.06***	-1,367.21***	-28.76***	221.01***	1,309.71***	2,735.10***
	(37.06)	(32.57)	(9.31)	(10.96)	(22.22)	(37.61)
Public	20.60	-213.58***	301.65***	270.86***	-173.16***	1,883.65***
	(54.71)	(13.87)	(11.42)	(15.13)	(38.78)	(51.68)
IMR	-4,351.41***	-510.62***	-556.22***	-987.31***	-1,387.38***	-3,367.52***
	(52.28)	(13.46)	(11.53)	(15.30)	(31.96)	(42.43)
Three Largest Chain Only						
For-Profit	-350.63***	-3,194.58***	-130.51***	34.39*	818.08***	4,899.97***
	(75.88)	(1,026.11)	(21.79)	(26.46)	(30.05)	(59.75)
Public	730.04***	310.06***	304.9*5***	391.20***	191.57***	1,662.67***
	(49.56)	(16.51)	(10.26)	(13.55)	(28.79)	(50.94)
IMR	3,123.20***	-578.07***	-618.06***	-628.98***	-773.61***	-2,647.60***
	(45.61)	(15.97)	(11.10)	(13.21)	(25.47)	(43.57)
No Three Largest Chain						
For-Profit	-103.12***	-1,336.52***	-25.47***	223.19***	1,280.74***	2707.15***
	(37.38)	(32.24)	(9.38)	(11.03)	(22.17)	(37.92)
Public	23.45	-214.64***	301.85***	267.52***	-182.01***	1,856.60***
	(54.58)	(13.98)	(11.44)	(15.09)	(38.50)	(51.69)
IMR	-4,306.92***	-514.39***	-553.66***	-976.38***	-1,352.74***	-3,342.24***
	(52.31)	(13.56)	(11.59)	(15.31)	(31.85)	(42.58)

Controls include income, dependency status, female, race, married resident, GPA, SAT, age, number of students enrolled, and tuition
Robust Standard Errors in parentheses
*** p < 0.01, ** p < 0.05, * p < 0.1

Chapter 2

To Apply or Not to Apply: FAFSA Completion and Financial Aid Gaps

2.1 Introduction

College affordability and rising student loan debt are great concerns to fiscal and education policymakers. These worries come at the same time that federal and state governments are encouraging their citizens to increase rates of college attendance and completion. In the 2009 State of the Union Address, President Obama announced that the federal government set a goal to boost graduation rates until the United States again leads the world in college completion. Organizations such as the Lumina Foundation and state governments such as Georgia, Utah, and Wisconsin have set similar goals to boost college completion among their respective constituents.

One way to make college more affordable is to ensure that each eligible student completes the Free Application for Federal Student Aid (FAFSA). FAFSA serves as the gateway for many programs sponsored by the federal government including Pell Grants, Stafford loans, Perkins loans, and work-study. In addition to federal aid, many states,

institutions, and private organizations sponsoring scholarships require FAFSA completion to qualify for other financial aid programs. Despite the large amounts of aid at stake, many students who are eligible for aid fail to complete FAFSA (King 2004). Possible explanations for why eligible students do not complete FAFSA include the complexity of the form[1] (Deming and Dynarski 2009) and a lack of information regarding eligibility for aid[2] (Avery and Kane 2004). Also some students may not complete the form because they believe that they are not eligible for grants, and would only receive loans. While a student who has other sources of college funding or is unsure about his academic skills may not want to take on unneeded college debt. However, if the student is credit constrained, some student loan debt may be necessary and FAFSA completion is an important step to asses financial need.

Using the National Postsecondary Student Aid Study (NPSAS), I investigate which individual, academic, and institutional attributes influence a student's decision to not complete FAFSA, and quantify the amount of financial aid that a non-applicant forgoes. The NPSAS is an excellent source of information describing students who are already enrolled in college and what resources students used to cover costs of attendance. These data contain personal information from the FAFSA, academic characteristics such as high school GPA, detailed scholarship, grant, and loan information, and institutional characteristics. While the NPSAS contains student responses from the FAFSA, the National Center for Education Statistics (NCES) collects information that would have been

[1]Dynarski and Scott-Clayton (2006) outline the financial aid process and discuss the complexity of the FAFSA. The FAFSA is five pages long with 128 questions and is compared to the IRS 1040EZ which is one page with 37 questions and the 1040 form is two pages with 118 questions. The authors use simulations and econometric analysis to find that a number of questions on the FAFSA have no effect on eligibility determination or financial aid allocation.

[2]Bettinger *et al.* (2012) conduct an interesting, natural experiment to measure the effect of complexity and information asymmetry on the probability a student completes FAFSA. Partnering with H & R Block, a tax preparation company, Bettinger and coauthors assist students completing FAFSA. The authors divide students into three groups. The first group is paired with an H & R Block employee who calculates the expected family contribution (EFC) for the student and then helps the student complete FAFSA. For the second group, the employee calculates the student's EFC only, and the third group receives no help but a brochure explaining the benefits of college. The students in the first group are more likely to apply for federal aid and enroll in college.

on the FAFSA form from students who did not complete FAFSA. Using the data collected from student interviews, the NCES imputes the Expected Family Contribution[3] (EFC) for students who did not complete FAFSA. This imputation is done "by regression using dependency, family size, income, and number in college." While these imputed observations must be treated with caution, the NCES does include all components of the federal aid formula so there should be no concern about omitted variable bias. These data construct a helpful counterfactual to estimate how much aid a student would have received if he would have completed FAFSA.

I find that students who attend college but do not complete FAFSA are more likely to be white, male, independent from parents[4] and come from families making less than $50,000 annually. These students may have incomplete information regarding federal student aid eligibility before enrolling in college, and thus do not apply.

To calculate the amount of aid that a student forgoes by not completing FAFSA, I use propensity score matching. I find that the average total financial aid gap[5] between applicants and non-applicants is $9,741.05, of which $1,281.00 are Pell Grants, $2,439.50 are subsidized student loans, $1,986.65 are the balance of unsubsidized student loans, and $1,016.04 are institutional grants. Given the 20,966,826 college students in the United States in 2012, [6] these estimates imply that non-applicants forgo a total of $24 billion in aid of which $3.2 billion are Pell grants, $6.0 billion are subsidized student loans, $5.6 billion are unsubsidized student loans, and $2.9 billion in institutionally funded grants.

[3]The EFC is the government's estimate of how much the student or student's family can contribute to the student's education. The federal government uses a formula that incorporates family income and the number of dependents in the student's family. I include a detailed description of the EFC formula in Appendix A.

[4]The difference between independent and dependent students is very important when studying federal financial aid. A student is considered independent if he or she is over the age of 24, has dependents, is married, or is a military veteran. Otherwise the federal government classifies the student as a dependent. If the student is an independent, then the government uses the student's income to determine need. If the student is a dependent then the government uses parents' income to determine need.

[5]In this study, I define the term financial aid gap to be the difference in financial aid between students who complete FAFSA and students who do not apply for federal financial aid.

[6]National Center for Education Statistics (2012).

The reminder of the total aid consists of work-study, and state and private aid programs. Considering that the average student in 2012 took on $9,480 in both federally backed and private student loans, these estimates show that a considerable amount of student loan debt could be avoided by receiving grant aid for which the student is already eligible. Increasing FAFSA completion rates may alleviate the total balance of student loan debt which is, as of 2012, approaching one trillion dollars.

The failure to apply for and obtain federal aid is of great concern because financial aid can influence whether a student enrolls in college (Cornwell *et al.* 2006; Leslie and Brinkman 1987; van der Klauuw 2002; Dynarski 2000), the type and quality of the institution a student chooses (Bruce and Carruthers (2014), Avery and Hoxby 2004; Fuller *et al.* 1982; Kim 2004), and the probability that a student persists to graduation (Bettinger 2004; Dynarski 2008; Singell 2004; Alon 2011; Novak and McKinney 2011; Lovenheim and Owens 2013; McKinney and Novak 2013). While the data used in this study do not permit me to address these education outcomes directly, the financial aid literature provides evidence that failure to complete FAFSA and thus forgoing financial aid has negative consequences for student success.

This paper contributes to the literature by employing probit and multinomial logit models[7] to understand what factors affect a student's decision to complete FAFSA, and how much aid an eligible student forgoes by not applying for federal aid. While much of the literature focuses on the effects of financial aid on educational outcomes, this paper shows how completing FAFSA influences how financial aid is allocated, which correspondingly has a substantial effect on the student's academic and occupational success.

[7]King (2004) presents summary statistics from the 1999-2000 wave of the National Postsecondary Student Aid Survey (NPSAS). Characteristics that are negatively correlated with FAFSA completion include if the student is considered an independent, income, full or part time enrollment, and the type of school to which a student enrolls. The NPSAS inputs an estimated expected family contribution for non-applicants. Using these data, the author concludes that many students who do not complete FAFSA, would have been eligible for financial aid.

The results from this paper can help policymakers and higher education administrators identify certain groups of students who are not reached by school counselors or other programs before they entered college. Completing FAFSA and helping students to obtain the financial aid resources for which they are already eligible, reduces the cost of attendance and the growing amount of student loan debt. While increased FAFSA completion would increase the amount of money spent by the Federal Government on education, the returns in the form of increased tax revenue from workers' increased income, possible health benefits (Eide and Showalter 2011), and a more engaged citizenry (Dee 2004) may be worth the increased investment.

2.2 Data and Trends

2.2.1 Description of Data

National Postseconday Student Aid Study (NPSAS)

I use data from the 1999-2000, 2003-2004, 2007-2008 waves of the National Postsecondary Student Aid Survey (NPSAS). The National Center of Education Statistics (NCES), a subsidiary of the United States Department of Education, compiles the NPSAS and updates it with a new cross section every four years. These data contain information from many sources including student interviews, student responses to the FAFSA, and surveys completed by college and university administrators about their institutions. Data contained in the NPSAS describe student characteristics such as grades, standardized test scores, and parents' income. NPSAS also identifies the college or university that the student attends and provides data about enrollment size, institutional control, and tuition pricing. All monetary variables are expressed in 2008 dollars.

NCES constructed the NPSAS by randomly sampling both institutions and students to create a representative sample of typical college students for each of the fifty states, the District of Columbia, and Puerto Rico. Each institution of higher education that is eligible for federal student aid (i.e. Title IV compliant) was assigned a sampling probability and sampled with replacement so that the NPSAS creates a representative sample of the college student population in each state. After the number of observations per institution was determined, NCES randomly sampled students such that the data represent the student body with regards to demographic information, types of financial aid, and major.

Sample Selection

I limit my sample to undergraduate students who are American citizens, attend only one institution during the school year, and attend a four-year public or private not-for profit institution. I drop observations that are over the age of 65 and under the age of 15 (115 observations). I also drop observations of students whose institutions reported a "sticker price" tuition rate less than $100 for full-time students (22 observations) and attend universities with headcount enrollment less than 100 (51 observations). The tuition observations for these institutions were probably mistakes because they are large, well known universities whose tuition prices are much greater.

Summary Statistics

Eligibility for federal financial aid is determined by the cost of attendance (including tuition, fees, books, room and board, etc.) minus the expected family contribution. One unique attribute of the NPSAS is that the NCES calculates a hypothetical EFC for non-applicants. Using the cost of attendance and EFC data from the NPSAS, I calculate potential eligibility and then sort observations into four groups: eligible and applied; eligible and did not apply; non-eligible and applied; non-eligible and did not apply.

Table 2.1 shows descriptive statistics for the 83,600 observations in this study. As a condition of the restricted use license, all summary statistics and number of observations are rounded to the nearest ten. Across the three cross-sections, the average total financial aid package and federal need based grant are $8,140 and $760 respectively. The average expected family contribution during this time period was $10,640 and the average GPA and SAT scores were 3.00 and 1060 respectively. The universities in the sample charged an average $7,490 for the entire school year in tuition and fees and have an enrollment of 14,580 students. The students in this sample are representative of student bodies for most colleges and universities. Table 2.2 describes the differences in key summary statistics between students who are eligible for any type of federal aid who complete FAFSA, eligible students who do not complete FAFSA, non-eligible students who do not complete FAFSA, and non-eligible students who do not complete FAFSA. Of these students 58.90 percent are eligible for aid and complete FAFSA, 19.35 percent are eligible for aid but do not complete FAFSA, 8.29 percent are not eligible for any federal aid and complete FAFSA, and 13.46 percent are not eligible for any federal aid and do not complete FAFSA.

The differences between non-applicants and applicants conditional on being eligible for any federal aid are significant. The EFC for eligible non-applicants (column 2) is $5,200 more than eligible students who apply (column 1). Eligible, non-applicants (or their parents) tend to make around $13,500 more than non-applicants. Non-applicants also tend to be older, more white and Asian, and more likely to be independent from their parents. Academically, non-applicants have higher GPA and SAT scores, but attend colleges that are less expensive. Non-applicants are also less likely to earn financial aid even when compared to not-eligible students who complete FAFSA.

Students who are not eligible (columns 3 and 4) for any federal aid have, on average, $18,642 more in EFC and $61,437 more in parent or family income than eligible students (columns 1 and 2). However, eligible and non-eligible students are quite similar

when comparing GPA. Also, students who were not eligible for aid attend schools who charge, on average, $2,531 less than students who are eligible for aid. These results may reflect the aid formula used by the Department of Education that accounts for cost of living expense (including tuition, room, and board) in addition to financial need. Students attending schools with lower tuition prices would have less incentive to complete FAFSA and less likely to be eligible for federal financial aid compared to students at more expensive institutions.

Table 2.3 displays summary statistics for students whose EFC is below the eligibility cap for a Pell Grant. Pell Grants are only available to students whose EFC is under a certain limit determined each year and who cost of attendance exceeds the EFC. The maximum EFC for Pell Grant eligibility was $4,110 in 2008, $3,850 in 2004, and $2,925 in 2000.

The summary statistics for Pell Eligible students are similar to those for the whole sample in Table 2.2. Pell elgible students who complete FAFSA receive, on average, $10,297 more than those students who did not complete FAFSA. Non-applicants, however, only have $100 more in expected family contribution than those Pell-elgible students who complete FAFSA. Also non-applicants are more likely to be white or Asian, older, independent from their parents, and attend institutions with lower tuition prices. The pool of students who are not eligible for federal aid (meaning that their cost of attendance is still less than their EFC) is quite small. Non-eligible students account for 156 observations of 34,408 (or around 0.453% of the sample).

2.2.2 Trends in FAFSA Completion

Figure 2.1 shows the percentage of dependent and independent students who completed FAFSA for each year by parent's income. The Department of Education classifies a student as a dependent if she is under the age of 24, single, a non-veteran, and has no children. For

financial aid purposes, a dependent student reports her income along with her parents' income, while an independent student reports solely her own income.

Income reduces the percentage of students who complete FAFSA because eligibility for many federal programs is need based. What is surprising, however, is how quickly the share of students who do not complete FAFSA drops as income rises; particularly for independent students. For example, around 80% of independent students who make less than $10,000 complete FAFSA, but only 50% of independent students who make $40,000 apply for federal aid.

Eligibility for federally based financial aid is determined by the difference between the cost of living and the EFC. Figure 2.2 plots the percentage of students who completed FAFSA given the amount of federal aid (including grants, loans, and work-study employment) for which the student is eligible. If students have complete information regarding their eligibility before their decision to complete FAFSA, then a student would not complete FAFSA when the EFC exceeds the cost of attendance; while all students who are eligible for aid would complete FAFSA. Thus there would exist a clear discontinuity where zero percent of students complete FAFSA when they are not eligible and then all students with positive need would complete FAFSA.

The vertical line in Figure 2.2, plots what the FAFSA completion trend should look like if students have perfect information and low transaction costs of completing FAFSA (compared to actual trends for both dependent and independent students). This figure indicates that students do not have complete information regarding their eligibility because 85 percent of eligible, dependent students and around 70 to 80 percent of eligible, independent students complete FAFSA. One reason that independent student consistently complete FAFSA at lower rates is that they do not have parents or high school counselors to motivate or ensure FAFSA completion.

While non-eligible applicants may waste time and other non-monetary resources while completing FAFSA, the group of students of most concern to policymakers are the eligible students who do not complete FAFSA. FAFSA completion varies greatly depending on the extent of need. Marginally needy students complete FAFSA at a rate from 55 to 80 percent. However, the FAFSA completion rate drops for the extremely needy students who may be most sensitive to changes in financial aid.

Figure 2.3 plots the percentage of students who complete FAFSA across the high school GPA distribution by dependency status. Between 60 and 70 percent of independent students complete FAFSA until the 70th percentile where the completion rate drops to 50 percent. GPA may not significantly influence on FAFSA completion as income or tuition because of two reasons. First, the federal government allocates aid by considering financial need not academic merit and students who receive institutional or private merit aid are still eligible for federal need based aid. Second, only students at the very top of the grade distribution are generally eligible for merit aid.[8] While one may suppose that a student who already has a full merit scholarship may have less incentive to complete FAFSA, Figure 2.3 shows that this trend may not be general for all students.

2.3 Estimation Strategy

This study examines three questions regarding the application for federal student aid. First, how do demographic characteristics and family finances influence whether a student completes FAFSA? Second, what characteristics influence eligible students to mistakenly not apply even though the would have been eligible for aid? Finally, how much aid does a non-applicant forgo?

[8]Notable exceptions include HOPE-style merit aid programs that are usually very generous. For example, during the sample periods, Georgia students were only required to have a 3.0 high school GPA to be eligible.

2.3.1 Applying for Federal Aid

Probit Model

I estimate a probit model, to calculate how personal characteristics, financial resources, and institutional characteristics influence a student's decision to complete FAFSA. If all students have complete information about their eligibility for federal aid before they complete FAFSA, then the only variables that should influence FAFSA completion are the cost of attendance and the expected family contribution. All other variables such as income, gender, race, and GPA should not be statistically significant because they do not directly determine aid eligibility.[9] However, if students do not have complete knowledge about their aid eligibility before the complete FAFSA, many of these characteristics will influence their decision because it biases the student's belief about their eligibility. One helpful aspect of the NPSAS, is that the Department of Education provides a random sample of students who did not complete FAFSA and calculates their hypothetical EFC. This EFC serves as a helpful counterfactual to determine the eligibility status of non-applicants. I also estimate a probit model using only students who are eligible for Pell Grants.

Multinomial Logit Model

Knowing which groups of students are eligible for federal aid, but do not apply would help policy makers boost FAFSA completion and ensure that deserving students receive the financial aid for which they are eligible. If the assumption of complete information does not hold, then there are essentially four possible outcomes: eligible students who do complete FAFSA, non-eligible students who do not complete FAFSA, non-eligible students

[9]While Federal aid is means tested, income is only one component of the EFC and thus if students have complete information, then EFC should be statistically significant while income should not. However with incomplete information, a student may incorrectly estimate her EFC. I summarize how the federal government calculates EFC in the Appendix.

who do not complete FAFSA, and eligible students who do not complete FAFSA. To measure how personal, financial, and institutional characteristics influence the propensity for a given ineligible student to not complete FAFSA, I estimate a multinomial logit model. The multinomial logit model has response probabilities:

$$P(y = j|\mathbf{X}, I) = \frac{exp(\mathbf{X}\boldsymbol{\beta}_J + \alpha I + \gamma S)}{\left[1 + \sum_{h=1}^{J} exp(\mathbf{X}\boldsymbol{\beta_J} + \alpha I + \gamma S)\right]}, \tag{2.1}$$

where I is a student's own or family income, $\mathbf{X}$ is a matrix containing all other personal characteristics, S is a matrix of school characteristics, and J indicates which eligibility/application group a student finds herself in.

Unlike the probit model, I do not estimate the multinomial logit model for only students whose EFC is below the cutoff for possible Pell eligibility. It is possible to have an EFC below this cutoff but not receive a Pell Grant because the student attends an institution where the cost of attendance is less than the EFC. In my sample, this condition applies only to 156 observations that account for only 0.453% of the sample of students with sufficiently low EFCs for Pell eligibility. If one removes these two options with small numbers of observations, then the multinomial logit model collapses to the standard logit model.

2.3.2 Propensity Score Matching and the Financial Aid Gap

Propensity score matching calculates the difference between an outcome and its counterfactual when using non-experimental data. The basic conceptual framework for propensity matching is provided by the Roy (1951) and Rudin (1974) models. I consider students who complete FAFSA as the treated group and students who fail to complete FAFSA as a control group. The financial aid gap is essentially the average treatment on the treated, which can be calculated by the following formula:

$$\tau_{att} = E(y|w = 1) - E(y|w = 0),$$

where y is the amount of financial aid that a student receives, w is a latent variable indicating whether a student completed FAFSA, and τ_{att} is the average treatment on the treated.

One challenge in using this framework is that one cannot observe $E(y|w = 1)$ or $E(y|w = 0)$ at the same time for the same student because either the student completes FAFSA and receives an observable financial aid package or does not complete FAFSA and receives no federal aid. The other observation is purely counterfactual.

Propensity score matching calculates a counterfactual with similar characteristics to a given treated observation. To avoid problems with dimensionality, the researcher first calculates a propensity score for receiving the treatment for each individual and then uses one of many available algorithms to match a student who completed FAFSA with a similar student who did not complete FAFSA.

In this study, I use Gaussian kernel matching. While, nearest neighbor is the simplest algorithm and is considered a good baseline for comparison to other forms of estimation (Caliendo and Kopeinig 2008), I use Kernel matching because this technique uses all of the observations within a certain bandwidth (Heckman *et al.* 1997, 1998) instead of using only one or an average of a few observations to develop the counterfactual as in nearest neighbor matching. The counterfactual is simply a weighted average of all observations with weights determined by how close an observation is to the treated observation. Using a normal density, observations that are the closest to the treated observation are weighed greater than those farther away. Following Smith and Todd (2005), I match with replacement which allows for better matching and increases the standard error, thus reducing the possibility for Type I error in casual inference.

The counterfactual observation, using kernel smoothing, is:

$$E(y|w=0) = \frac{\sum_{i:W_i=w} y_i \cdot \phi\left(\frac{X_i - x}{h}\right)}{\sum_{i:W_i=w} \phi\left(\frac{X_i - x}{h}\right)}, \tag{2.2}$$

where ϕ is the standard normal distribution, X_i is the control observation for which the weight is being calculated, x is the treated observation that the researcher is comparing, and h is the chosen bandwidth.

One matching algorithm is not optimal for all circumstances (Imbens 2004), there are tradeoffs for using one method over another. For example, the variance of the nearest neighbor estimator is smaller than the variance in the kernel estimator, but the kernel estimator uses all available data to form the counterfactual to reduce the probability of a bad match (Heckman *et al.* 1997; Abadie and Imbens 2006). Also, a tighter bandwidth creates a smoother estimate, but reduces the number of observations taken into consideration. The literature is divided regarding optimal bandwidth (Imbens 2004), so I use 0.06 as the bandwidth; which is common in other studies (e.g. Heckman *et al.* 1997). I check this bandwidth selection by repeating the routine using bandwidths of 0.03 and 0.10 and find that the alternative bandwidths do not significantly affect the results.

2.4 Results

2.4.1 Results from Probit Models

Understanding which personal, academic, and institutional characteristics affect a student's decision to complete FAFSA is important to policymakers because financial aid affects a myriad of education outcomes. Since cost of attendance and expected family contribution are the only variables that directly affect aid eligibility, if students have perfect information then all other variables should not be statistically significant. Table 2.4 displays the partial

effects from the estimated probit models for both the full sample (columns 1 and 2) and the sub-sample comprised of only Pell eligible students (columns 3 and 4). Included with the covariates discussed in Section 3.1, columns 2 and 4 show models that include state effects to estimate if results are robust even across unobserved characteristics of the various states. These fixed effects should also control for particular state financial aid programs that require students to complete FAFSA to gain access to aid.

Demographic and family characteristics have considerable influence over the choice to complete FAFSA. In accordance with the descriptive statistics in Section 3.2, the probit model indicates that the probability that a student completes FAFSA declines as income increases, but the magnitude of the effect is surprising. An increase in a student's own or family income by $10,000 decreases the probability of FAFSA completion by 3.29 percentage points. This decline in FAFSA completion is concerning because many low or moderate middle income households still would be eligible for some amount of Pell Grant or subsidized student loan.

Other student characteristics influence FAFSA completion. Probably as a result of extensive outreach programs at both highs schools and universities (Alon 2007; Boschung *et al.* 1998, Fenske, Porter, and DuBrock 2000; and St. John and Noell 1989), black and Hispanic students are, on average, 12.5 and 7 percentage points more likely to complete FAFSA than their white classmates. For the sample of only Pell eligible students, blacks are around 10 percentage points and Hispanics are around 6 percentage points more likely to complete FAFSA than whites.[10] Females are also more likely to complete FAFSA. While these increases are beneficial for underrepresented students, white students may erroneously believe that minority status is required for aid eligibility. Also, dependent students are 8.16 percentage points more likely to complete FAFSA than independent

[10]Recall that the NPSAS contains observation of only individuals who matriculate into college. These results may be different if the data included both students and those who never attend college.

students. All results are robust when state fixed effects are added (columns 3 and 4). However when students who are not Pell eligible are omitted from the sample, many characteristics that do not directly affect aid eligibility become statistically insignificant. This result is probably because students who are eligible for a Pell Grant have a sufficiently low EFC and may have benefited from college and high school counselor outreach.

2.4.2 Results from Multinomial Logit Model

The complexity of the FAFSA form may prevent students who would be otherwise eligible for a Pell Grant or subsidized student loans from completing FAFSA. To understand which institutional, personal, and academic characteristics are associated with non-application, I estimate a multinomial logit model with the following categories: eligible and applied, not eligible but applied, not eligible and did not apply, and eligible but did not apply. I sort observed students into one of these three categories by subtracting each student's EFC from the cost of attendance of the college the student attends. Then using the indicator in the NPSAS for whether a student completed FAFSA, I sort students into the four categories described above. The students of interest are eligible for aid but do not complete FAFSA and thus were denied financial aid.

Figure 2.4 plots financial need (meaning cost of attendance net EFC) against parent or student income for students who did not complete FAFSA and thus forgo any federal financial aid. I limit this figure to students whose own or parent's income is less than $100,000. Any student whose need is greater than the minimum Pell Grant[11] would have been eligible for federal aid. While the number of eligible students declines with income, there still is a significant number of eligible students who are not completing FAFSA. One surprising result from this figure is how many students are still eligible for financial aid despite their high parents' or own income. While not all of these students are eligible for

[11]During the 2007-2008 school year, the minimum Pell Grant amount was $400.

Pell Grants, these students may be eligible for student loans, work study, or institutional aid.

Table 2.5 displays the results from the estimated multinomial logit model. Column 1 shows the outcome that is of most concern to policymakers: eligible students who do not apply. The omitted category is eligible for aid and complete FAFSA. Thus the coefficients represent the probability that an eligible student would not complete FAFSA compared to eligible students who do complete FAFSA. These students are eligible for at least some types of federal aid, but still do not complete FAFSA. Understanding which characteristics influence a student to not complete FAFSA despite the student's eligibility may help college administrators target students for FAFSA completion and policymakers to simplify the FAFSA form. The partial effects in Table 2.5 compare the probability that a student is classified in a certain group compared to a student being eligible and completing FAFSA.

If students are perfectly informed about their aid eligibility, then the only coefficients that should be significant are tuition and EFC. Table 2.5, shows that if a student's income increases by $10,000 then the probability that an eligible student does not complete FAFSA increases by 1.37 percentage points. Race and gender also influence the decision not to complete FAFSA. Black and Hispanic students who are eligible for federal aid are nine and five percentage points more likely, respectively, to complete FAFSA than similar white students. Eligible female students are around 1.8 percent more likely to complete FAFSA than eligible male students. Eligible students who are dependent on their parents are 5.22 percentage points more likely to complete FAFSA. A student's age also decreases FAFSA completion by 0.10 percentage points.

Columns (2) and (3) are not as important to policymakers because they represent students who were either not-eligible and applied for aid, or where not-eligible and did not apply for aid. If students had complete information about the eligibility, then we would expect the situation in column (3) to prevail for all non-eligible students, but not column

(2). Tuition rates and EFC in both columns conform to expectations. If a student matriculates into a college with a higher tuition rate, then the probability that a student will not be eligible for aid declines (0.659 percentage points for not eligible and did apply and 2.40 for not eligible and did not apply). Females are less likely to find themselves in either category. Also students are dependent or black are 5.23 and 2.58 percentage points respectively more likely to complete FAFSA when they are not eligible.

2.4.3 Results from Propensity Score Matching

Finally, I use propensity score matching to measure the magnitude of the financial aid gap between FAFSA applicants and non-applicants. One of the primary conditions for propensity score matching is that the data must provide a region of common support (Bryson *et al.* 2002); meaning that the distributions of the estimated propensity scores for the treated and untreated must overlap and thus provide enough data to construct a counterfactual. Figure 2.5 displays a histogram of the propensity scores for federal aid applicants and non-applicants. The distributions of propensity scores for both categories overlap over the majority of propensity scores. The possibility of a non-match does exist however at the extreme ends, but for students on the margin of completing FAFSA this should not be of concern. I also estimate the financial aid gap for Pell-eligible students only, but I only estimate the gap by income level up to $50,000 to $60,000 a year because higher income levels do not have enough observations for the kernel matching.

First, I measure the total financial aid gap. This gap includes all forms of financial aid (both loans and grants) from all sources (private donors, institutions of higher education, state and federal governments). Table 6 contains the results from the propensity score matching that show that there is a large and significant gap between students who complete FAFSA and those who do not. Figure 2.6 also plots these results over income for

each wave of the data over household income. While the gap is the largest for very poor students, the gap still exists across income levels.

The most interesting result is the extent of the financial aid gap. The results from the propensity score matching show that even students who have high incomes lose considerable amounts of financial aid when they do not complete FAFSA. For example, for students making over $100,000, the financial aid gap from the pooled sample is $9,150.22 per year. The large gap may be a result of private, institutional, and state aid programs that are merit based but require the student to complete FAFSA. The gap also closes while student income increases, but has remained somewhat constant over time.

The total aid variable cannot measure how the composition of the financial aid package changes as income increases. For example, as income increases many students will not receive Pell Grant aid but the Federal Government may offer them a subsidized student loan. Also many higher income students may earn more merit aid if they attend a university with more financial resources. To better understand how the financial aid gap changes when income changes, I conduct the same propensity score matching technique on Pell Grants and subsidized Stafford Loans.

Table 7 shows results from the propensity score matching for Pell Grants. Unlike the total aid results, the financial aid gap is only positive for students whose income is less than $60,000. While the gap is statistically significant at all levels, the minimum Pell Grant was around $400 for all of the time period represented by the data. This result implies that lower and lower-middle income households forgo significant amounts of aid (for example, $1,732.04 for households with incomes between $30,000 to $40,000). For the very poor, the effects of not completing FAFSA are very large. Households making less than $10,000 forgo over $3,000 in Pell Grant aid. The accompanying Figure 2.7 plots these results and shows how the stark downward trend of the financial aid gap for Pell Grants. Also since the federal government has expanded the Pell program over the last decade, the

amount of Pell Grant aid that a non-applicant forgoes increased with each wave of the data.The Pell aid gap almost doubles when only Pell eligible students are considered. The average Pell grant forgone across time and income is $2,721.28, but even students whose families make between $50,000 and $60,000 and are eligible for Pell (probably because they come from a family with many dependents and few financial assets) forgo $1,357.63

Table 8 displays results for the financial aid gap for subsidized student loans. The results are similar to those for Pell Grants except that it the financial aid gap is bigger across income levels. While loans need to be repaid, they are valuable because the student does not pay while in school and the Federal Government subsidizes the interest rate after graduation. These results reflect the balance of the student loan and does not account for the interest paid by the federal government on the student's behalf but reflects the amount of payments postponed and lower interest rate the student could have paid on that balance.

Even high income students lose out on significant amounts of subsidized student loans by not completing FAFSA. Students whose families make more than $100,000 forgo $1,125 while students with family/own income around $50,000 forgo almost $3,300. The financial aid gap for subsidized student loans is consistent across each wave of the data. Figure 2.8 plots the financial aid gap across income levels. The downward trend reflects the need-based method of allocating subsidized student loans.

Table 9 displays results for unsubsidized student loan gap. These loans are offered by the federal government and accumulate interest while the student attends school. The amount of unsubsidized loans is determined by the university to fund the cost of attendance after other forms of financial aid. Students do not need to demonstrate financial need to receive unsubsidized loans, but students still must complete FAFSA to access these loans. The average balance of unsubsidized loans forgone by non-applicants is $1,986.65. Figure 2.9 shows how the unsubsidized loan gap changes with income. Unlike the Pell Grant and subsidized student loan gaps, the amounts of forgone unsubsidized

loans increases as household income increases. Poorer households are eligible for other types of aid and thus do not need unsubsidized loans, so richer households are more likely to use these loans. For example the average amount of unsubsidized loan that a very poor (income less than $10,000) forgoes is $1,610.02, but a household making more than $100,000 will lose $3,303.61. Interestingly, being Pell eligible decreases the amount of unsubsidized student loans that a non-applicant household forgoes, probably because these loans are substituted with Pell Grants.

Table 10 displays results for the institutional aid gap. These results are not as clear as the previous categories because institutions vary widely on the amounts of aid that they are willing and able to allocate to students. As opposed to the previous aid categories where all estimates were statistically significant at the 99% level, some estimates of the institutional aid gap are not statistically significant. The the average aid gap across the waves of the data and income is statistically significant and estimated to be $1,016.04. Figure 2.12 shows the aid gap across household income. While there is a clear trend like in previous categories, it does show that students regardless of income forgo significant amounts of institutional aid when they do not complete FAFSA.

Table 11 shows results for the total grant aid gap. While FAFSA completion is not required for all types of aid, many institutions and states do require a student to complete FAFSA even when the aid eligibility for a particular program is not based on financial need. Thus these results may help test the hypothesis that students to fail to complete FAFSA do so because they already have sufficient grant aid that is not tied to the form. However, these propensity score matching results indicate that students who do not complete FAFSA forgo large amounts of grant aid which may include aid funded by the federal government, state governments, and institutions. This total grand aid gap ranges from $5,464.45 for family/student incomes less than $10,000 to $1,784.43 for families or individuals making more than $100,000. The average forgone aid across years and income levels is $3,254.87.

The aid gap for only students who are Pell eligible is not significantly higher than the general student population. Thus institutions may be substituting Pell Grant funds for institutionally based financial aid. Figure 11 plots the total aid gap over income levels.

One possible reason that students may not complete FAFSA is that they could already be receiving sufficient amounts of financial aid from their employer. Particularly for non-traditional working students, employer funded tuition assistance can be an important part of the financial aid package. Table 12 shows propensity score matching results for students receiving employer aid across income levels, NPSAS waves, and Pell Grant eligibility. I find that students who do not complete FAFSA do receive more employer aid however, in some cases, the gap is neither statistically nor economically significant. While some point estimates are significant, there is no discernible trend across income levels that gives evidence to the idea that employer aid is influencing the FAFSA completion decision for a significant number of students. There is also no difference between the amount of aid between Pell Eligible and the complete sample of students. Figure 12 plots the employer aid gap across income levels.

The propensity score matching results confirm that it is important that low-income students complete FAFSA, but also suggest that lower middle and middle income students lose significant financial aid if they do not complete FAFSA. Thus while focus is still needed on lower income students, policymakers and educators should encourage middle income students to complete FAFSA.

2.5 Conclusion

Since the creation of the Federal Pell Grant Program, federal need-based aid has become a major portion of university tuition revenue (McPherson and Schapiro 1991). There is considerable evidence that financial aid increases access to higher education, the quality of

match between the student and college, and the probability that a student persists to graduation. However, little is known about the types of people who apply for federal financial aid, the characteristics that influence this decision, and the amount of financial aid that a student forgoes by not applying.

The results from this study show that parents' or student's own income reduces the probability that a given student completes FAFSA. Many eligible, lower to middle income students do not complete FAFSA and forgo significant amounts of financial aid. Also, female and minority students are more likely to complete FAFSA. Whites, males, independent students, residents and upperclassmen are less likely to apply for aid even when they are eligible. These results are conditional on attending college but may not be reflect the general population. Data including observations of people who chose not to attend college may yield different results. The results in this study are helpful because students who forgo financial aid may reduce the probability of persisting to graduation and may have a higher student loan burden.

Finally, I use prosperity score matching to measure the amount of forgone financial aid for non-applicants. I find that there is a large and statistically significant aid gap that may have a substantial effect on education outcomes. Overall, the average financial aid gap for all types of aid is $9,741.05. While this gap is declining in income, it is surprising that even upper middle and high income students lose significant amounts of aid when they do not complete FAFSA. The financial aid gap is also significant for Pell Grants, subsidized student loans, unsubsidized student loans, and, in most cases, institutional aid. For Pell Grants the financial aid gap is very large for poor students, but even students whose families make around $40,000 lose $1,1730 in aid, while most students forgo large amounts of subsidized student loans including very generous interest and repayment benefits. The balance of unsubsidized loans increases with income. While unsubsidized loans do not come with the same benefits as subsidized loans, students who do not complete FAFSA will

have to find other ways to pay their tuition including using credit cards or private loan sources that have higher interest rates than unsubsidized loans. There is not a clear pattern with institutional aid, but the gap does trend upwards with regards to income. Not all institutions require FAFSA completion to access aid, but the average student could forgo $1,016 by not completing FAFSA.

These findings are significant because many studies show that financial aid is important in school choice, enrollment, and persistence to graduation. The complexity of the FAFSA or lack of knowledge of federal financial aid programs deprive students of important resources that can help to succeed in college. Simplifying the FAFSA form and promoting FAFSA completion may be effective policies to to boost the number of college graduates; a goal of the federal government and various state governors.

Table 2.1: Summary Statistics for Overall Sample

Variable	Observations	Mean	Std. Dev.	Min	Max
Financial Aid					
Completed FAFSA	83,600	0.672	0.470	0	1
Total Aid	83,600	8,140	8,690	0	58,540
Pell Grant	83,600	760	1,380	0	4,620
Sub. Student Loans	83,600	1,600	2,250	0	10,830
Personal Characteristics					
EFC	83,600	10,640	13,690	0	127,210
Income	83,600	60,260	54,090	0	611,640
GPA	83,060	3.01	67.86	0	4.00
Dependent	83,600	0.652	0.476	0	1
Female	83,600	0.569	0.495	0	1
Asian	83,600	0.053	0.223	0	1
Black	83,600	0.109	0.311	0	1
Hispanic	83,6000	0.082	0.274	0	1
Age	83,600	23.73	6.90	15	65
Father's Education	83,600	12.68	5.18	0	20
Resident	83,600	0.834	0.372	0	1
Freshman	83,600	0.196	0.400	0	1
Sophomore	83,600	0.150	0.359	0	1
Junior	83.600	0.152	0.358	0	1
Senior	83,600	0.436	0.496	0	1
Fifth Year	83,600	0.048	0.214	0	1
Other Class	83,600	0.019	0.138	0	1
Institutional Characteristics					
Tuition	72,380	7,490	7,510	100	45,110
Enrollment (000)	83,370	14,580	12,150	120	54,090
Public	83,600	0.716	0.451	0	1

Note: All summary statistics are rounded to the nearest ten to comply with NPSAS restricted-use license agreement.

Table 2.2: Summary Statistics of Key Variables by Eligibility and FAFSA Completion-Total Sample

VARIABLES	(1) E, A	(2) E, NA	(3) NE, A	(4) NE, NA
Financial Aid				
Total Aid	11,820	2,300	8,690	1,210
	(8,720)	(4,880)	(6,710)	(2,900)
Pell Grant	1,290	0	0	0
	(1,590)	(0)	(0)	(0)
Sub. Student Loans	2,720	0	0	0
	(2,360)	(0)	(0)	(0)
Individual Characteristics				
EFC	5,410	10,640	29,980	23,360
	(7,450)	(10,060)	(18,740)	(16,590)
Income	43,290	56,720	120,150	102,730
	(38,770)	(45,920)	(65,300)	(64,910)
GPA	2.99	3.06	3.01	3.02
	(67.46)	(65.75)	(67.17)	(72.49)
Dependent	0.646	0.589	0.896	0.619
	(0.478)	(0.492)	(0.306)	(0.486)
Female	0.586	0.540	0.564	0.541
	(0.493)	(0.498)	(0.500)	(0.498)
Asian	0.053	0.065	0.033	0.047
	(0.223)	(0.246)	(0.180)	(0.211)
Black	0.142	0.061	0.066	0.057
	(0.350)	(0.239)	(0.247)	(0.233)
Hispanic	0.097	0.063	0.050	0.060
	(0.297)	(0.243)	(0.218)	(0.237)
Age	23.25	24.54	21.47	26.05
	(6.13)	(7.53)	(5.18)	(8.99)
Institutional Characteristics				
Tuition	8,390	7,810	7,170	3,970
	(7,700)	(8,220)	(6,800)	(4,860)
Observations	49,240	16,180	6,930	11,250
% of Observations	58.90	19.35	8.29	13.46

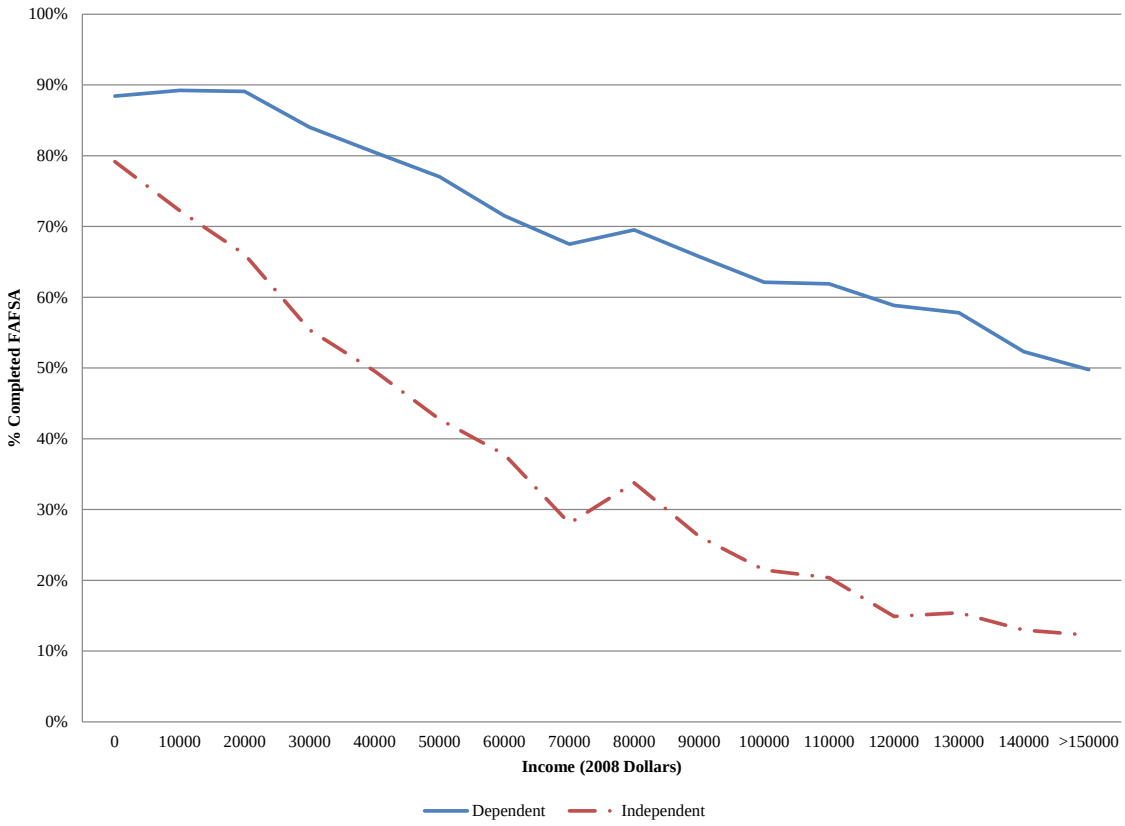
Note: *E* represents eligible students, while *NE* represents non-eligible students. *A* represents applicants, while *NA* represents non-applicants. Other demographic and institutional characteristics such as father's education, resident, class, enrollment and institutional control were not significantly different across categories. All summary statistics are rounded to the nearest ten to comply with NPSAS restricted-use license agreement.

Table 2.3: Summary Statistics of Key Variables by Eligibility and FAFSA Completion-Only Pell-Eligible Students

VARIABLES	(1) E, A	(2) E, NA
Financial Aid		
Total Aid	12,080	1,780
	(8,460)	(4,190)
Pell Grant	2,200	0
	(1,520)	(0)
Subsidized Student Loans	2,960	0
	(2,360)	(0)
Individual Characteristics		
EFC	1,080	1,180
	(1,260)	(1,360)
Income	21,970	21,920
	(18,180)	(20,130)
GPA	2.96	2.97
	(0.693)	(0.693)
Dependent	0.525	0.356
	(0.499)	(0.479)
Female	0.589	0.511
	(0.492)	(0.500)
Asian	0.063	0.078
	(0.243)	(0.268)
Black	0.184	0.091
	(0.388)	(0.287)
Hispanic	0.123	0.084
	(0.328)	(0.279)
Age	24.02	25.40
	(6.46)	(7.59)
Institutional Characteristics		
Tuition	7,050	4,800
	(6,720)	(5,580)
Observations	28,950	5,310

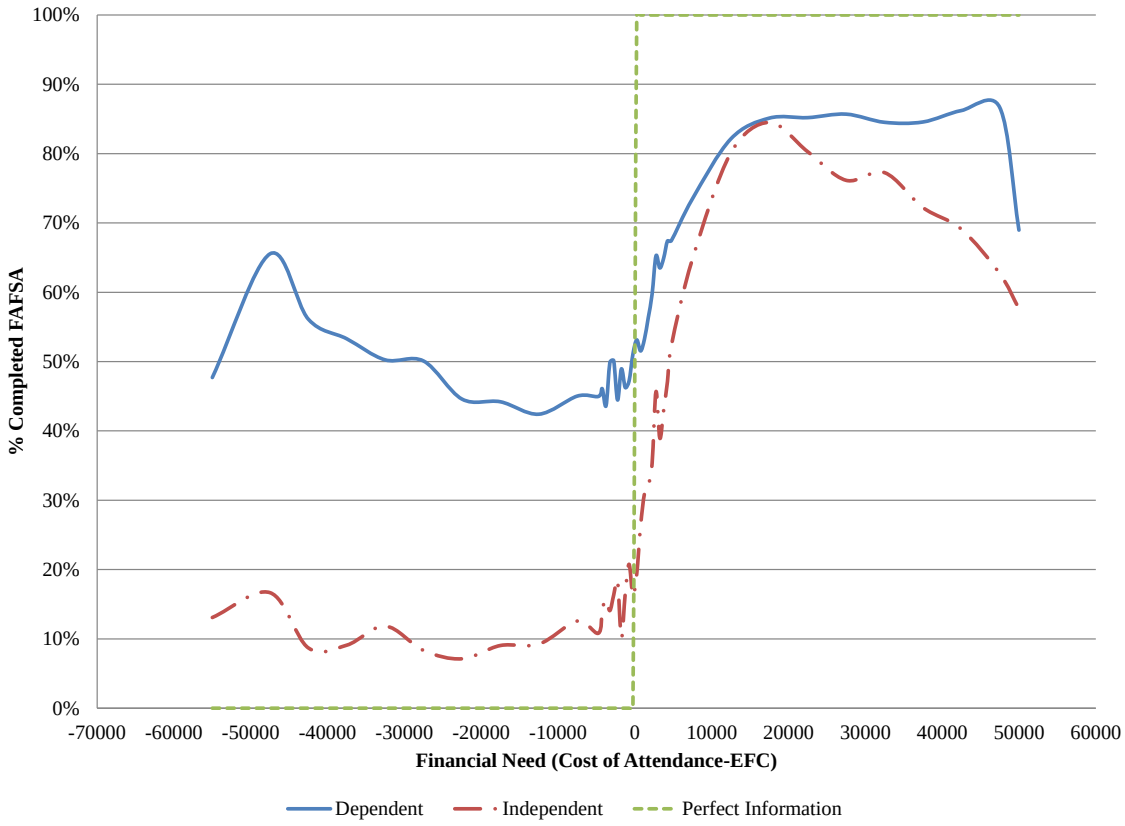
Note: *E* represents eligible students, while *NE* represents non-eligible students. *A* represents applicants, while *NA* represents non-applicants. Other demographic and institutional characteristics such as father's education, resident, class, enrollment and institutional control were not significantly different across categories. All summary statistics are rounded to the nearest ten to comply with NPSAS restricted-use license agreement.

Figure 2.1: Percent of Independent/Dependent Students who Completed FAFSA by Parents'/Own Income (2008 dollars)



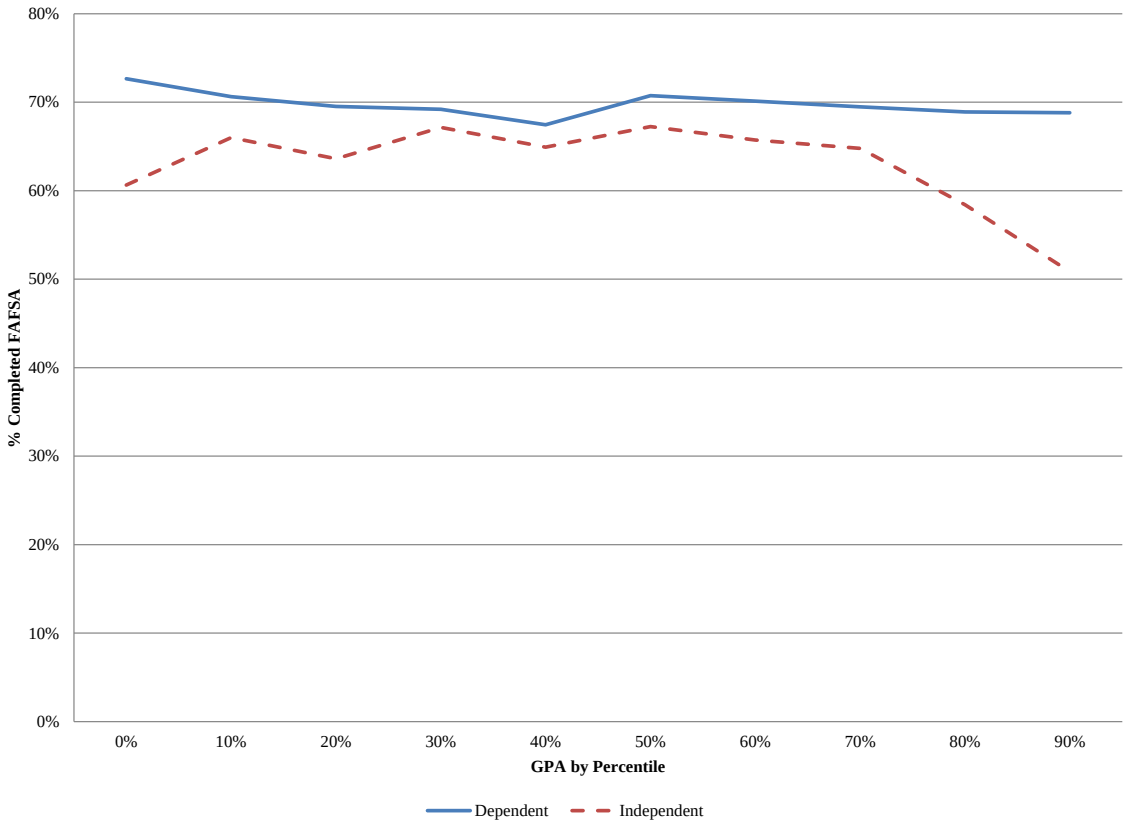
Note: Data drawn from the 1999-2000, 2003-2004, and 2007-2008 waves of the NPSAS. Income expressed in 2008 dollars.

Figure 2.2: Percent Completed FAFSA by Financial Need or (Tuition-EFC)



Note: Data drawn from the 1999-2000, 2003-2004, and 2007-2008 waves of the NPSAS. Income expressed in 2008 dollars.

Figure 2.3: Percent of Students who Completed FAFSA by GPA (by quantile)



Note: Data drawn from the 1999-2000, 2003-2004, and 2007-2008 waves of the NPSAS.

Table 2.4: Probit Model Estimating FAFSA Completion (Marginal Effects)

VARIABLES	(1) Probit	(2) Probit	(3) Probit	(4) Probit
Tuition ($000)	0.00997***	0.00843***	0.00997***	0.00964***
	(3.436e-4)	(5.071e-4)	(3.680e-4)	(5.469e-4)
EFC ($000)	-0.00340***	-0.00789***	-0.00333***	-0.00697***
	(1.951e-4)	(0.00188)	(1.946e-4)	(0.00187)
Income ($000)	-0.00329***	-8.798e-4***	-0.00326***	-9.19e-4***
	(8.450e-5)	(2.102e-4)	(8.440e-5)	(2.103e-4)
Income^2 ($000)	7.83e-09***	7.53e-10	7.72e-09***	1.04e-09
	(2.21e-10)	(1.37e-09)	(2.21e-10)	(1.38e-09)
GPA	0.0685***	0.00678	0.0666***	0.00638
	(0.0122)	(0.0146)	(0.0121)	(0.0146)
GPA^2	-1.05e-06***	3.87e-08	-1.02e-06***	2.68e-08
	(2.20e-07)	(8.53e-07)	(2.20e-07)	(2.69e-07)
Dependent	0.107***	0.0821***	0.101***	0.0816***
	(0.00523)	(0.00570)	(0.00524)	(0.00572)
Female	0.0281***	0.0232***	0.0277***	0.0256***
	(0.00324)	(0.00412)	(0.00320)	(0.00411)
Asian	-0.0293***	- 0.00494	-0.0257***	-0.00149
	(0.00717)	(0.00825)	(0.00730)	(0.00844)
Black	0.127***	0.0930***	0.132***	0.100***
	(0.00592)	(0.00646)	(0.00603)	(0.00666)
Hispanic	0.0577***	0.0595***	0.0712***	0.0650***
	(0.00625)	(0.00702)	(0.00649)	(0.00751)
Age	-0.00541***	-1.329e-4	-0.00539***	1.313e-4
	(3.253e-4)	(3.736e-4)	(3.258e-4)	(3.754e-4)
State FE	NO	NO	YES	YES
Year FE	YES	YES	YES	YES
Only Pell Eligible	NO	YES	NO	YES
Observations	71,700	29,600	71,660	29,590

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

Note: Demographic controls include father's education, resident, class, enrollment and institutional control.

Figure 2.4: Financial Need for Students who Did Not Complete FAFSA

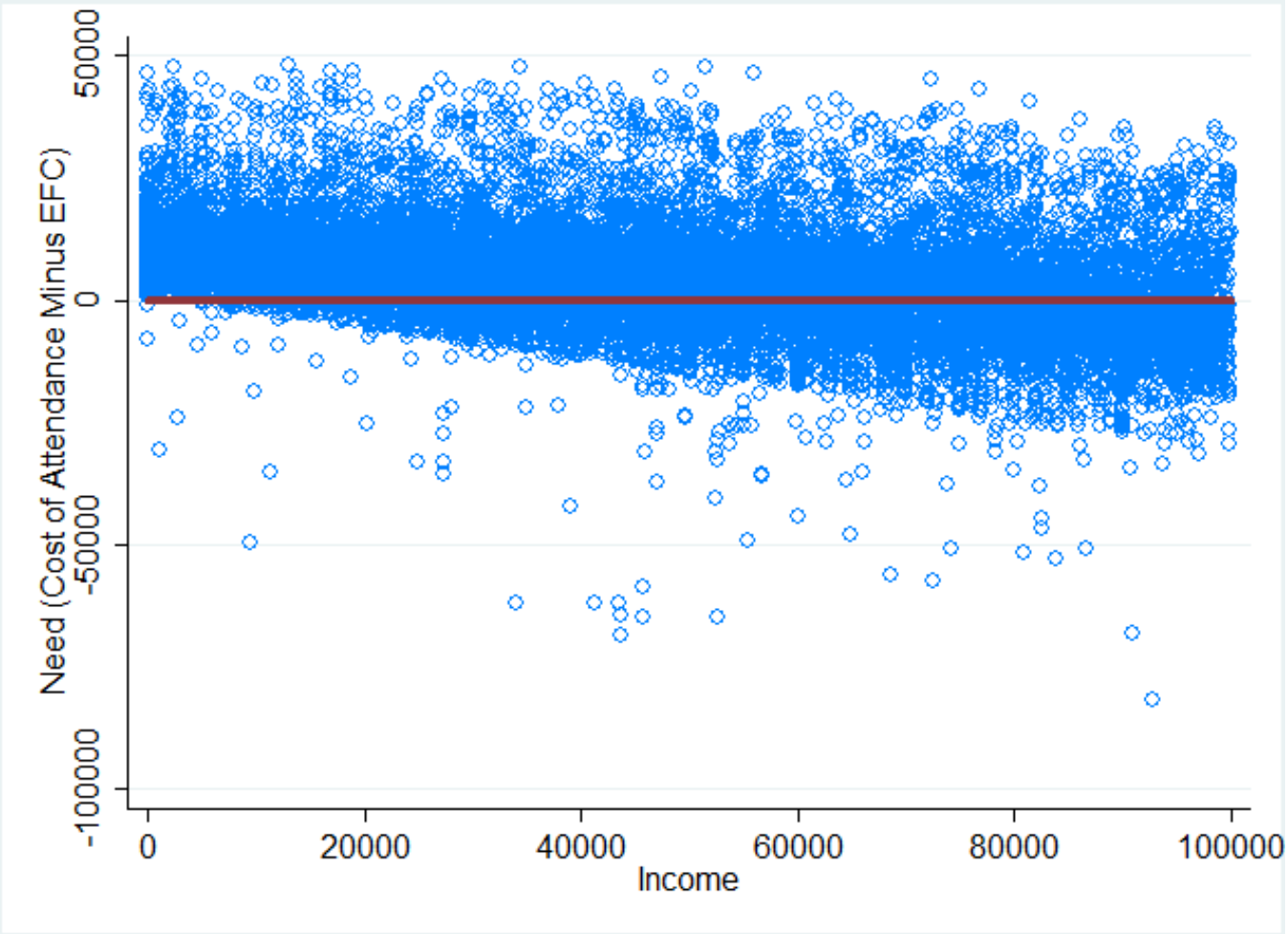


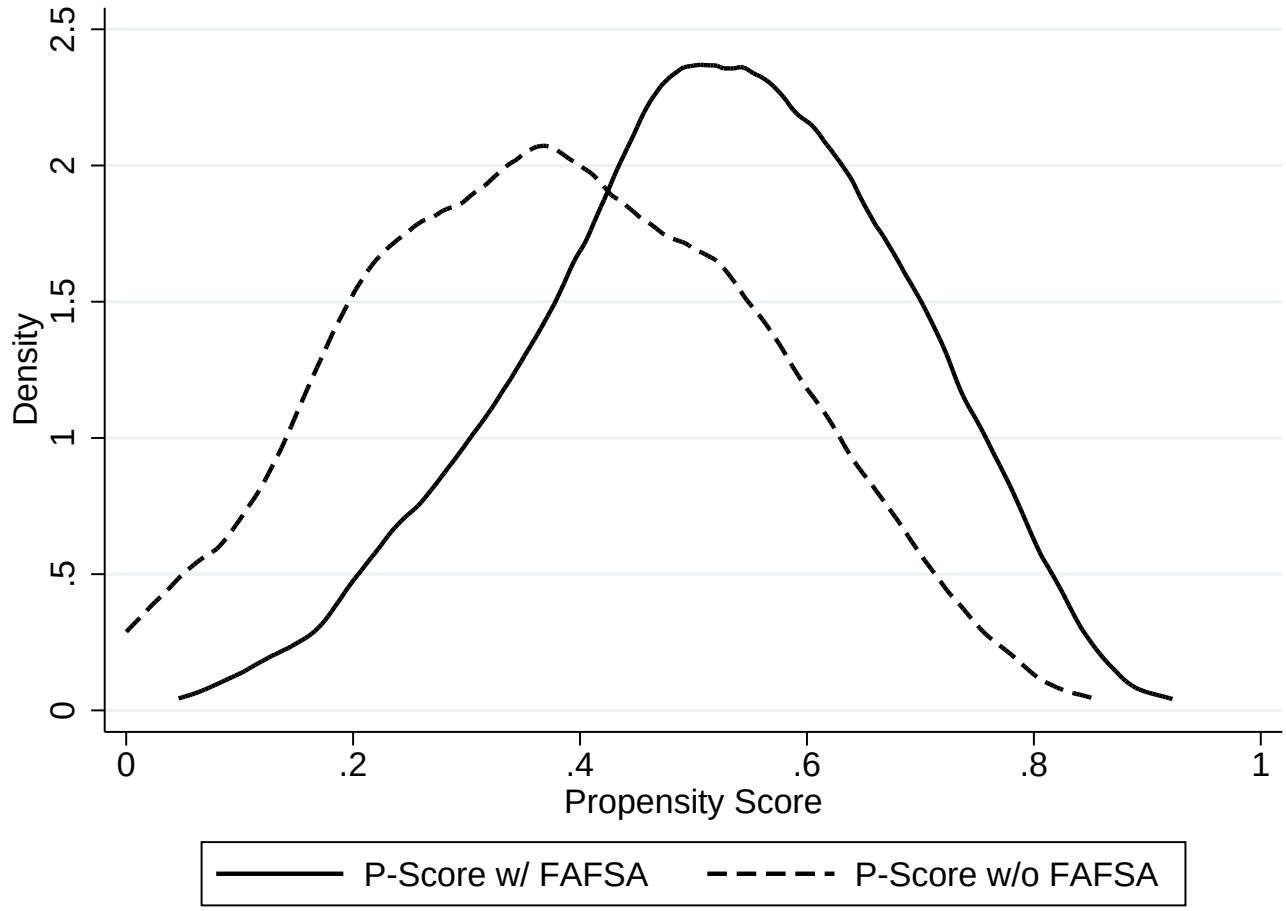
Table 2.5: Multinomial Logit Results for Eligible Non-applicant Students

VARIABLES	(1) E, NA	(2) NE, A	(3) NE, NA
Tuition ($000)	0.0221***	-0.00659***	-0.0240***
	(3.345e-4)	(2.650e-4)	(3.299e-4)
EFC ($000)	-0.0235***	0.00888	0.0139***
	(3.024e-4)	(1.160e-4)	(1.426e-4)
Income ($000)	0.00137***	-0.0005285***	-1.267e-4**
	(1.251e-4)	(5.07e-5)	(6.140-5)
Income^2	-9.53e-09***	8.68e-10***	1.20e-09***
	(6.82e-10)	(1.34e-10)	(1.88e-10)
GPA	-0.01581***	0.01052***	-0.03168***
	(1.048e-4)	(0.00651)	(0.00673)
GPA^2	2.90e-07	-1.12e-07	3.96e-07***
	(1.89e-7)	(-1.19e-7)	(1.24e-7)
Dependent	-0.0522***	0.0523***	-0.0579***
	(0.00442)	(0.00401)	(0.00392)
Female	-0.0180***	-0.00735***	-0.00863***
	(0.00268)	(0.00179)	(0.00198)
Asian	0.0141**	-0.0111**	0.0128**
	(0.00572)	(0.00482)	(0.00502)
Black	-0.0916***	0.0258***	-0.0260***
	(0.00534)	(0.00372)	(0.00415)
Hispanic	-0.0543***	0.00114	-0.00382
	(0.00558)	(.00402)	(0.004268)
Age	0.001534***	-0.00111***	0.00207***
	(2.727e-4)	(2.428e-4)	(0.00221)
Observations	71,660	71,660	71,660

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

Note: *E* represents eligible students, while *NE* represents non-eligible students. *A* represents applicants, while *NA* represents non-applicants. Demographic controls include father's education, resident, class, enrollment, and institutional control.

Figure 2.5: Overlap or area of common support for propensity scores for students who did or did not complete FAFSA



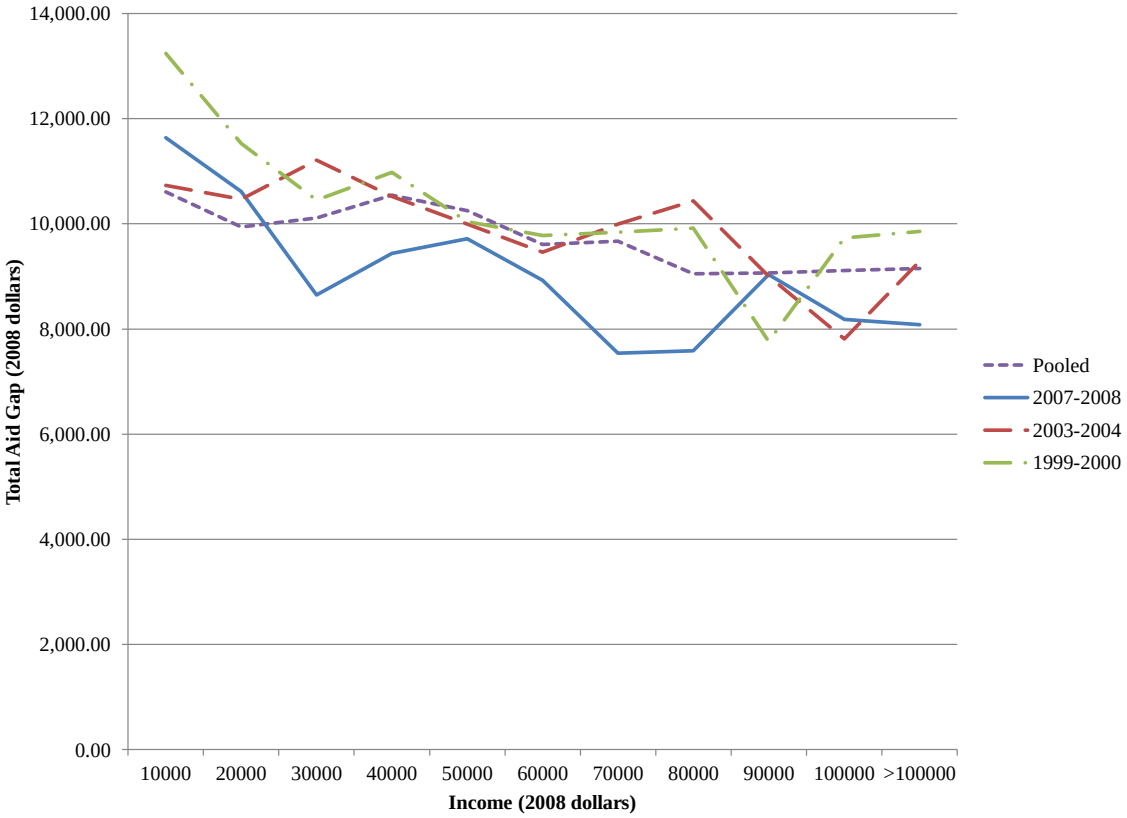
Note: This figure shows the distribution of propensity scores associated with completing FAFSA. Propensity score matching requires that a signification amount of the two distributions overlap so that there is enough data to construct a counterfactual.

Table 2.6: Total Aid Gap by Income

	Full Sample				Pell-Eligible			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Income	Pooled	2007-2008	2003-2004	1999-2000	Pooled	2007-2008	2003-2004	1999-2000
Overall	9,741.05	9,312.67	10,358.39	8,275.39	11,780.59	11,212,01	11,143.31	12,500.61
	(100.62)	(126.74)	(173.89)	(155.84)	(109.58)	(196.87)	(276.08)	(170.36)
<10,000	10,610.37	11,639.75	10,729.69	13,244.54	12,414.80	11,681.12	10,724.54	13,246.83
	(226.91)	(301.85)	(596.42)	(285.95)	(181.94)	(313.04)	(612.83)	(294.43)
10,000 to 20,000	9,939.78	10,614.50	10,467.30	11,529.17	11,410.56	10,868.78	10,867.22	11,795.12
	(249.74)	(322.29)	(657.33)	(276.01)	(212.18)	(349.79)	(714.40)	(335.55)
20,000 to 30,000	10,111.26	8,646.14	11,215.34	10,450.27	11,560.51	10,231.10	12,031.89	12,000.82
	(262.49)	(522.36)	(684.63)	(412.55)	(337.72)	(793.94)	(1,003.31)	(595.35)
30,000 to 40,000	10,545.58	9,440.36	10,524.40	10,981.73	12,096.53	10,966.81	11,703.00	13,282.05
	(223.12)	(487.84)	(709.58)	(324.61)	(362.36)	(827.11)	(908.81)	(640.08)
40,000 to 50,000	10,253.71	9,719.38	9,993.10	10,039.16	11,252.38	10,341.06	10,023.97	11,793.34
	(245.70)	(438.53)	(570.00)	(401.29)	(435.72)	(913.90)	(843.92)	(1,016.71)
50,000 to 60,000	9,610.00	8,927.48	9,464.93	9,778.44	12,789.67	12,394.16	14,594.57	13,071.90
	(253.45)	(446.57)	(550.78)	(415.90)	(713.70)	(2,156.69)	(1,435.14)	(2,474.84)
60,000 to 70,000	9,670.08	7,542.90	9,996.28	9,838.74				
	(277.08)	(570.62)	(640.98)	(418.00)				
70,000 to 80,000	9,048.08	7,583.63	10,438.45	9,914.46				
	(258.89)	(472.24)	(556.28)	(436.75)				
80,000 to 90,000)	9,063.48	9,035.62	9,005.92	7,764.89				
	(300.19)	(478.68)	(651.91)	(583.89)				
90,000 to 100,000	9,115.30	8,181.23	7,810.64	9,731.38				
	(318.69)	(435.77)	(789.80)	(605.92)				
>100,000	9,150.22	8,079.11	9,287.27	9,852.85				
	(143.95)	(235.89)	(285.23)	(257.76)				

Note: Controls include tuition, EFC, income, GPA, dependent, gender, race, age father's education, resident, class, distance, enrollment and institutional control. Standard errors in parentheses. All estimates are statistically significant at 99% level. All values expressed in 2008 dollars. Pell-Eligible capped at $60,000 because of lack of observations.

Figure 2.6: Total Aid Gap by Income



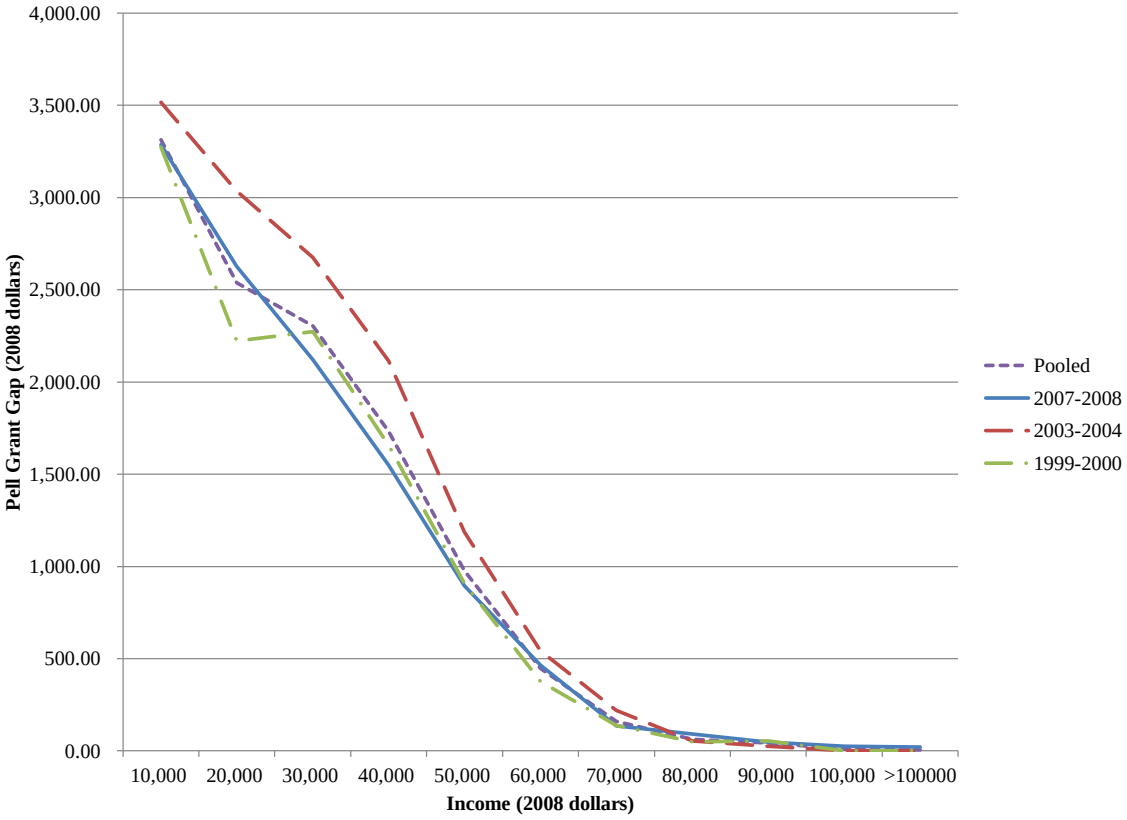
Note: I use kernel matching with a bandwidth of 0.06 to construct the total aid gap. Total aid includes all forms of assistance to the student including grants, loans, and work-study. Income and aid amounts are expressed in 2008 dollars.

Table 2.7: Pell Grant Gap by Income

	Full Sample				Pell-Eligible			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Income	Pooled	2007-2008	2003-2004	1999-2000	Pooled	2007-2008	2003-2004	1999-2000
Overall	1,281.36	1,403.04	1,081.03	920.18	2,721.28	2,662.97	2,834.94	2,719.55
	(10.54)	(13.34)	(17.02)	(11.67)	(10.46)	(15.15)	(22.69)	(18.19)
<10000	3,313.98	3,287.40	3,517.23	3,273.18	3,684.90	3,326.75	3,558.44	3,347.80
	(18.66)	(25.34)	(47.79)	(32.16)	(36.62)	(24.80)	(47.01)	(31.55)
10000 to 20000	2,538.30	2,626.76	3,033.91	2,222.60	2,832.49	2,821.84	3,241.44	2,641.46
	(23.28)	(32.87)	(56.51)	(38.99)	(22.86)	(31.81)	(53.98)	(40.12)
20,000 to 30,000	2,303.81	2,120.65	2,676.02	2,272.30	2,978.40	2,685.04	3,310.10	3,059.85
	(24.96)	(35.74)	(56.38)	(42.46)	(23.83)	(33.44)	(51.12)	(42.35)
30,000 to 40,000	1,731.79	1,549.80	2,114.40	1,656.06	2,388.55	2,090.85	2,710.34	2,493.54
	(23.01)	(33.75)	(50.62)	(38.53)	(23.26)	(34.61)	(48.99)	(43.41)
40,000 to 50,000	977.66	895.12	1,186.78	908.01	1,659.41	1,503.61	1,809.08	1,696.70
	(19.96)	(30.47)	(43.48)	(32.96)	(25.52)	(40.28)	(52.70)	(48.33)
50,000 to 60,000	447.72	464.50	542.07	375.85	1,357.63	1,327.17	1,532.85	1,346.76
	(15.40)	(26.01)	(33.19)	(23.42)	(33.84)	(55.49)	(70.27)	(69.81)
60,000 to 70,000	159.65	135.14	219.62	136.91				
	(10.21)	(16.25)	(21.74)	(16.02)				
70,000 to 80,000	63.04	91.48	53.21	50.11				
	(7.33)	(17.85)	(10.77)	(9.71)				
80,000 to 90,000	43.17	46.53	25.68	52.71				
	(7.40)	(13.57)	(9.11)	(13.86)				
90,000 to 100,000	9.88	26.14	1.40	0.00				
	(3.80)	(10.44)	(0.99)	0.00				
>100000	6.23	20.78	0.00	0.00				
	(1.55)	(5.16)	0.00	0.00				

Note: Controls include tuition, EFC, income, GPA, dependent, gender, race, age father's education, resident, class, distance, enrollment and institutional control. Standard errors in parentheses. All estimates are statistically significant at 99% level. All values expressed in 2008 dollars. Pell-Eligible capped at $60,000 because of lack of observations.

Figure 2.7: Pell Grant Gap by Income



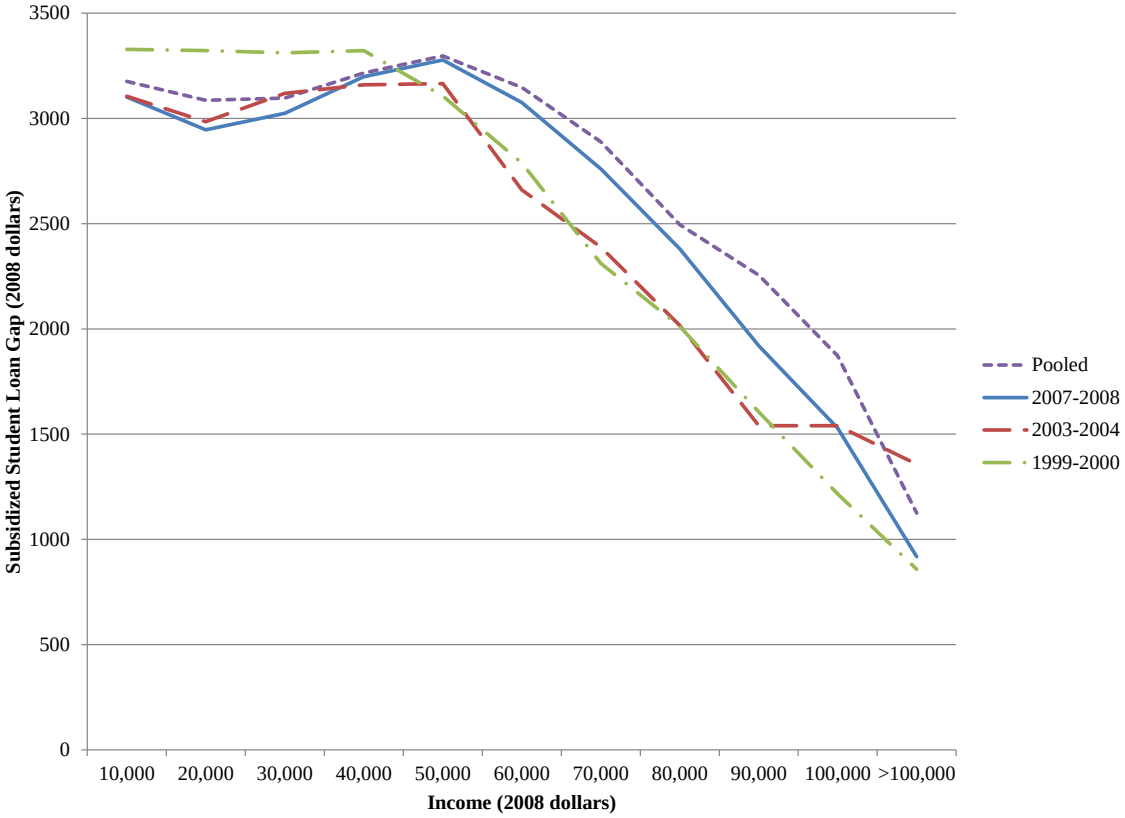
Note: I use kernel matching with a bandwidth of 0.06 to construct the Pell grant gap. The federal government requires students to complete FAFSA to determine financial need. Students to not need to repay Pell Grants. Income and aid amounts are expressed in 2008 dollars.

Table 2.8: Subsidized Student Loan Gap by Income

	Full Sample				Pell-Eligible			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Income	Pooled	2007-2008	2003-2004	1999-2000	Pooled	2007-2008	2003-2004	1999-2000
Overall	2,875.32	2,628.71	2,292.40	3,489.01	3,521.36	3,157.28	3,018.17	4,186.69
	(13.27)	(18.60)	(22.53)	(25.03)	(19.07)	(25.20)	(35.98)	(36.02)
<10,000	3,176.09	3096.74	3,124.82	3,314.49	3,684.90	3,189.74	3,036.37	4,423.80
	(39.66)	(48.73)	(117.01)	(86.27)	(36.62)	(45.44)	(81.35)	(66.87)
10,000 to 20,000	3,085.53	2,944.49	3,009.91	3,451.87	3,024.66	2,790.85	4,207.13	
	(42.02)	(52.17)	(123.13)	(91.39)	(40.26)	(50.62)	(86.90)	(75.71)
20,000 to 30,000	3,096.93	3,027.12	3,025.63	3,224.82	3,304.49	3,013.50	2,916.27	3,795.09
	(42.92)	(57.01)	(98.43)	(93.90)	(45.09)	(62.33)	(86.63)	(86.19)
30,000 to 40,000	3,215.37	3,198.13	3,029.23	3,291.46	3,473.01	3,159.30	2,917.42	3,992.92
	(45.71)	(63.76)	(98.33)	(95.65)	(50.36)	(71.96)	(93.93)	(104.85)
40,000 to 50,000	3,296.93	3,268.52	3,187.41	3,391.95	3,623.17	3,460.92	3,043.22	4,209.95
	(48.64)	(70.66)	(98.06)	(101.60)	(61.54)	(92.66)	(106.43)	(130.11)
50,000 to 60,000	3,146.56	3,077.31	3,083.50	3,310.34	3,555.25	3,443.34	3,324.94	3,986.82
	(51.30)	(77.12)	(97.94)	(100.13)	(87.34)	(140.31)	(166.54)	(187.21)
60,000 to 70,000	2,888.37	2,759.88	2,624.33	3,371.92				
	(50.84)	(78.86)	(93.85)	(96.03)				
70,000 to 80,000	2,494.64	2,371.67	2,296.92	2,807.79				
	(51.36)	(81.56)	(90.05)	(99.11)				
80,000 to 90,000	2,255.38	1,928.25	2,036.87	2,749.45				
	(54.25)	(78.65)	(102.42)	(109.19)				
90,000 to 100,000	1,872.01	1,529.33	1,500.89	2,605.94				
	(53.21)	(79.4)	(90.31)	(105.43)				
>100,000	1,125.01	914.28	901.61	1,447.84				
	(22.37)	(35.93)	(36.94)	(39.79)				

Note: Controls include tuition, EFC, income, GPA, dependent, gender, race, age father's education, resident, class, distance, enrollment and institutional control. Standard errors in parentheses. All estimates are statistically significant at 99% level. All values expressed in 2008 dollars. Pell-Eligible capped at $60,000 because of lack of observations.

Figure 2.8: Subsidized Loan Gap by Income



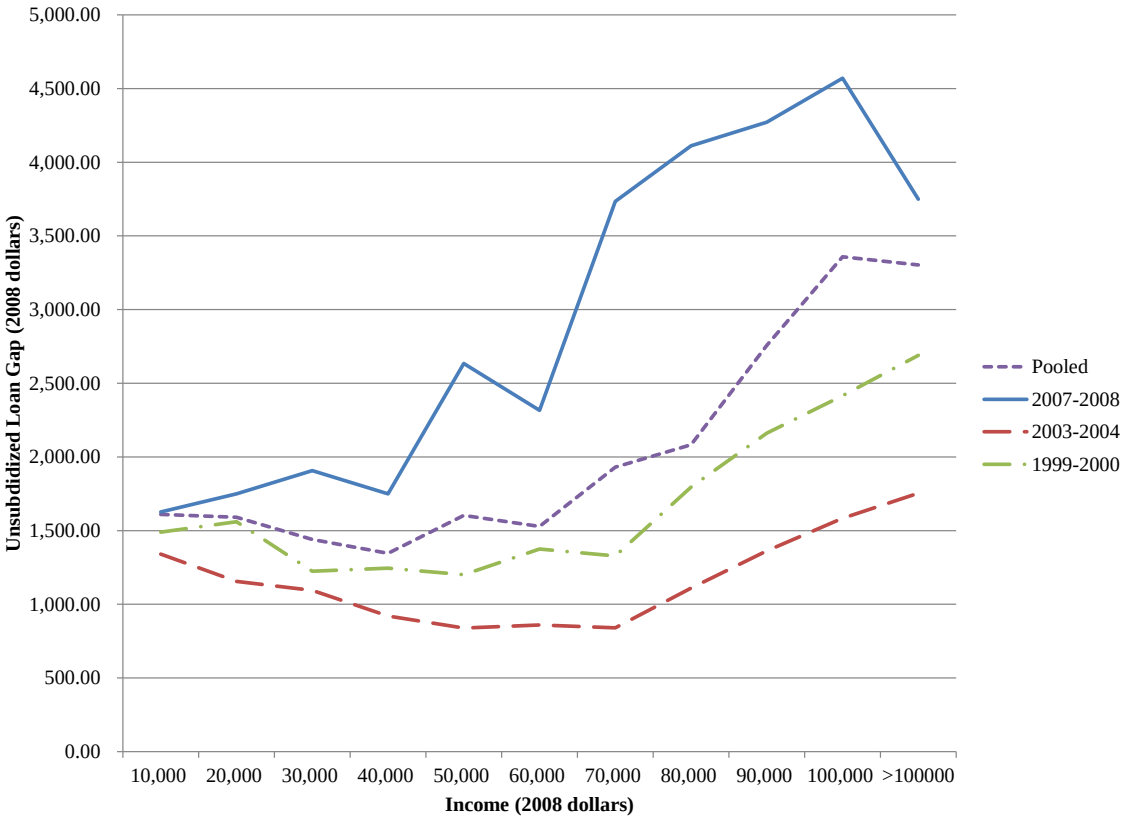
Note: I use kernel matching with a bandwidth of 0.06 to construct the subsidized student loan gap. The federal government requires students to complete FAFSA to determine financial need. The government does not charge interest and students do not need to repay the loan until they graduate. Income and aid amounts are expressed in 2008 dollars.

Table 2.9: Unsubsidized Student Loan Gap by Income

	Full Sample				Pell-Eligible			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Income	Pooled	2007-2008	2003-2004	1999-2000	Pooled	2007-2008	2003-2004	1999-2000
Overall	1,986.65	2,801.15	1,264.28	1.671.18	1,332.45	1,514.41	951.65	1,180.06
	(23.63)	(69.63)	(18.94)	(19.47)	(38.90)	(115.47)	(26.05)	(23.36)
<10000	1,610.02	1,626.56	1,340.58	1,489.59	1,577.28	1,533.82	1,338.68	1,468.64
	(71.01)	(209.09)	(66.25)	(45.49)	(73.16)	(218.84)	(66.61)	(45.70)
10000 to 20000	1,591.14	1,749.98	1,155.51	1,560.55	1,488.72	1,687.34	1,065.28	1,370.82
	(58.00)	(184.06)	(65.34)	(50.22)	(68.47)	(207.52)	(65.68)	(52.32)
20,000 to 30,000	1,440.16	1,906.96	1,094.75	1,224.82	1,177.29	1,633.53	799.19	906.45
	(84.64)	(300.71)	(62.33)	(49.65)	(121.82)	(443.15)	(58.63)	(50.63)
30,000 to 40,000	1,346.02	1,749.81	919.93	1,245.77	973.36	615.80	720.03	872.34
	(69.97)	(259.67)	(57.42)	(58.94)	(130.01)	(446.07)	(56.94)	(64.65)
40,000 to 50,000	1,602.66	2,634.69	838.52	1,201.49	1,386.64	2,485.84	694.20	909.01
	(75.43)	(240.43)	(61.86)	(61.50)	(109.38)	(384.30)	(66.45)	(74.10)
50,000 to 60,000	1,529.10	2,316.46	860.09	1,375.26	1,103.99	1,116.57	649.73	754.95
	(86.56)	(290.15)	(67.83)	(71.22)	(288.23)	(1,494.03)	(104.68)	(104.01)
60,000 to 70,000	1,930.07	3,734.23	839.75	1,328.19				
	(98.31)	(347.11)	(61.62)	(68.41)				
70,000 to 80,000	2,081.94	4,110.79	1,109.56	1,795.66				
	(103.60)	(109.12)	(68.92)	(96.90)				
80,000 to 90,000	2,757.62	4,271.83	1,363.02	2,161.62				
	(120.37)	(129.42)	(83.29)	(93.72)				
90,000 to 100,000	3,358.21	4,570.67	1,584.03	2,415.68				
	(127.79)	(131.20)	(88.94)	(114.71)				
>100,000	3,303.61	3,749.63	1,753.53	2,689.51				
	(60.64)	(59.55)	(41.09)	(56.54)				

Note: Controls include tuition, EFC, income, GPA, dependent, gender, race, age father's education, resident, class, distance, enrollment and institutional control. Standard errors in parentheses. All estimates are statistically significant at 99% level. All values expressed in 2008 dollars. Pell-Eligible capped at $60,000 because of lack of observations.

Figure 2.9: Unsubsidized Loan Gap by Income



Note: I use kernel matching with a bandwidth of 0.06 to construct the unsubsidized student loan gap . The federal government requires students to complete FAFSA to access unsubsidized loans, but demonstrated financial need is not required. The government does charge interest while students are in school, but students can defer loan payments until graduation. Income and aid amounts are expressed in 2008 dollars.

Table 2.10: Institutional Aid Gap by Income

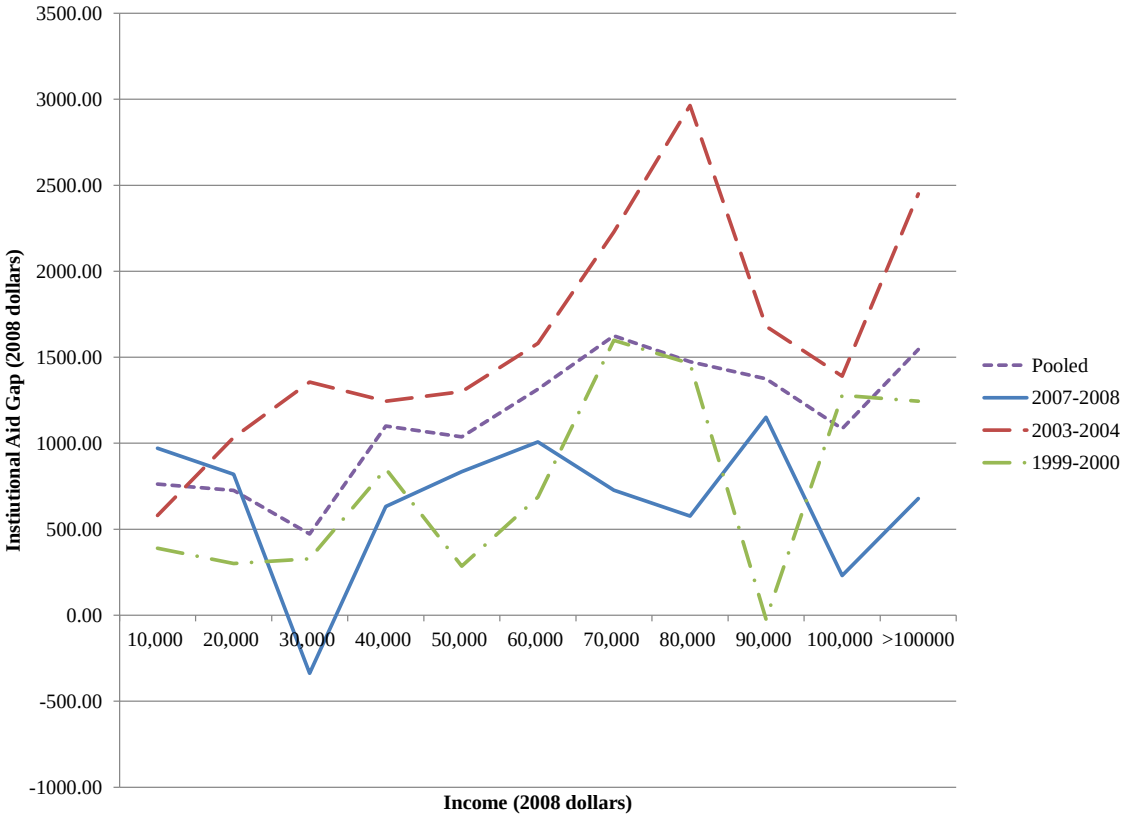
	Full Sample				Pell-Eligible			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Income	Pooled	2007-2008	2003-2004	1999-2000	Pooled	2007-2008	2003-2004	1999-2000
Overall	1,016.04***	551.29***	1,827.67***	1,420.21***	1,154.23***	1,221.40***	1,394.38***	877.55***
	(38.72)	(66.43)	(102.34)	(51.98)	(63.78)	(100.57)	(201.90)	(91.20)
<10000	762.35***	971.38***	580.37	389.65**	761.19***	1,064.98***	493.42	319.73*
	(99.03)	(131.91)	(371.91)	(166.44)	(101.10)	(133.77)	(373.66)	(173.23)
10000 to 20000	725.77***	819.92***	1,033.87***	300.68**	894.53***	830.73***	1,389.70***	435.78***
	(105.39)	(178.03)	(371.93)	(135.98)	(124.42)	(196.21)	(438.48)	(186.27)
20,000 to 30,000	471.92***	-337.46	1,355.68**	327.53	1,106.19***	460.54	1,818.42**	816.78***
	(142.70)	(310.21)	(610.65)	(176.55)	(201.88)	(470.09)	(944.74)	(250.76)
30,000 to 40,000	1,100.08***	632.40**	1,244.29**	851.16***	1,836.84***	2,304.89***	1,871.48***	1,884.96***
	(128.98)	(291.95)	(557.13)	(157.02)	(209.68)	(461.83)	(717.62)	(224.96)
40,000 to 50,000	1,037.23***	835.28***	1,300.13***	285.40	1,410.24***	2,085.17***	893.88	1,129.03
	(150.62)	(268.89)	(411.27)	(228.48)	(285.34)	(481.41)	(609.12)	(709.21)
50,000 to 60,000	1,313.85***	1,008.10***	1,581.14***	686.30***	2,857.62***	2,599.54***	4,152.20***	2,213.09
	(146.78)	(257.75)	(373.44)	(223.29)	(378.19)	(896.77)	(1,076.88)	(1,356.35)
60,000 to 70,000	1,624.96***	726.91***	2,228.75***	1,598.84***				
	(158.11)	(311.59)	(443.35)	(219.52)				
70,000 to 80,000	1,473.73***	576.96**	2,963.28***	1,463.93***				
	(148.41)	(267.22)	(396.95)	(222.09)				
80,000 to 90,000	1,374.70***	1,151.11***	1,680.74***	-22.15				
	(163.93)	(260.40)	(460.14)	(268.74)				
90,000 to 100,000	1,084.58***	230.76	1,389.53***	1,278.31***				
	(187.14)	(263.12)	(503.91)	(332.22)				
>100,000	1,544.82***	678.52***	2,449.68***	1,244.47***				
	(81.02)	(131.94)	(172.25)	(126.41)				

Standard errors in parentheses

*** p < 0.01, ** p < 0.05, * p < 0.1

Note: Controls include tuition, EFC, income, GPA, dependent, gender, race, age father's education, resident, class, distance, enrollment and institutional control. All values expressed in 2008 dollars. Pell-Eligible capped at $60,000 because of lack of observations. All values expressed in 2008 dollars.

Figure 2.10: Institutional Aid Gap by Income



Note: I use kernel matching with a bandwidth of 0.06 to construct the institutional aid gap. Not all institutions require FAFSA completion to access either aid or need based aid. The aid displayed in this chart is grant aid, and thus does not need to be re-payed by the student. Income and aid amounts are expressed in 2008 dollars.

Table 2.11: Total Grant Aid Gap by Income

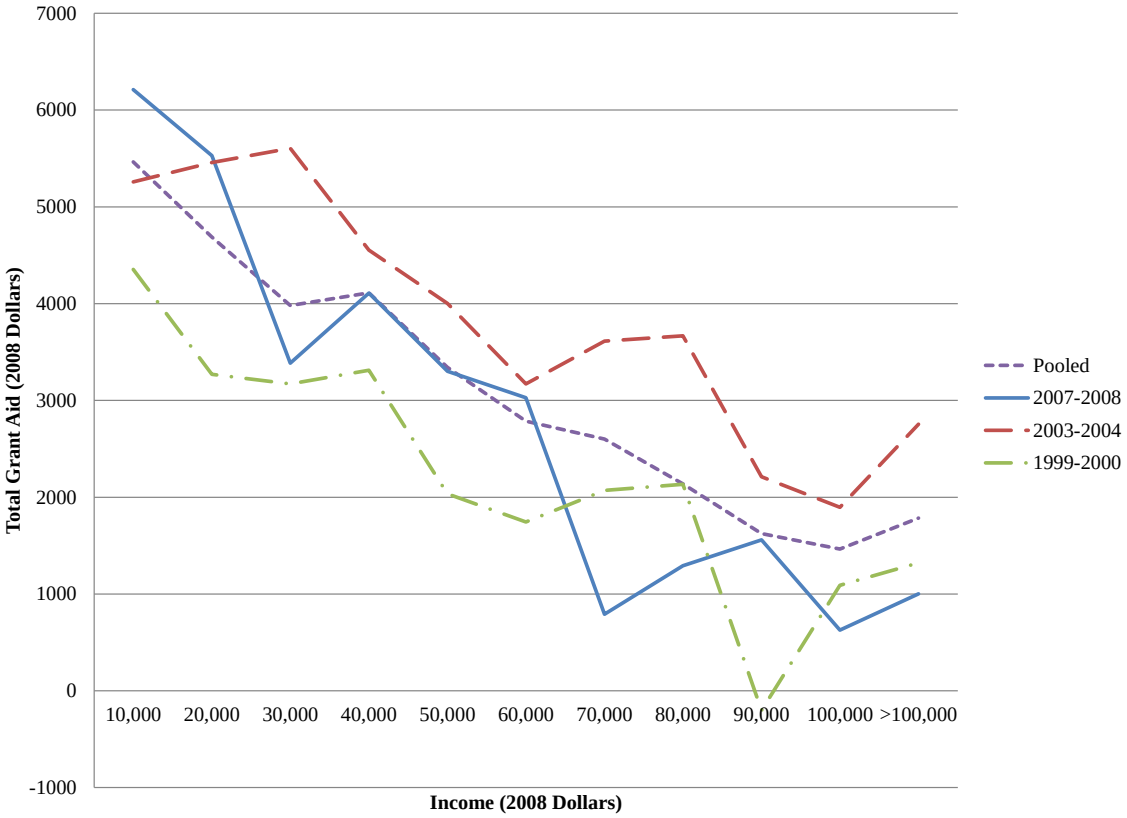
	Full Sample				Pell-Eligible			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Income	Pooled	2007-2008	2003-2004	1999-2000	Pooled	2007-2008	2003-2004	1999-2000
Overall	3,254.87***	3,414.98***	4,013.19***	2,583.40***	5,428.27***	6,093.22***	5,819.98***	4,341.86
	(47.59)	(87.15)	(119.81)	(63.35)	(77.90)	(138.55)	(235.80)	(105.48)
<10000	5,464.45***	6,210.89***	5,257.77***	4,354.09***	5,527.57***	6,337.79***	5,187.13***	4,360.68***
	(120.68)	(181.78)	(477.49)	(187.56)	(123.24)	(186.20)	(485.96)	(194.50)
10000 to 20000	4,687.93***	5,529.88***	5,458.33***	3,269.56***	5,222.61***	5,812.35***	6,114.95***	3,628.70***
	(124.66)	(229.85)	(522.04)	(148.68)	(142.43)	(242.40)	(539.14)	(197.51)
20,000 to 30,000	3,979.98***	3,385.27***	5,604.93***	3,171.39***	5,483.28***	5,154.10***	6,846.79***	4,490.76***
	(178.90)	(404.64)	(651.21)	(225.48)	(258.77)	(618.21)	(982.27)	(387.96)
30,000 to 40,000	4,112.20***	4,108.45***	4,552.36***	3,311.24***	5,943.20***	6,898.88***	6,116.56***	5,535.67***
	(161.39)	(375.03)	(667.49)	(192.31)	(270.30)	(634.13)	(859.60)	(293.10)
40,000 to 50,000	3,342.29***	3,301.42***	4,001.75***	2,035.49***	4,760.67***	4,273.20***	4,350.40***	4,008.90***
	(178.13)	(335.68)	(480.25)	(260.07)	(330.74)	(718.01)	(688.20)	(723.24)
50,000 to 60,000	2,785.33***	3,027.40***	3,170.65***	1,745.09***	6,370.47***	7,364.32***	8,041.04***	4,686.58***
	(179.85)	(320.60)	(450.97)	(268.98)	(448.67)	(1,011.53)	(1,197.19)	(1,725.60)
60,000 to 70,000	2,601.61***	791.47*	3,612.44***	2,070.30***				
	(191.96)	(408.24)	(514.78)	(258.06)				
70,000 to 80,000	2,137.69***	1,291.78***	3,668.36***	2,133.58***				
	(173.90)	(311.72)	(473.71)	(259.71)				
80,000 to 90,000	1,623.59***	1,559.06***	2,211.91***	-200.79				
	(202.06)	(316.48)	(503.59)	(383.91)				
90,000 to 100,000	1,465.45***	627.45**	1,896.30***	1,090.66***				
	(218.87)	(314.21)	(562.17)	(394.13)				
>100,000	1,784.83***	1,000.99***	2,754.04***	1,322.11***				
	(92.85)	(155.02)	(190.73)	(146.59)				

Standard errors in parentheses

*** p < 0.01, ** p < 0.05, * p < 0.1

Note: Controls include tuition, EFC, income, GPA, dependent, gender, race, age father's education, resident, class, distance, enrollment and institutional control. All values expressed in 2008 dollars. Pell-Eligible capped at $60,000 because of lack of observations.

Figure 2.11: Total Grant Aid Gap by Income



Note: I use kernel matching with a bandwidth of 0.06 to construct the total grant aid gap. Not all institutions require FAFSA completion to access either aid or need based aid. The aid displayed in this chart is grant aid, and thus does not need to be re-payed by the student. Income and aid amounts are expressed in 2008 dollars.

Table 2.12: Employer Grant Aid Gap by Income

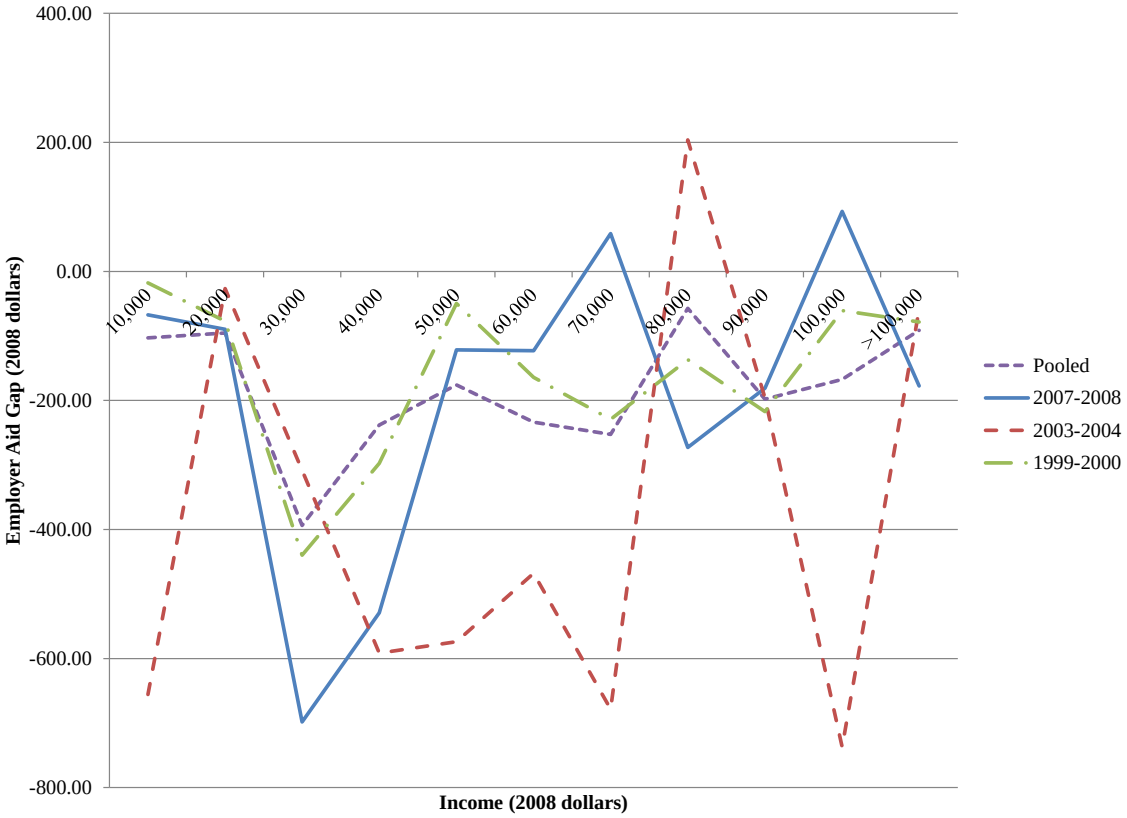
	Full Sample				Pell-Eligible			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Income	Pooled	2007-2008	2003-2004	1999-2000	Pooled	2007-2008	2003-2004	1999-2000
Overall	-209.52***	-190.26***	-260.18***	-188.62***	-172.97***	-165.13***	-358.23***	-84.83***
	(17.03)	(35.88)	(46.87)	(20.31)	(29.68)	(54.46)	(125.34)	(27.17)
¡10000	-102.99***	-67.37	-655.71***	-17.96	-108.90***	-73.42	-687.49***	-25.07
	(41.10)	(69.73)	(281.56)	(33.73)	(42.63)	(72.97)	(295.65)	(35.22)
10000 to 20000	-95.36***	-89.75	-26.58	-77.16***	-128.40***	-91.15	-47.38	-139.44***
	(33.58)	(95.53)	(83.26)	(32.85)	(34.97)	(80.75)	(97.94)	(45.53)
20,000 to 30,000	-393.58***	-698.24***	-308.16	-439.80***	-477.48***	-369.40	-245.29	-262.20
	(69.80)	(173.82)	(344.95)	(70.47)	(114.81)	(242.51)	(587.59)	(166.13)
30,000 to 40,000	-238.13***	-529.15***	-591.47***	-297.37***	-104.46	-101.39	-488.63	65.73
	(67.31)	(176.31)	(288.68)	(75.84)	(104.83)	(233.74)	(354.77)	(140.14)
40,000 to 50,000	-175.79***	-121.75	-573.80***	-49.60	-124.58	-755.28***	-1,224.71***	88.16
	(61.12)	(126.86)	(236.25)	(77.09)	(111.21)	(276.20)	(315.20)	(118.28)
50,000 to 60,000	-233.77***	-122.93	-467.79***	-164.40	96.17	81.78	117.92	324.08***
	(67.02)	(126.39)	(178.52)	(103.38)	(117.04)	(519.48)	(165.48)	(118.81)
60,000 to 70,000	-252.61***	58.53	-678.48***	-229.31***				
	(81.12)	(172.32)	(277.95)	(98.46)				
70,000 to 80,000	-57.26	-272.92***	203.72***	-136.92				
	(59.79)	(120.83)	(94.60)	(105.27)				
80,000 to 90,000	-197.97***	-180.85	-196.23	-217.37				
	(75.19)	(154.89)	(124.14)	(156.79)				
90,000 to 100,000	-167.27***	92.93	-737.04***	-60.67				
	(82.50)	(118.41)	(305.71)	(133.78)				
¿100000	-91.32***	-177.65***	-59.18	-78.31				
	(30.50)	(62.91)	(67.10)	(41.56)				

Standard errors in parentheses

*** p < 0.01, ** p < 0.05, * p < 0.1

Note: Controls include tuition, EFC, income, GPA, dependent, gender, race, age father's education, resident, class, distance, enrollment and institutional control. All values expressed in 2008 dollars. Pell-Eligible capped at $60,000 because of lack of observations.

Figure 2.12: Employer Grant Aid Aid Gap by Income



Note: I use kernel matching with a bandwidth of 0.06 to construct the employer grant aid gap. Not all institutions require FAFSA completion to access either aid or need based aid. The aid displayed in this chart is grant aid, and thus does not need to be re-payed by the student. Income and aid amounts are expressed in 2008 dollars.

Chapter 3

The Effect of the Business Cycle on Freshman Financial Aid (joint with Elizabeth S. Bradley)

3.1 Introduction

In the wake of the most recent recession, student financial aid has garnered attention from the news media, policymakers, and university administrators. Declining economic conditions induce university budget cuts, increase student enrollment rates, and increase student loan application rates (Clark, 2010; Weller, 2012). Consequently, during downturns, there is more student demand for financial aid resources but less aid to allocate. By January 2009, the U.S. Department of Education had processed 10% more loan applications than it had in the previous year, while enrollment in universities across the country expanded dramatically (Erb, 2009).

Students can receive aid for higher education from several sources including the states, federal government, postsecondary institutions, private lenders, and their families. When this demand for resources increases, the proportions that these parties contribute to a student's aid package might shift. This is the first known paper to explore how contributions to a student's financial aid package change with business cycle fluctuations.

Understanding the ramifications of students borrowing money for higher education has been the focus of several public policy initiatives. The National College Finance Center recently launched the "Don't Major in Debt Campaign," to "educate students and families all across the country on how to evaluate their options for financing higher education." If these options change during recessions, then programs like "Don't Major in Debt" should be aware so they can provide better information to the beneficiaries of their services.

More extensive information about financial aid opportunities during downturns can also assist a struggling student to, "find dollars that they hadn't connected with before," says Tim Malette, the financial aid director at Michigan Technological University (Erb, 2009). Pleskac *et al.* (2011) show that on average low income students are more likely to drop out of college to avoid debt. It would be constructive for these students to know their options for aid during recessions before they drop out of school completely.

"Freshman Survey" data from the Higher Education Research Institute's (HERI's) Cooperative Institutional Research Project (CIRP) allows us to observe student demographic characteristics along with financial aid information from 1980-2000. Business cycle information comes from state level tax revenues, unemployment rates, and personal income growth rates per capita.

When tax revenues rise, we find that students are more likely to receive parental and state aid and less likely to receive all other forms of aid. On average, as tax revenues increase by one percentage point, parental aid increases by $48.89, state aid increases by $181.14, institutional aid falls by $374.17, and Pell Grants fall by $60.63. However, after unemployment rates increase students receive $5.49 more in Pell Grants and $10.22 Stafford loans, on average.

Section 2 outlines the background and intuitive framework for the paper. Section 3 describes the data used in the paper. Section 4 discusses the empirical models used for analysis. Section 5 reports the results from the estimation. Section 6 concludes.

3.2 Background and Intuitive Framework

The business cycle and student financial aid have been thoroughly researched individually, but little is know about the link of one topic to the other. This section provides an overview of the most important known aspects from the business cycle and financial aid literature that will assist in uncovering the relationship between the two topics.

3.2.1 Overview of the Business Cycle and its Effects on Student Decisions

Researchers have extensively investigated several links between the business cycle and students' higher education decisions. Most of these studies focus on the effects of economic fluctuations on student enrollment rates (Mattila, 1982; Goldin, 1999; Sakellaris and Spilimbergo, 2000), and time to degree during downturns (Messer and Wolter, 2007; Khan, 2010; Brunullo and Winter-Ebmer, 2003). These studies find that the aggregate college enrollment rate for students increases following downturns, and that students take longer to graduate during recessions.

These factors potentially influence student decisions about how much to spend on college and how they will finance their education. If different types of students enroll during recessions that were not going to college before the downturns, then these students might have different financial needs. The empirical methods described later control for this to some extent by including observable student level demographic characteristics. However, unobservable student characteristics may influence a student's decision to enroll during recessions and their ability to pay for school. Therefore, the results in this paper should be interpreted with this in mind.

One benefit of only exploring freshman financial aid is that student's time-to-degree decisions in recessions should have very little impact on the aid they receive as a freshman.

Those financing decisions will be made at the margin that will occur a few years into their postsecondary studies.

Though several studies focus on a recession's impact on state funding and expenditure on higher education (Bhatt *et al.*, 2011; O'Rear, 2010; Humphreys, 2000), few focus on how student specific funding and expenditure is affected. Long (2012) provides the most comprehensive examination of how "The Great Recession" affected students' financial decisions for higher education. She finds that for the 2009 recession college spending per student increased. This increase could be a result of tuition and fees rising during downturns.

While Long (2012) finds that students are spending more on college during recessions, she does not document the sources of the spending and the types of financial aid that students use. Therefore, this paper examines the breakdown in the shares of different types of financial aid, not just the raw totals of aid received.

3.2.2 Overview of Financial Aid and its Effects on Student Decisions

The economics of education literature focuses mainly on how financial aid influences three key student behaviors: the decision to enroll in college (Ehrenberg and Sherman, 1984; Moore *et al.* (1991); and Cornwell *et al.*, 2006) the choice of which college to attend (Avery and Hoxby, 2004; Fuller *et al.*, 1982), and whether a student persists to graduation (Bitzan, 2009; Singell, 2004; Bettinger, 2004). These studies find that increases in financial aid increase the likelihood that students enroll in college, choose a college that provides more aid, and persist to graduation. This section provides an overview of the different broad categories of financial aid. Distinguishing between the types of aid and who bears the burden for each type will be crucial to forming testable hypotheses.

Loans vs. Scholarships and Grants

Two very broad categories to consider are aid that must be repaid versus aid that does not have to be repaid. Student loans must be repaid. These loans can come from several sources (federal government, states, families) and usually have interest attached. Two types of aid that do not have to be repaid are scholarships and grants. Scholarships are typically given based on some form of merit criterion like academic ability, athletic prowess, or a unique ability like skill in dairy farming. Grants are usually given based on categorical qualifications like income level or ethnicity. We will assume that students strictly prefer aid that does not have to be repaid (scholarships and grants) to aid that does (loans).

Subsidized vs. Unsubsidized Loans

The student loan aid category can be broken down further into subsidized loans and unsubsidized loans. Subsidized loans do have to be repaid, but the loan issuer assumes some or all of the interest burden. An example of a subsidized loan would be a Perkins loan from the federal government, where the interest rate is lower than other types of federal loans and does not begin to accumulate until after the student graduates from college. We also assume that students prefer subsidized loans to unsubsidized loans.

3.2.3 Hypotheses

Given what we know about business cycle fluctuations and the types of financial aid, several testable hypotheses develop that propose directions of the changes to the likelihoods that students will receive certain types of aid during a recession. These hypotheses differ based on the category of aid.

We expect state aid to decrease during downturns. Most states are required to pass balanced budgets and are more credit constrained than the federal government. Because

states reduce general funding for higher education during downturns, we expect to see decreases in state funding for student aid (O'Rear, 2010; Humphreys, 2000; Bhatt et al., 2011). We can exploit the degrees of fiscal health and rigidity between the states to see if this hypothesis truly holds. We expect state financial aid falling at faster rates in states where the debt holding rules are more stringent.[1]

We expect parental aid to be procyclical as well. During downturns families are more likely to face high unemployment and loss of savings. Therefore, they will have less money to allocate to their children's higher education costs. During more stable economic times families are more likely to have money in reserve or more disposable income that can be used to fund college.

A recession's overall impact on student institutional aid is less intuitive. Some students could receive more institutional aid if they attend a school with a large endowment that uses some of its funds to smooth student need during downturns. Other students may receive less institutional aid during downturns because certain schools do not have large endowments and their alumni giving rates fall during recessions. Therefore, we are unsure about how institutional aid will change during business cycle fluctuations.

The relationship between downturns and federal financial aid is more clear. Because the federal government is less credit constrained than the states, we expect that it will borrow money to meet the student demand for financial aid. Also, because family income and wealth are considered in the FAFSA funding formula and those formulas do not change during downturns, more students will qualify for different types of federal aid as the economy declines. We especially expect an increase in federal aid programs like the Pell Grants and subsidized Perkins loans because this aid is awarded to students with the

[1]We distinguish between debt holding rules in the constitutions of states included in our sample. All of the states were required to balance their budgets, and although many restrict carrying over deficits from one year to the next, states rarely abide by these rules. We are seeking another measure to adequately distinguish between states who are more credit constrained than others.

highest degrees of financial need. Consequently, the federal government will bear a bigger aid burden during downturns because the Pell Grants will not be paid back and the interest rates on Perkins loans does not start to accumulate until nine months after students graduate from college. We also expect increase in the dollar amount of Stafford loans that students receive during downturns, but we do not anticipate that the average effects will be as strong as they are for the Pell Grants and Perkins loans.

3.3 Data

Researchers have made little headway in answering whether students' financial aid packages change during recessions because of data limitations. Few datasets collect information on student demographics and financial aid packages with geographic heterogeneity over an extended time period, which makes it difficult to observe several recessions and financial aid simultaneously.

We explored several data options for this analysis. The National Postsecondary Student Aid Study (NPSAS) has extensive information about the type and amount of financial aid. However, these data are collected every four years and thus do not allow us to identify how business cycle fluctuations affect financial aid allocation over a continuous time period.

The National Longitudinal Survey of Youth (NLSY) data are different because they observe students over many years. Unfortunately, they collect only information on educational costs and whether students receive "educational loans or financial aid." These data do not report the categories with which the financial aid is associated.

An alternate data source is the Cooperative Institutional Research Program's (CIRP's) Freshman survey housed in the Higher Education Research Institute (HERI) at the University of California, Los Angeles (UCLA). These data address both of the

shortcomings of the NPSAS and the NLSY data by collecting student financial aid information for an extended time period and for several different aid categories. These data have never been used to investigate the relationship of a student's financial aid package and the business cycle.

3.3.1 Higher Education Research Institute Data

Every year CIRP offers a survey of college freshmen that institutions can administer to their students. Schools who use the survey must pay HERI a fee for the survey materials and the data analysis provided after survey completion. HERI requires the survey to be administered to first-time, full-time freshmen before they begin fall semester classes. Consequently, only freshman financial aid information is observed. As recommended by HERI, the large majority of institutions conduct the survey during their freshmen orientations in a proctored setting, ensuring the highest response rates and the most accurate information.[2]

This study uses data from 191 institutions that participated in the "Freshman Survey" from 1980-2000,[3] and where the state of the institution is observable. To protect the identity of the institutions, HERI requires that five or more institutions from the same state to be present in the sample before they reveal the state identity of the institution.[4]

[2]The "Freshman Survey" data are restricted access data and only granted to researchers after a thorough proposal process to ensure the identities of the institutions and the students are protected.

[3]HERI did not collect financial aid data on the "Freshman Survey" after 2000.

[4]The states observed for the 191 institutions are CA, CT, GA, IL, IN, IA, MD, MA, MI, MN, MO, NY, NC, OH, PA, TX, VA, and WI.

HERI Institutions Compared to a National Sample

Table 1 reports the composition of schools in the HERI sample versus the national universe of four-year universities.[5] Public institutions account for 17.42 percent of all of the institutions in the HERI sample versus about 24.40 percent of all national institutions.

Likewise, the observed institutions in this study are more heavily weighted towards religious and liberal arts institutions than the nationally representative sample of institutions. The discrepancy in the proportion of liberal arts colleges has important implications for this analysis because liberal arts colleges are on average much more expensive than the average four year school. According to the National Center for Education Statistics (NCES) the average tuition for the top tier liberal arts institutions was $26,496 in 2002 compared to the average for all public and private four year institutions of $13,639.

The Annapolis Group, an alliance of the majority of liberal arts colleges in the country, commissioned a study that found its graduates reported extreme differences in their college experience and the value of their college degrees compared to students at other types of private and flagship public institutions. For example, 87 percent of students at liberal arts colleges graduated in four years versus 76 percent at other private institutions and 51 percent of students at state flagship public institutions. Because students at liberal arts institutions graduate faster, on average, than students at other types of universities, liberal arts students are more likely to complete their degrees.

Furthermore, 79 percent of students who attended the liberal arts colleges in the survey reported the quality and breadth of academic preparation equipped them well for being accepted to graduate school or finding their first job. Only 73 percent of students at other private universities and 64 percent of students at state flagship public schools

[5]Data for the national universe of schools come from IPEDS and the *Digest of Education Statistics* from the NCES.

reported the same level of preparation, respectively (Day, 2011). These factors might change a student's willingness to take out student loans compared to a more nationally representative sample of students, because the risk of not graduating from school is lower and their perceived preparation for graduate school and their careers is higher.

Finally, the percentage of institutions classified as a Historically Black College or University (HBCU) in the HERI sample is comparable to the national average, with 3.73 percent in the HERI sample versus 3.90 percent, nationally. However, as reported in Table 2, the percentage of students in the sample identifying as black is 3.49% less than the nationally representative proportion of black freshmen.

HERI Students Compared to a National Sample

Table 2 compares the demographic conditions between the HERI and a nationally representative samples. Because the institutions included in the survey differ from a nationally representative sample of institutions, the students in the HERI data will also differ slightly from the broader group of their college going peers. The HERI sample of students has 7.39% more females than a nationally representative sample of students. Females are more likely to receive financial aid than are male students. Table 2 also documents that the average student in the HERI sample is more financially secure than the average college freshman. The average family income for a student in the HERI sample is $106,683.70 compared to $94,791.34 nationally, a $11,892.36 difference. Students in the HERI sample are also more likely to be white than are average college students. Both of these groups are less likely to receive aid. Finally, students in our sample are marginally younger than a more nationally representative sample of students. Younger freshman are more likely to receive parental, institutional, and Perkins loans, and less likely to receive state aid, Pell Grants and Stafford loans.

The sample is also selected because of response rates to the variables of interest in our model. Only 42.6 percent of students in the HERI data answer all of the questions in our model. Much of the attrition occurs because of the low response rates to the financial aid variables.

Unfortunately, we do not have access to the weights to more closely resemble a nationally representative sample of students. Papers like Wiswall and Zafar (2011) are also unable to weight their sample to match the population. They address this problem by recognizing the differences in the two samples and discussing how those differences affect the results when students select a major. In the present context, the students are richer, whiter, of more traditional age, and more likely female than a more nationally-representative sample of students. While we can control for these observable demographic characteristics that influence student aid packages, there might be unobservable factors correlated with these groups that may bias our results. Therefore, the effects in this study can be interpreted with caution knowing that the results apply to this specific population of students and not necessarily to college students universally.

Table 3 details the breakdown of each aid category by gender and race characteristics. On average, females receive more aid than males in all of the aid categories. Hispanic students receive the most institutional ($1,866.58) and state aid ($885.51) along with federal Stafford ($1,338.50) and Perkins loans ($560.15). White students receive more parental aid ($3,065.10) than other groups, while black students receive more Pell Grants ($1,366.48) than any other race category.

Figures 1-4 display how the aid categories change over the sample period. Figure 1 compares average state and institutional aid. During recessions we see both of these types of aid falling until the recession troughs after which state and institutional aid increase. Figure 2 compares federal Pell grants and state aid. From the raw data it is difficult to distinguish if Pell and state aid move in tandem or in opposite directions. Their

relationship differs depending on the time period. Empirical methods are needed to test our hypotheses about these aid types. The same is true for Figure 3 which compares federal Stafford loans to parental aid over time. Across some portions of the graph these groups move in opposite directions, but sometimes they trend in the same direction. More careful empirical analysis is also needed to make any conclusions about their relationships to the business cycle. In Figure 4 the general shape of the trend line for each federal aid category is the same. Empirical analysis will distinguish the degree of change between each of the federal aid categories, helping to establish if there is a difference in changes of unsubsidized versus subsidized aid.

3.3.2 Business Cycle Data

To correctly identify the effects of economic fluctuations on freshman financial aid packages, the business cycle variables must capture the information shock of an economic downturn. This paper will take advantage of the geographic heterogeneity in the data and focus attention on state level business cycle indicators. The state is the most appropriate level of observation because fluctuations in a states' economy will determine the states and families' abilities to provide college funding for students, not fluctuations in national level business cycle variables. Presumably, the tax revenues in California will not affect Georgia's ability to provide aid to students. However, an aid package to a California student might be highly dependent on California's revenues.

Bhatt et al. (2011) use fluctuations in tax revenues to capture business cycle fluctuations, which is appropriate in this context because we expect state aid to be highly sensitive to state tax revenues. Tax revenues simultaneously reflect changes in the state's economic activity and how much money the state can allocate to students as financial aid. Tax revenue data are from the U.S. Census Bureau's Quarterly Summary of State & Local

Taxes and converted to real dollars.[6] Figure 5 shows how the natural log of the average state tax revenues change over 1979-2000. These business cycle data allow us to document that state tax revenues have been growing over time, but that upward trend was disrupted during the recessions of 1980, 1982, and 1991.

The rate of unemployment in a state reflects both the financial stability of the student's parents and the increase in demand for student aid. Unemployment also indirectly affects federal and state public finance because a decrease in labor market activity lowers the amount of tax revenue that the government can collect. The Bureau of Labor Statistic's (BLS) yearly unemployment rates by state from years 1979-2000 help capture the labor market opportunities of freshmen and their parents that potentially contribute to their need for outside aid. Figure 6 displays how average state unemployment rates change over the sample period. Unemployment rates increase until recession troughs and then they start to trend downward.

The Regional Economic Information System at the Bureau of Economic Analysis (BEA) reports quarterly personal income per capita by state. These data are then adjusted for inflation and converted to growth rates by state from year to year. As personal income growth increases, parents have more resources to give to their college bound children, and governments receive more money from tax revenues. Figure 7 shows how personal income growth rates change over the sample period. This graph is the opposite of the unemployment rate graph. Personal income growth rates trend downward until the recession trough when the economy starts to recover.

During a recession, increases in unemployment usually lag behind decreases in wages. Therefore, the lags of these variables will be introduced in the empirical model to

[6]Humphreys (2000) argues that state tax revenues might be a biased business cycle indicator because of fluctuations in tax rates. He uses personal income instead as his state level business cycle indicator. Even though state tax rates do not change very often over the period used in our analysis, we include both business cycle variables for robustness.

allow past values of personal income growth and unemployment rates to affect the current shares and levels of student aid. The lags are not expected to be important for the tax revenue variable because the contemporaneous revenues determine the amount of aid that states can allocate to incoming freshman. In the results we will concentrate on the contemporaneous term models for the tax revenue variable, and the lagged terms for the unemployment and personal income growth rate variables.

3.3.3 Distribution of Financial Aid Variables

Table 4 displays the percentage of students receiving positive aid with corresponding standard deviations. Students most commonly receive aid from their parents with nearly 89 percent of students receiving family assistance. The next most common source of aid is institutional aid with more than 41 percent of students receiving aid. These statistics reflect the high concentration of private liberal arts colleges.

Government aid plays an important but smaller role in our sample. Nearly 25 percent of students receive a state-based grant, and around 25 percent a federal need-based Pell Grant. Regarding federally subsidized student loans, nearly 38 percent receive Stafford loans and 15 percent received Perkins loans.

Figure 8 displays the distributions of the financial aid categories, conditional on receiving aid. Parental aid and institutional aid appear normally distributed. The distributions for the other aid categories are somewhat right skewed which could bias some of the empirical models described in the following section. One of the methods, the hurdle model, will address this concern.

3.4 Empirical Models

Each empirical approach outlined here has a different goal. Incorporating a logit model into the estimation scheme addresses whether students are more likely to receive the different categories of aid during business cycle fluctuations. The OLS midpoint model is the first and most basic attempt to assign a dollar value to the amount students' aid packages may change during downturns. The interval regressions correct for the perceived biases introduced by the OLS midpoint model. Finally, the hurdle model conditions on students receiving aid to estimate the dollar amount changes in each aid category.

3.4.1 Logit Model Estimation

First, we investigate whether the likelihoods that students receive the different categories of aid change during downturns by estimating the following logit model:

$$Pr(Y = 1|X) = \frac{e^{\beta_j' x_i}}{1 + e^{\beta_k' x_i}}$$

where $Y = 1$ if a student receives the particular type of aid of interest and $Y = 0$ otherwise. X is a vector of business cycle variables, student demographic characteristics, and year, state, and institutional indicators. The demographic variables include gender and race indicators, family income, high school GPA, and the student's age, which influence the probability that students receive financial aid and must be accounted for to determine the true effect of business cycle changes. Each business cycle variable (tax revenues, unemployment rate, and personal income growth rate) is included in a separate model. Coefficient estimates for this model can be interpreted as percentage point changes in the likelihood that students receive a particular type of aid given changes in the variable in X.

3.4.2 OLS Midpoint Model Estimation

The "Freshman Survey" is an excellent data set to study these effects because it surveys many college students in various states over a number of business cycles. One difficulty with the data is that income and the amount of financial aid are reported as categorical data. The categories are broken into ranges of $500 each. The most common approach to convert categorical data into a continuous dependent variable, which we adopt first for baseline estimates, is to simply take the midpoint of each category and thus artificially create a continuous dependent variable.

After calculating the midpoint for each observation, we estimate the following baseline regressions for student i in state s and year t:

$$Aid_{ij} = \gamma BC_{st} + X_i\beta + \theta_1 state + \theta_2 college + \theta_1 year + \epsilon_i, \tag{3.1}$$

$$Aid_{ij} = \gamma BC_{st} + \gamma BC_{st-1} + X_i\beta + \theta_1 state + \theta_2 college + \theta_1 year + \epsilon_i, \tag{3.2}$$

where Aid is one of the following j financial aid categories: parent, institutional, state, Pell Grants, Stafford Loans, and Perkins Loans. X is a matrix of controls including high school GPA, parent income, age, and whether the student is male, black, or Hispanic. Finally, we estimate equations 1 and 2 separately with three separate models for the different business cycle indicators: log of state revenues, the unemployment rate and average personal income growth rate for the state where the institution is located.

3.4.3 Interval Regression

While the "midpoint method" has been used by various researchers (Eide and Showalter, 1999; Layard *et al.*, 2008; Trostel *et al.*, 2002), there are some concerns that the technique may bias results since construction of the continuous dependent variable may introduce

measurement error since the true value is unobserved and censored by the categorical cutoffs (Bettin and Lucchetti, 2012; Stewart, 1983). Caudill (1992) shows that if the intervals are of equal length and exhaustive,[7] then the bias is very small. Unfortunately, our data do not meet these conditions. One common alternative that avoids using a biased OLS estimator is to use an interval maximum likelihood routine proposed by Stewart (1983) who assumes that the true value of the amount of financial aid (y^*) is unobserved, but the interval that contains y^* is observed:

$$A_{k-1} < y^* < A_k,$$

where A_k and A_{k-1} represent the higher and lower bounds for a given category k. Stewart estimates the following log-likelihood function to obtain the conditional probabilities $P(w = j|X)$:

$$l_i(\beta, \sigma) = 1[w_i = 0]\, log\left\{\Phi\left(\frac{A_1 - x_i\beta}{\sigma}\right)\right\} + 1[w_1 = 1]\, log\left\{\Phi\left(\frac{A_2 - x_i\beta}{\sigma}\right) - \Phi\left(\frac{A_1 - x_i\beta}{\sigma}\right)\right\} + ... + 1[w_i = J]\, log\left\{1 - \Phi\left(\frac{A_1 - x_i\beta}{\sigma}\right)\right\}, \quad (3.3)$$

assuming that ϕ is the standard normal distribution. The coefficients from this estimation routine can be interpreted similar to those estimated by ordinary least squares (Wooldridge, 2010, page 783); meaning that a one unit increase in a dependent variable corresponds to a change in the dependent variable of magnitude β.

[7] Meaning that there are no open ended categories.

3.4.4 Hurdle Models

Each of the previous empirical techniques only requires a one-step estimation procedure to estimate a student's financial aid package. However, in reality a student's financial aid package is built in two steps. The first step determines whether a student will receive a certain type of aid at all. Then the second step determines the amount of aid a student will receive conditional on receiving a nonzero amount. Given the large tail of zero aid in each category, the previous estimation techniques do not condition on students receiving aid and could be biased downward.

In this context we employ a hurdle model to fit the two stage decision process of financial aid package determination. The first step estimates whether students receive aid at all, and the second step estimates the amount of aid a student receive conditional on receiving aid. We use Cragg's (1971) tobit version of the hurdle model where the first step of the model is a standard probit estimation and the second step is a truncated normal estimation. This model can be characterized as follows:

$$f(w, y|x_1, x_2) = \{1 - \phi(x_1\gamma)\}^{1(w=0)}[\phi(x_1\gamma)(2\pi)^{-\frac{1}{2}}\sigma^{-1}exp\{-(y - x_2\beta)^2/2\sigma^2/\phi(x_2\beta/\sigma)]^{1(w=1)} \tag{3.4}$$

where w is an indicator equal to 1 when y is positive. The model will return estimated coefficients for the first stage γ which are maximum likelihood estimates using the probit model, and β which are returned in the second step using Cragg's likelihood function. We are interested in the conditional and unconditional partial effects of the business cycle variables in β. We can compare these estimates to the OLS Midpoint and to see if there is strong bias present because of the tail of zeros in our financial aid distributions.[8]

[8]Using this version of the hurdle model we are unable to correct for any bias used from using the midpoint as the categorical mean. Therefore these estimates are not as comparable to the interval regression results.

3.5 Results

The coefficients for the business cycle variables are reported in Tables 5-6 for the Logit, Tables 7-8 for the OLS Midpoint, and Tables 9-10 for the Interval Regression models, respectively. The models in Tables 5, 7, and 9 are estimated with just the contemporaneous term of the business cycle variable, while the models in 6, 8, and 10 include the contemporaneous and the first lagged terms of the business cycle variables. As expected, the model with only the contemporaneous term produces the best and most consistent results for the tax revenue variable, while the models with the first lags produce the best and most theoretically sound results for the unemployment rate and the personal income growth rate variables. We also focus on the sign of the changes to the log likelihoods when reporting the logit model estimations. But when we report the OLS Midpoint and the Interval Regression results we center the discussion on the magnitudes of the coefficients, because they estimate the dollar amounts by which aid is changing during business cycle fluctuations.

3.5.1 Logit Model Results

Tables 5 and 6 report the results for the logit model estimation for the contemporaneous business cycle term model and the lagged business cycle variable model. For the tax revenue variable we will concentrate on the results from the contemporaneous term in Table 5. For the unemployment and personal income growth rate variables we will concentrate our analysis on the coefficients on the first lag of these terms in Table 6.

Table 5 shows that as the contemporaneous term for tax revenues increases the log odds[9] that students receive state aid by 1.192, while the log odds that students receive parental (-0.305), institutional (-0.247), and all forms of federal aid falls (-0.299 for Pell

[9]Marginal Effects are not reported because the large sample size makes it nearly impossible to calculate them and thus log odds are reported.

Grants, -0.126 for Stafford Loans, and -0.500 for Perkins Loans). This supports our hypothesis that as states have more money coming in, they make that money available as financial aid for college students. Symmetrically, as state revenues decrease other aid granting parties are more likely to give students aid.

Table 6 reports that as the first lag of unemployment increases the log odds of receiving Federal Pell Grants (0.037), Stafford Loans (0.054), institutional aid (0.007). Meanwhile, students are less likely to receive parental (-0.043), state aid (-0.024), and federal Perkins Loans (-0.011). Therefore, as students' family resources and states are constrained, the institutions and federal government steps in and is more likely to provide students aid. The federal government is more likely to provide grants and subsidized aid after downturns and less likely to provide Perkins loans because more students qualify for free or subsidized aid when the unemployment rate increases.

Finally, as the first lag of the personal income growth rate per capita increases, students are more likely to receive state aid and rely less on federal Pell grants and Perkins loans. The results for the other aid categories are statistically insignificant. Again this supports the idea that as the economy is booming, states are better equipped to provide money for college students, and students do not rely as heavily on the federal government for help.

3.5.2 OLS Midpoint Results

Contemporaneous Lags-OLS

Table 7 displays results from the baseline OLS estimates using the business cycle indicator from the contemporaneous time period. The first row shows results using the log of the tax revenues from the state where the institution is located. The interpretation of the log is a one percent increase in state tax revenues changes the dollar amount of the type of financial

aid. The estimates indicate that a one percent increase in state tax revenues increase state-based financial aid by $559 and Stafford Loans by $123.74, but decrease parent aid by $621.16, institutional aid by $317.90, Pell Grants by $91.68, and Perkins Loans by $82.94. As states distribute more aid to students, parents allocate family resources to other needs.

Also, Li (2010) finds a high correlation between tax receipts and GDP growth, which helps explain the results for the federal aid variables. Since tax revenues and income growth rates are positively related, as state tax revenues increase then presumably students' family incomes are increasing as well. These results are consistent with our expectations because need plays a major role in determining eligibility according to the federal student aid eligibility formula. Thus the number of low-income students eligible for Pell Grants and Perkins loans decreases, while the number of students who are no longer eligible for Pell Grants and Perkins loans but are offered unsubsidized Stafford loan increases.

Contemporaneous lags are the most appropriate indicator of the flexibility of state and federal budgets since budgeting is an annual process and policy makers have already spent any previous year's tax revenues. These results show that during expansions, state governments become less budget constrained and increase the amount of aid they allocate to students by $558.71. This reduction in aid places a higher burden on parents and the federal government who can easily borrow to fund the increased number of students applying for aid. A one percent increase in tax revenues decreases the amount of Pell Grant aid allocated to students by $91.68 and the balance of Perkins Loans by $82.94, but the balance of Stafford Loans increases by $123.74.

The state unemployment rate also has large implications for financial aid allocation. As unemployment increases, parents can no longer fund their children's education as previously planned. Also, as more workers become unemployed, governments receive less tax revenue. In addition, more displaced workers enroll in college to learn new skills to re-enter the labor market. Table 7 shows that as unemployment increases, parent,

institutional, and state aid all decrease by $7.45, $7.86, and $5.39 respectively. This result is evidence that these groups have fewer resources to allocate generally and thus reduce their contribution to individual student's education. However as unemployment increases, Pell Grants, and the balance of Stafford and Perkins loans increase by$10.27, $15.69, and $3.01 respectively. While these results conform to our expectations that as parent and other forms of grant aid decline, more students rely on loans to pay for college; the results are not economically significant.

The final business cycle indicator is the percentage change of personal income for the state in which the institution is located. While an increase in the personal income growth rate boosts parent aid by $5.26, decreases state aid by %5.39, and decreases Pell Grant aid by $2.64. This result may be because as parents have more disposable income, students may no longer be eligible for state need-based aid and Pell Grants. However, the balance of Stafford and Perkins loans does not change with personal income growth.

One Period Lag-OLS

Table 8 displays the results for estimating the baseline OLS models with the business cycle indicator for both the contemporaneous and lagged time periods. As noted above, this model is not very useful for the log of tax revenues because what matters most to policy makers who are setting federal and state budgets is the current amount of tax revenue that can be allocated for the current fiscal year. Thus the results for the one period lag model with state tax revenues are either not statistically significant or have an unclear interpretation.

The lagged unemployment matches the story from the model with only the contemporaneous time period because the previous year's labor is taxed to fund public goods in the next fiscal year. Thus, as the previous year's unemployment increases, the amount of revenue available for state funded financial aid for the next year decreases. The

states take some time to recover from the previous year's unemployment shock. Also if there is an increase in unemployment during the previous year, federally funded financial aid increases because there are more eligible students and the federal government can more easily raise money for deficit spending than a state or family. An increase in the lagged unemployment rate increases Pell Grants by $6.80, Stafford Loans by $44.50, and Perkins Loans by $10.95. These magnitudes may be small because a significant portion of students did not receive these types of aid. A hurdle model framework correct for the long tail of zeros in the financial aid distribution.

The rate of personal income growth for the previous year also has a logical effect on the financial aid given to a student for the current year. As the previous year's personal income increases, parents may have more in savings to devote to their children's college education, while fewer students may be eligible for need-based programs such as Pell Grants and Perkins Loans. Also, students who were on the margin between a Stafford loan and a Pell Grant will receive the loan.

3.5.3 Interval Regression

Contemporaneous Lags-Interval Regression

As outlined in the econometric section, the interval regression corrects for any biasedness caused by introducing measurement error by using the midpoint method. Table 9 displays the results from estimating the interval regression with only contemporaneous business cycle indicators. Most of the signs on the coefficients are the same between the interval regression and the baseline OLS estimates except state aid and Stafford loans. These results make more sense than the baseline estimates because state revenues also reflect the amount of labor market income earned in the state during the year.[10] Thus as the economy

[10] Assuming that state income taxes remain constant.

expands, parent and state aid increases by $48.89 and $181.14, respectively, for every one percent increase in state tax revenues. The coefficient for log tax revenue in regards to Stafford Loans also changes from positive to negative with the interval regression. This result implies that as parent and state income increases, students do not need to use student loans to finance their educations, and thus the balance of Stafford and Perkins loans decreases.

In addition to the sign changes for parent aid and Stafford loans, almost all of the magnitudes of the coefficient are smaller with interval regression than the baseline OLS estimates. These results show that business cycle fluctuations have a smaller effect on financial aid when one corrects for the possible bias from the midpoint method.

One Period Lag-Interval Regression

Table 10 displays the results from the interval regression with a one period lag. As noted earlier, the one period lag model is more helpful for the unemployment and rate of personal income growth indicators than tax revenue because financial aid is determined by the budget that is based on fiscal year estimates of the current year. Any state revenue that is collected during previous years should not affect future budgets.

As in the interval regression with contemporaneous business cycle indicators, the interval regression with one lag dampens the magnitude of the coefficients. However, the unemployment variable shows that as the previous year's unemployment rate increases, institutional and state aid decreases by $3.46 and $6.96 respectively. However, similar to the interval regression with contemporaneous variables, the coefficient for the Stafford loan variable is $10.22; indicating that an increase in the unemployment rate increases the balance of the student's loans. As the previous year's rate of personal income growth increases, the amount of institutional aid increases by $1.60 while the balance of Perkins student loans and Pell Grants decreases by $1.09 and $2.32 respectively.

3.5.4 Hurdle Model Results

To determine whether there is bias present from the tail of zeros, we estimate the contemporaneous models for the different types of aid using a 20 percent sample of institutions.[11] Results in Table 11 report the unconditional partial effects which are most comparable to the OLS Midpoint estimates in Table 7.[12] We then report the conditional partial effects for each category using the hurdle model in Table 12.

According to Table 11 we find that as tax revenues increase, freshmen receive $411.70 more dollars of state aid and fewer dollars of all other forms of aid. This is the same result we find using the OLS midpoint method with the exception of the Stafford loan category, which has a very probable explanation. As tax revenues increase, fewer students receive Stafford aid, but those who remain and receive aid are the lowest income students. Therefore, they will receive more aid on average. The OLS midpoint method does not take into account that fewer students on average receive Stafford loans, so that is why we observe the counterintuitive positive sign for this category. The hurdle model corrects for the bias and when we consider that fewer students receive Stafford loans, the group average falls by $119.49. Table 12 confirms this hypothesis because conditional on students receiving Stafford aid, students actually receive $435.03 more aid.

The magnitudes for most of the remaining categories in Table 11 are tempered by using the hurdle model instead of the OLS midpoint version. Students receive $286.11 less in parental aid as tax revenues increase by one percentage point, compared to the $621.16 less than they received using the OLS midpoint method. They receive $260.64 less in institutional aid compared to the $317.90 they received according to OLS midpoint. They receive $411.70 more in state aid compared to the $558.71 using OLS midpoint. The

[11] Estimates for Perkins loans were not available because the sample size became too small when using a 20 percent sample for this particular aid category.

[12] Using this version of the hurdle model we are unable to correct for any bias used from using the midpoint as the categorical mean. Therefore these estimates are not as comparable to the interval regression results in Table 9

magnitude of the negative coefficient for Pell aid increases compared to the OLS midpoint method. According to the hurdle model students receive $200.20 less in Pell aid as tax revenues increase compared to $91.68 less in Pell aid when using the OLS midpoint method.

The results for the unemployment and personal income growth rate business cycle variables are not as interesting because we are using the contemporaneous version of the variables instead of their lags, which are the most important for these variables. However, for both of these business cycle variables the signs are the same and magnitudes are very similar for parental, institutional and state aid compared to the OLS midpoint estimates. For the Pell aid category the magnitudes differ more dramatically. Students receive $24.60 more dollars of Pell aid as unemployment rates increase by one percent compared to a $10.27 increase when using OLS midpoint. As personal income growth rate increases by one percent Pell aid increases by$2.84 according to the hurdle model but decreases by $2.64 when using the OLS midpoint model. Intuitively, we expect this sign of this coefficient to be negative. The coefficients for the Stafford loan category are statistically insignificant for these business cycle variables when using the hurdle model. By examining the lags of these business cycle variables in future research we will be able to better determine how well the hurdle model fits our theoretical priors for this set of business cycle variables.

3.5.5 Robustness Checks

The results in the paper conform to our hypotheses, however some may be concerned that different types of students may enroll during recessions. As reported in Chapter 2, students enrolling during recessions are more likely to be female, lower income, and older on average. While we control for those variables in the model, these variables may be correlated with some unobservable. We want to be sure that these unobservables are not driving our results.

The HERI data include many behavioral type questions in the Freshmen Survey. We do not include these types of variables in our model because of the low response rates to the questions and we do not want to lose any more observations. They ask students questions like the following: did you choose this college because of you were offered financial assistance?, did you choose this college because of the low tuition rate?, do you plan to work full time while attending college?, etc. If student answers to these types of questions are correlated with recessions then our results might be biased. However, we observe no association between the behavioral questions and business cycle fluctuations.

3.6 Conclusion

Since the recent recession of 2008, higher education has begun to rethink the way that it allocates financial aid to students. One concern is the countercyclical relationship of enrollment and the business cycle. As the economy slips into recession, more students enroll in college to retrain for the workforce and increase future labor market opportunities. Unfortunately, at the same time that colleges see dramatic enrollment increases, there are fewer financial aid resources to allocate to these new students. In this study, we estimate the effects of business cycle fluctuations on the amount of financial aid that a given student receives, and the composition of a student's financial aid package.

These results from both the baseline OLS, interval regression, and hurdle models show a fairly consistent pattern of how different types of aid react differently to business cycle fluctuations. The results indicate that state, institutional, and parental aid moves in tandem with the business cycle. As the economy expands, parents have more resources to fund their children's education and states receive more tax revenue that can be allocated to students. During times of economic expansion, students substitute loans for grants.

When the economy slips into recession, however, students are now more likely to be eligible for Pell Grants and since the federal government can more easily borrow money to offer more Pell Grants than institutions or state legislatures. Parents also have fewer resources so students must rely on student loans to meet tuition balances. Thus, Pell Grants and student loans are countercyclical, while parent, institution, and state aid seem to fluctuate with the business cycle.

The changing composition of financial aid packages are important because financial aid plays a key role in determining whether a student enrolls in college, the quality of institution that the student selects, and the probability that a student persists to graduation. Enacting policies that ensure that ample resources are available for students during recessions may ensure positive education outcomes during times of increasing budget constraints for governments, institutions, and families.

Table 3.1: Institutional Characteristics

Sample of Institutions	**Public (%)**	**Religious (%)**	**HBCU (%)**	**Liberal Arts (%)**
HERI Sample	17.42	37.76	3.73	55.60
National Universe	24.41	33.33	3.90	20.00

Note: This table compares the HERI Sample with the National Universe of higher education from IPEDS. It shows that the sample that we use in this analysis consist of a higher concentration of private, religious, liberal arts colleges than a typical nationally representative sample.

Table 3.2: Nationally Representative vs. HERI Sample: 1980-1999

Variables	**National**	**HERI**	**Difference**$_{HERI-National}$
Male	52.88%	45.49%	-7.39% ***
Asian	3.74%	4.97%	1.23%***
Black	10.72%	7.23%	-3.49%***
Hispanic	2.88%	2.56%	-0.32%***
White	82.33%	86.06%	3.73% ***
Income	$94,791.34	$106,683.70	$11,892.36***
Age	3.26	3.20	-0.06***

*** p < 0.01, ** p < 0.05, * p < 0.1

Note: This table displays the significant differences between the HERI sample and a nationally representative sample. The sample use in this study has more Asian, white, and higher income students. A nationally representative sample would have more male, black, Hispanic, and older students.

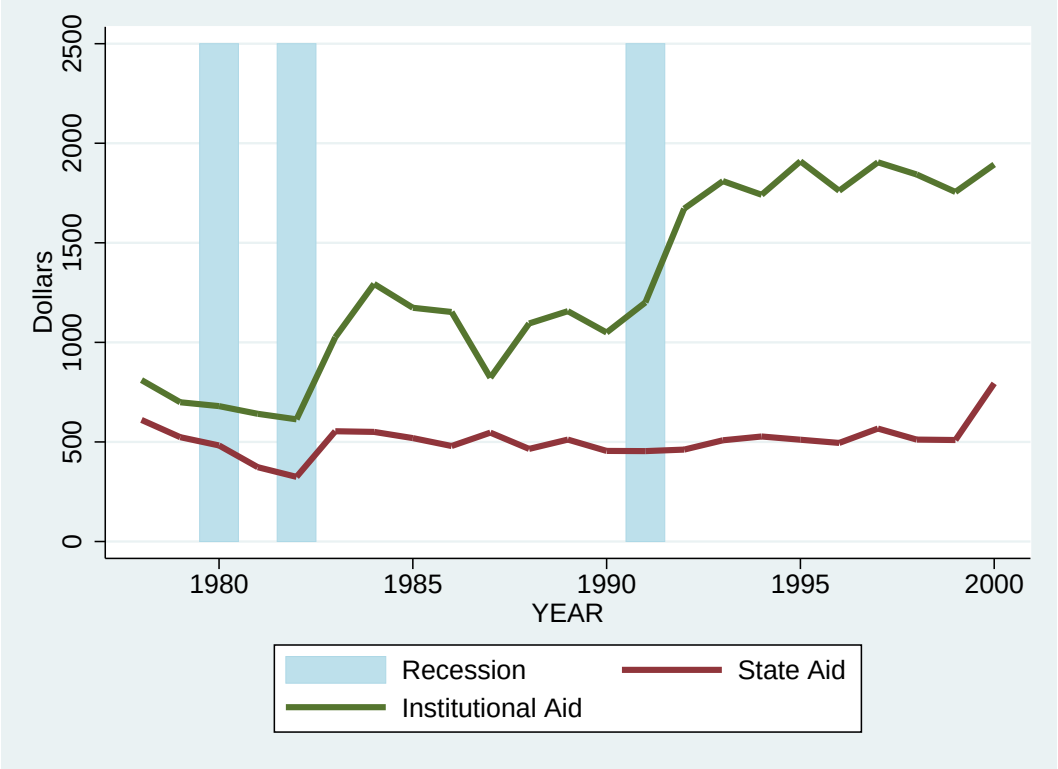


Figure 3.1: State vs. Institutional Aid: 1980-2000

Note: This figure plots the average amount of state and institutionally funded student grant aid from 1980-2000. The blue columns indicate recessions as determined by NBER.

Table 3.3: Demographic Summary Statistics by Aid Type

Aid Type	Male	Female	Asian	Black	Hispanic	White	All Students
Parental	3,065.10	3,145.79	3,125.72	2,170.73	2,456.05	3,201.06	3,108.89
Institutional	1,168.43	1,306.51	1,501.74	1,481.48	1,866.58	1,244.21	1,244.21
State	487.63	518.27	656.42	738.08	885.51	465.46	504.39
Federal:							
Pell	550.35	560.79	721.96	1,366.48	1,128.35	458.66	556.06
Stafford	1,099.11	1,134.82	1,058.63	1,147.22	1,338.50	1,114.61	1,118.63
Perkins	324.92	337.29	397.16	492.13	560.15	309.37	331.68

Note: This table displays summary statistics for a given type of aid and student characteristic.

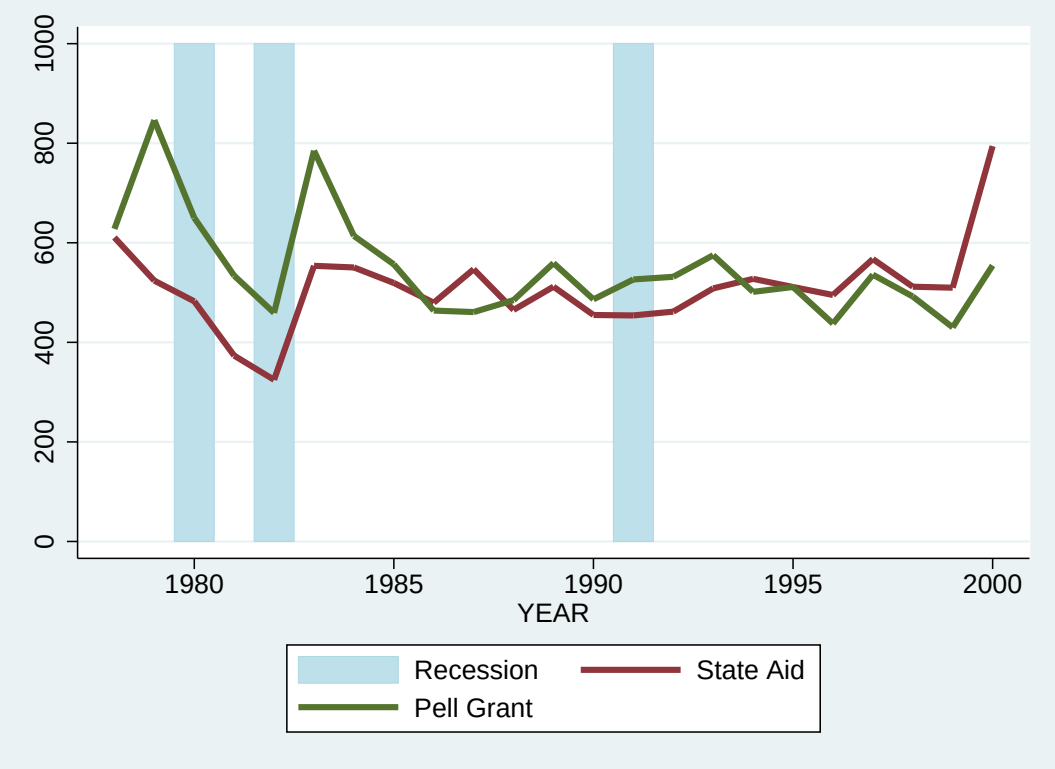


Figure 3.2: State vs. Pell Aid: 1980-2000

Note: This figure plots the average amount of state funded student financial aid and the average Pell Grant from 1980-2000. The blue columns indicate recessions as determined by NBER.

Table 3.4: Percentage of Students Receiving a Particular Type of Aid

Aid Type	Percentage	Standard Deviation
Parental	88.9	31.4
Institutional	41.2	49.2
State	24.3	42.9
Pell	25.4	43.6
Stafford	38.0	48.5
Perkins	15.3	36.0

Note: This table displays the percentage and standard deviations of students who receive positive values of a certain type of aid.

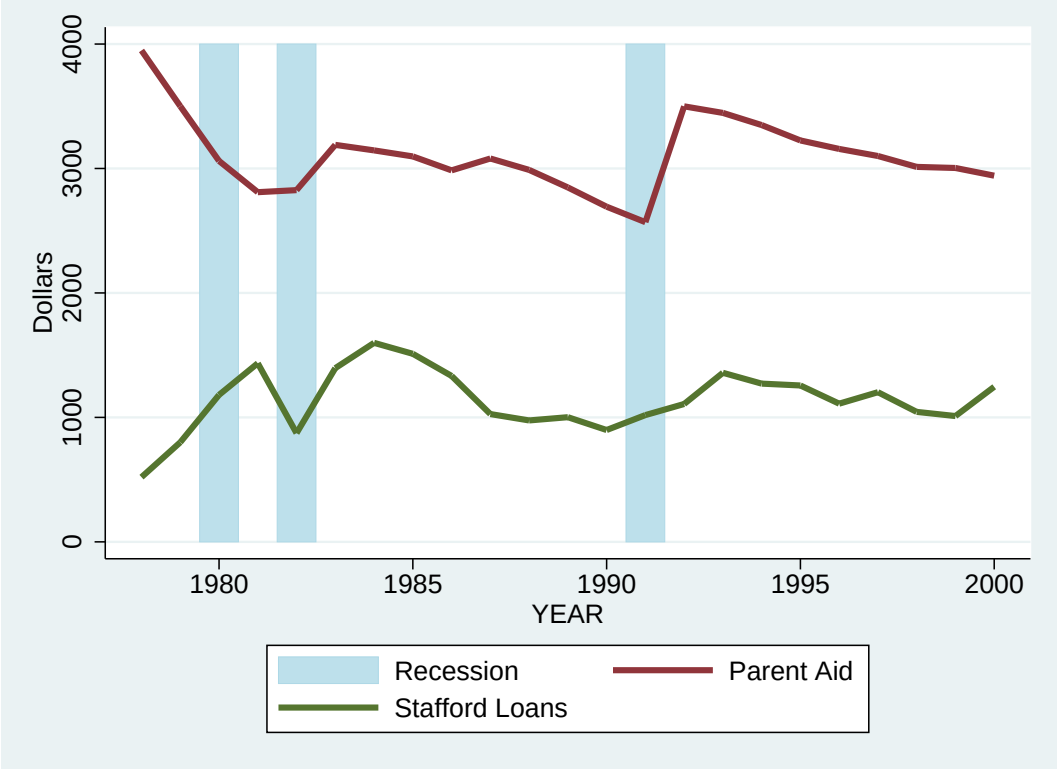


Figure 3.3: Parental Aid vs. Federal Aid: 1980-2000

Note: This figure plots the average amount of parent aid and the average student loan from 1980-2000. The blue columns indicate recessions as determined by NBER.

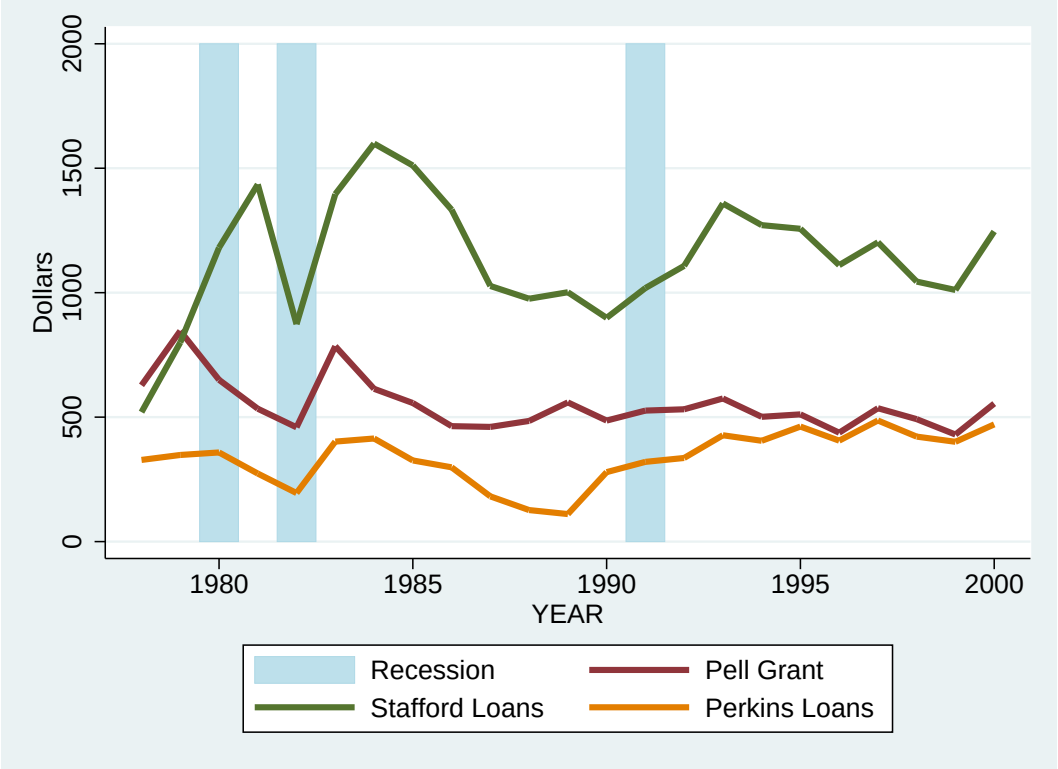


Figure 3.4: Federal Aid by Type: 1980-2000

Note: This figure plots the average amount of aid from each federal student aid program (Pell Grants, Stafford Loans, and Perkins Loans) from 1980-2000. The blue columns indicate recessions as determined by NBER.

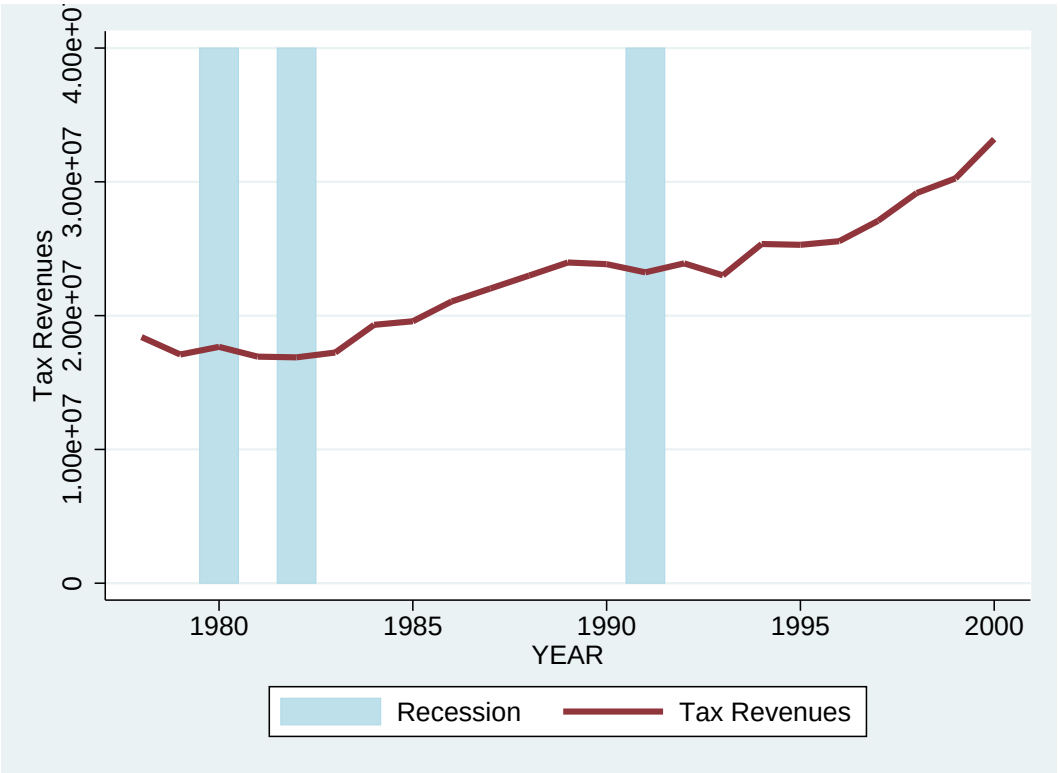


Figure 3.5: Tax Revenues and Recession Troughs

Note: This figure plots the average tax revenues recieved by state governments from 1980-2000. The blue columns indicate recessions as determined by NBER.

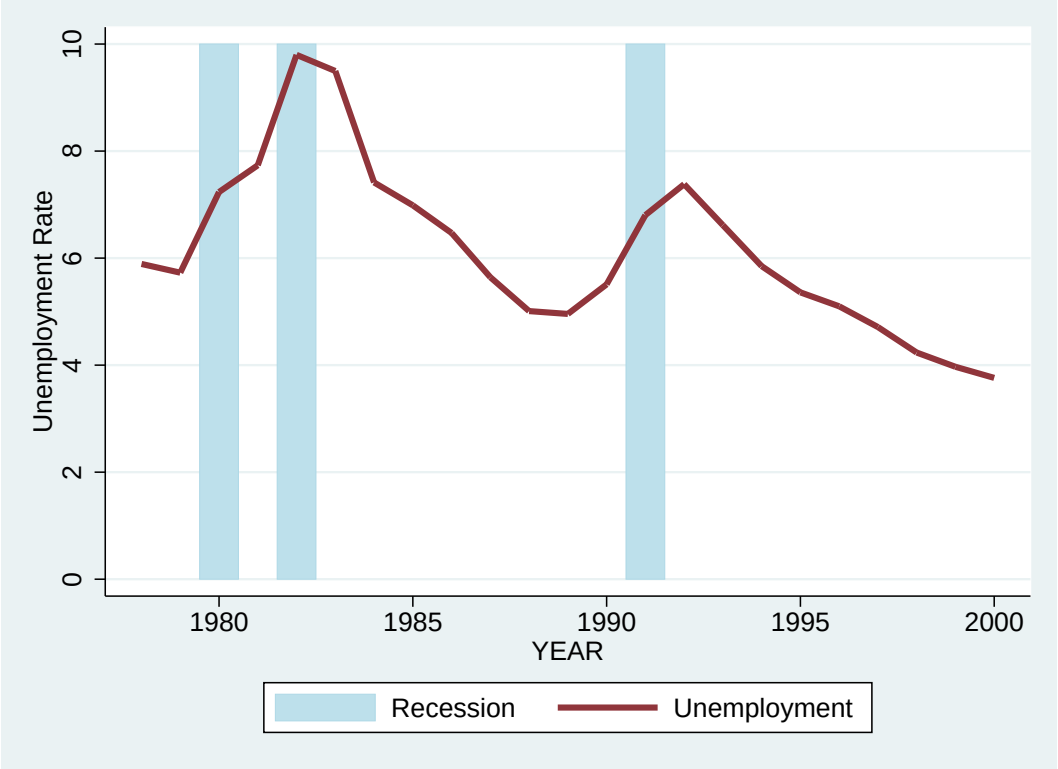


Figure 3.6: Unemployment Rate and Recession Troughs

Note: This figure plots the national unemployment rate from 1980-2000. The blue columns indicate recessions as determined by NBER.

Figure 3.7: Personal Income Growth and Recession Troughs

Note: This figure plots the personal income growth rate from 1980-2000. The blue columns indicate recessions as determined by NBER.

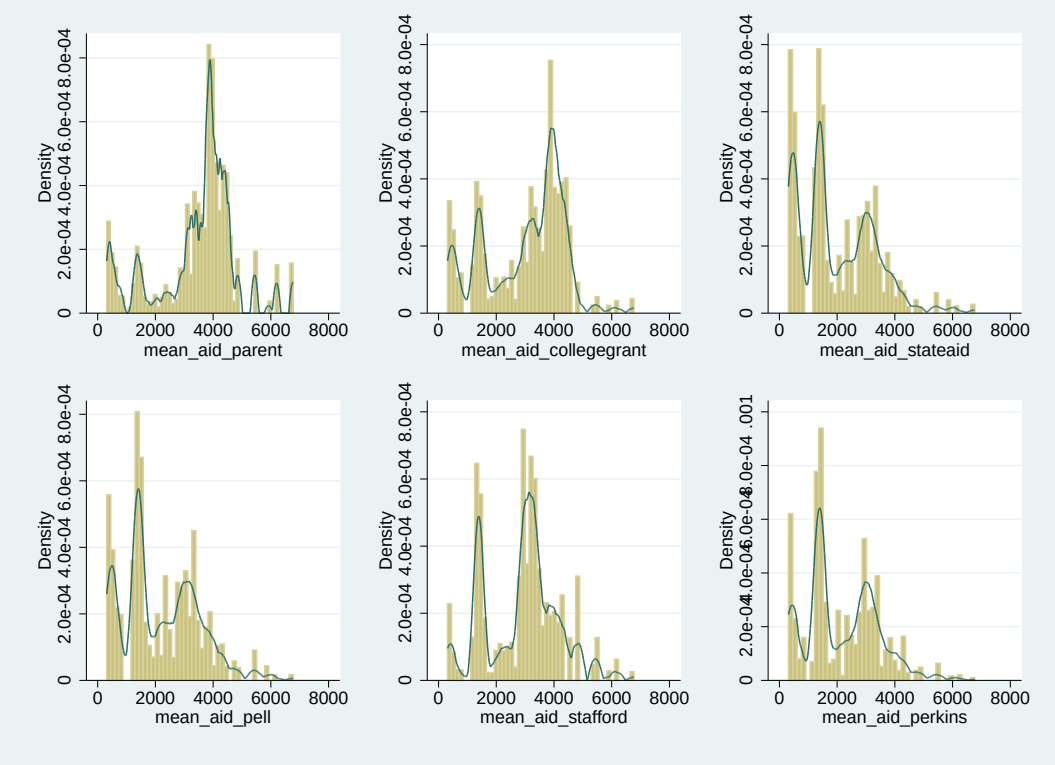


Figure 3.8: Distribution of Financial Aid by Aid Type

This figure displays histograms of positive values of financial aid by aid type.

Table 3.5: Logit Results

BC Variable	(1) Parental	(2) Institutional	(3) State	(4) Pell	(5) Stafford	(6) Perkins
$\ln\text{TaxRev}_t$	-0.305***	-0.247***	1.192***	-0.299***	-0.126***	-0.500***
	(0.040)	(0.031)	(0.032)	(0.035)	(0.030)	(0.040)
Unemployment_t	-0.008***	-0.013***	-0.036***	0.020***	0.040***	-0.017***
	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)
PIgrowth_t	-0.001	-0.006***	0.002	0.005***	0.009***	0.009***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	
Demographics	Yes	Yes	Yes	Yes	Yes	Yes
Year Indicators	Yes	Yes	Yes	Yes	Yes	Yes
State Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Institutional Indicators	Yes	Yes	Yes	Yes	Yes	Yes
N	1,343,666	1,343,666	1,343,666	1,343,666	1,343,666	1,343,666

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

Note: Each column is a unique dependent variable, and each row is a unique independent business cycle variable. Demographic controls include high school GPA, male, race, family income, and age.

Table 3.6: Logit Results

	(1)	(2)	(3)	(4)	(5)	(6)
BC Variable	Parental	Institutional	State	Pell	Stafford	Perkins
$\ln\text{TaxRev}_t$	-0.812	0.638	-0.090***	1.99	-2.339	-1.027
	(3.06)	(2.51)	(2.66)	(2.72)	(2.36)	(3.45)
$\ln\text{TaxRev}_{t-1}$	0.508	-0.885	1.282***	-2.29	2.21	0.527***
	(3.06)	(2.51)	(2.66)	(2.72)	(2.36)	(3.45)
Unemployment_t	0.028***	-0.019***	-0.015***	-0.012***	-0.006	-0.008
	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)
$\text{Unemployment}_{t-1}$	-0.043***	0.007*	-0.024***	0.037***	0.054***	-0.011**
	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)	(0.006)
PIgrowth_t	-0.001	-0.006***	0.001	0.007***	0.009***	0.009***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
PIgrowth_{t-1}	-0.002	0.001	0.007***	-0.009***	0.000	-0.004***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Demographics	Yes	Yes	Yes	Yes	Yes	Yes
Year Indicators	Yes	Yes	Yes	Yes	Yes	Yes
State Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Institutional Indicators	Yes	Yes	Yes	Yes	Yes	Yes
N	1,343,666	1,343,666	1,343,666	1,343,666	1,343,666	1,343,666

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Note: Each column is a unique dependent variable, and each row is a unique independent business cycle variable. Demographic controls include high school GPA, male, race, family income, and age.

Table 3.7: OLS Midpoint Results

BC Variable	(1) Parental	(2) Institutional	(3) State	(4) Pell	(5) Stafford	(6) Perkins
$\ln\text{TaxRev}_t$	-621.16***	-317.90***	558.71***	-91.68***	123.74***	-82.94***
	(19.72)	(17.14)	(12.07)	(12.58)	(18.26)	(10.14)
Unemployment_t	-7.45***	-7.86***	-5.39***	10.27***	15.69***	3.01***
	(1.43)	(1.24)	(0.870)	(0.910)	(1.32)	(0.730)
PIgrowth_t	5.257	3.71	-9.58***	-2.64***	-1.02	0.66
	(1.12)	(2.95)	(0.680)	(0.710)	(0.970)	(0.570)
Demographics	Yes	Yes	Yes	Yes	Yes	Yes
Year Indicators	Yes	Yes	Yes	Yes	Yes	Yes
State Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Institutional Indicators	Yes	Yes	Yes	Yes	Yes	Yes
N	1,343,666	1,343,666	1,343,666	1,343,666	1,343,666	1,343,666

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

Note: Each column is a unique dependent variable, and each row is a unique independent business cycle variable. Demographic controls include high school GPA, male, race, family income, and age.

Table 3.8: OLS Midpoint Results

	(1)	(2)	(3)	(4)	(5)	(6)
BC Variable	Parental	Institutional	State	Pell	Stafford	Perkins
$\ln\text{TaxRev}_t$	-216.99	-663.79	-92.98	285.53	-972.71	42.24
	(1,003.02)	(1,385.07)	(464.99)	(464.00)	(724.71)	(819.57)
$\ln\text{TaxRev}_{t-1}$	265.90	345.87	274.16	-346.18	872.44	-125.20
	(1,002.99)	(1,385.03)	(464.98)	(463.98)	(724.69)	(819.55)
Unemployment_t	-4.01***	-13.32***	4.65***	-0.25	-22.18***	-6.25***
	(1.21)	(2.31)	(0.770)	(0.780)	(2.460)	(1.370)
$\text{Unemployment}_{t-1}$	13.06***	6.42***	-8.38***	6.80***	44.50***	10.95***
	(1.20)	(2.29)	(0.770)	(0.770)	(2.44)	(1.36)
PIgrowth_t	5.06***	-0.670	-9.83***	-0.160	7.41***	1.25**
	(0.510)	(0.980)	(0.690)	(0.330)	(1.05)	(0.590)
PIgrowth_{t-1}	1.47***	-2.14**	-3.35***	-1.67***	0.740	-3.670***
	(0.520)	(0.990)	(0.330)	(0.330)	(1.050)	(0.590)
Demographics	Yes	Yes	Yes	Yes	Yes	Yes
Year Indicators	Yes	Yes	Yes	Yes	Yes	Yes
State Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Institutional Indicators	Yes	Yes	Yes	Yes	Yes	Yes
N	1,343,666	1,343,666	1,343,666	1,343,666	1,343,666	1,343,666

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Note: Each column is a unique dependent variable, and each row is a unique independent business cycle variable. Demographic controls include high school GPA, male, race, family income, and age.

Table 3.9: Interval Regression Results

BC Variable	(1) Parental	(2) Institutional	(3) State	(4) Pell	(5) Stafford	(6) Perkins
$\ln\text{TaxRev}_t$	48.89***	-374.17***	181.14***	-60.63***	-100.36***	-47.97***
	(12.53)	(11.04)	(5.74)	(5.76)	(9.02)	(4.59)
Unemployment_t	9.10***	-7.35***	-2.48***	5.54***	7.09***	0.33
	(0.890)	(0.800)	(0.420)	(0.420)	(0.650)	(0.330)
PIgrowth_t	-0.84	6.19***	-3.32***	-0.43	5.30***	1.03***
	(0.700)	(0.620)	(0.320)	(0.330)	(0.510)	(0.260)
Demographics	Yes	Yes	Yes	Yes	Yes	Yes
Year Indicators	Yes	Yes	Yes	Yes	Yes	Yes
State Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Institutional Indicators	Yes	Yes	Yes	Yes	Yes	Yes
N	1,343,666	1,343,666	1,343,666	1,343,666	1,343,666	1,343,666

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

Note: Each column is a unique dependent variable, and each row is a unique independent business cycle variable. Demographic controls include high school GPA, male, race, family income, and age.

Table 3.10: Interval Regression Results

BC Variable	(1) Parental	(2) Institutional	(3) State	(4) Pell	(5) Stafford	(6) Perkins
$\ln\text{TaxRev}_t$	42.11	-828.58	98.04***	-142.44***	-179.59***	-122.02
	(61.57)	(886.51)	(33.86)	(34.59)	(54.12)	(369.76)
$\ln\text{TaxRev}_{t-1}$	-37.76	454.45	42.36	49.39*	60.54	74.05
	(53.22)	(886.48)	(29.26)	(29.87)	(46.72)	(369.75)
Unemployment_t	-0.39	-4.41***	5.56***	1.83	-1.72	-1.00
	(4.15)	(1.48)	(2.29)	(2.34)	(3.65)	(0.62)
$\text{Unemployment}_{t-1}$	-1.33	-3.46**	-6.96***	5.49***	10.22***	1.56
	(4.13)	(1.47)	(2.28)	(2.33)	(3.64)	(0.612)
PIgrowth_t	0.69	5.93***	-2.67***	1.79*	3.42**	1.21***
	(1.77)	(0.630)	(0.970)	(1.00)	(1.56)	(0.260)
PIgrowth_{t-1}	0.09	1.60**	-0.36	-2.32**	2.03	-1.09***
	(1.77)	(0.630)	(0.98)	(1.00)	(1.56)	(0.260)
Demographics	Yes	Yes	Yes	Yes	Yes	Yes
Year Indicators	Yes	Yes	Yes	Yes	Yes	Yes
State Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Institutional Indicators	Yes	Yes	Yes	Yes	Yes	Yes
N	1,343,666	1,343,666	1,343,666	1,343,666	1,343,666	1,343,666

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

Note: Each column is a unique dependent variable, and each row is a unique independent business cycle variable. Demographic controls include high school GPA, male, race, family income, and age.

Table 3.11: Hurdle Model Results: Unconditional Partial Effects

BC Variable	(1) Parental	(2) Institutional	(3) State	(4) Pell	(5) Stafford	(6)
$\ln\text{TaxRev}_t$	-286.11***	-260.64***	411.70***	-200.20***	-119.49***	
	(60.24)	(55.45)	(33.09)	(21.76)	(48.51)	
Unemployment_t	-7.61*	-14.23***	-4.17*	24.60***	-3.84	
	(4.26)	(4.02)	(2.24)	(4.11)	(5.41)	
PIgrowth_t	1.71	0.91***	-5.00**	2.84*	4.82	
	(3.37)	(3.16)	(1.71)	(1.29)	(3.33)	
Demographics	Yes	Yes	Yes	Yes	Yes	
Year Indicators	Yes	Yes	Yes	Yes	Yes	
State Incidactors	Yes	Yes	Yes	Yes	Yes	
Institutional Indicators	Yes	Yes	Yes	Yes	Yes	
N	146,870	146,870	146,870	146,870	146,870	

Standard errors in parentheses

*** p < 0.01, ** p < 0.05, * p < 0.1

Note: Each column is a unique dependent variable, and each row is a unique independent business cycle variable. Demographic controls include high school GPA, male, race, family income, and age.

Table 3.12: Hurdle Model Results: Unconditional Partial Effects

BC Variable	(1) Parental	(2) Institutional	(3) State	(4) Pell	(5) Stafford	(6)
$\ln\text{TaxRev}_t$	-248.68***	-541.64***	435.03***	-256.96***	81.23	
	(53.71)	(75.80)	(89.09)	(82.55)	(74.88)	
Unemployment_t	-2.03	-29.96***	-1.38	9.36***	-3.84	
	(3.87)	(5.73)	(6.48)	(6.54)	(5.41)	
PIgrowth_t	1.26	5.28	-34.18***	-1.57	7.36*	
	(3.03)	(4.29)	(5.20)	(4.75)	(4.13)	
Demographics	Yes	Yes	Yes	Yes	Yes	
Year Indicators	Yes	Yes	Yes	Yes	Yes	
State Indicators	Yes	Yes	Yes	Yes	Yes	
Institutional Indicators	Yes	Yes	Yes	Yes	Yes	
N	146,870	146,870	146,870	146,870	146,870	

Standard errors in parentheses

*** p < 0.01, ** p < 0.05, * p < 0.1

Note: Each column is a unique dependent variable, and each row is a unique independent business cycle variable. Demographic controls include high school GPA, male, race, family income, and age.

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Appendix A

Construction of Expected Family Contribution

For a student to be eligible for federal, need based financial aid, she must first complete the Free Application for Federal Student Aid (FAFSA). The government uses the information gathered from the FAFSA to calculate the Expected Family Contribution (EFC) that measures how much she or her family could potentially contribute to her education. Colleges and universities use the EFC to determine student need which is the difference between cost of attendance and the EFC.

This section will describe in detail how the government calculates the EFC including the formula and the variables that the government uses. Also, this section will explain rules that the Department of Education proscribes to individual colleges and universities who calculate the cost of attendance for their college.

The EFC is a summation of two types of financial assets: income and savings. The Department of Education requires colleges to take into account income when calculating the EFC for all applicants. For a student's savings and assets to be exempted from inclusion in the EFC, the student (or her parents) must either have an adjusted gross

income (AGI) less than $50,000, not be required to file an IRS Form 1040, be a dislocated worker, or received a means-tested federal benefit.

To calculate the income component of EFC, the student must report her and her parents' (if dependent) AGI from the previous year tax form. The federal government then allows the following to be deducted from the reported AGI: federal taxes paid, state taxes paid, Social Security allowance for both parents, and the income protection allowance. The income protection allowance is a function of total family members and the number of college students in the household. The difference between AGI and the exceptions equals the portion of income that counts towards the EFC. If the student is a dependent, then this process is used for both student and parent income and the sum of the two equals the portion of the EFC from income. If the student is an independent then the parents' contribution is considered to be zero.

If a student does not qualify for the simplified EFC formula (income only), then the government adjusts the EFC for student's and family's savings and net worth. The federal government considers the student's and family's cash savings (including college savings), investments (not including 401k or pension funds, annuities, non-education IRA, or the value of a home), and net worth of a family own business or investment farm. This sum equals the student's and family's net worth. Finally, the government allows an adjustment for education savings and asset protection. This allowance depends on the age of the oldest parent and is increasing with age. Subtracting the asset protection allowance from the family's net worth yields the family's discretionary net worth. Students are not allowed to adjust their net worth for asset protection.

Finally, to calculate the student's and family's contribution from assets, the government multiplies the student's net worth by .20 and the family's discretionary net worth by .12. To calculate the final EFC, the government sums the contributions from income and the contributions from assets.