BEYOND THE BACCALAUREATE: DOES STUDENT LOAN DEBT IMPACT POST-COLLEGIATE DECISION-MAKING?

by

JASON C. LEE

(Under the Direction of Robert K. Toutkoushian)

ABSTRACT

Much has been made of the student loan crisis in recent years. Policymakers, families, and the media alike have blamed student debt for a number of the United States' less desirable macroeconomic trends. Though the perceptions of student loan debt are dire, rigorous examinations of the effects of student loan debt on post-graduation outcomes are few and far between. This study provides quasi-experimental evidence on the effects of student loan debt on a number of early adult outcomes. In short, the findings suggest that debt has little to no impact on post-collegiate outcomes for college graduates.

INDEX WORDS: Higher education, student loans, financial aid, federal policy

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CHAPTER 1

INTRODUCTION

For the average person, college is a worthwhile investment that has yielded increasing returns in recent decades (Autor, 2014; Avery & Turner, 2012). These returns come in both pecuniary and non-pecuniary forms with college-goers enjoying substantially higher levels of sustained employment, earnings that equate to an additional estimated $800,000 over a lifetime on average, and a host of civic, familial, and health-related benefits that persist beyond the traditional working age (Baum, Ma & Payea, 2013; Toutkoushian, Shafiq & Trivette, 2013). These private benefits, coupled with the many and varied societal benefits, have led governments, advocacy groups, and philanthropic organizations to make postsecondary attainment one of our nation's priorities.

As the attainment agenda has ramped up, so too have college prices. In fact, inflation-adjusted net prices in the four-year public and private non-profit sectors increased by 97% and 21% from 1990 to 2014 (College Board, 2015). Moreover, students are increasingly relying upon financial aid—presumably to afford these newfound costs—as the percentage of student aid recipients grew from 70% in 2000 to 83% in 2013 (NCES, 2015a). Because federal grant aid and other sources of non-loan aid have failed to keep pace with ever-increasing postsecondary prices, a significant percentage of that financial aid growth has been realized in the form of student loans. To wit, the proportion of graduates who borrowed increased by a third—from 51% in 1990

to 68% in 2012—and the average cumulative debt for those borrowers ballooned from $15,300 to $26,400 in 2014-15 constant dollars (NCES, 2015b).

Although the aforementioned benefits of higher education far outweigh the increasing costs to students and families, there are concerns that this increasing reliance on student loans is having adverse effects. Because the upward trend in borrowing has coincided with decreasing rates of home buying, wealth accumulation, and entrepreneurship, some have identified student loan debt as the primary cause of these macroeconomic issues (Kitroeff, 2014; Queally, 2014; Touryalai, 2014). Others have pointed out that student debt loads may also impact employment decisions, graduate or professional school plans, or even the decision to marry (Kantrowitz, 2016; Tompor, 2013). In fact, some have gone so far as to say that our growing student loan orientation has become a national crisis (Swidey, 2016; Vara, 2014). Despite the growing reliance upon loans and the mounting anecdotal evidence, little is actually known about the role student loan debt plays in these post-collegiate decisions (Heller, 2008; Hillman, 2015; Long, 2008).

Economic theory predicts that cumulative loan debt should have little to no impact on postbaccalaureate decision-making, as that debt obligation only represents approximately 1% of the average college graduate's lifetime earnings (Rothstein & Rouse, 2011). This prediction comes from Friedman's (1957) permanent income model in which he argues that a person's consumption at a given point in time is not only determined by her current income but also by her expected income in future years. Thus, extending this logic to early career decision-making, college graduates should not alter their employment decisions to account for what amounts to a small shock to lifetime

wealth in the form of student debt. On the other hand, there are those who argue that the psychosocial effects of debt may lead to suboptimal decision-making (Callendar & Jackson, 2005; Field, 2009). In other words, debt averse students who only wish to pay off their debt obligation as quickly as possible, may forego or delay graduate school enrollment, or accept a suboptimal employment opportunity.

To date, the evidence on the effects of student loan debt on later life outcomes is mixed. Researchers from a variety of academic disciplines have sought to determine whether student loan debt affects the decision to purchase a home (Baum & O'Malley, 2003; Chiteji, 2007; Houle & Berger, 2015), get married or have children (Addo, 2014; Bozick & Estacion, 2014; Gicheva, 2016), enroll in graduate or professional school (Malcolm & Dowd, 2012; Millett, 2003; Monks, 2001; Zhang, 2013), or alter early career employment decisions (Akers, 2012; Heller, 2001; Minicozzi, 2005; Rothstein & Rouse, 2011). Depending on the study cited, it seems that higher amounts of cumulative student loan debt may decrease the likelihood of purchasing a home, getting married, or enrolling in graduate school, but these findings are rarely consistent across studies. Moreover, many of these studies, especially those that examine the outcomes explored in this study, utilize data sources that pre-date the expansion of the federal loan programs that took place in the early 1990s (Akers, 2012). Finally, much of the research on these topics suffers from the endogeneity between the take up of loans and these post-collegiate outcomes (Dowd, 2008). The purpose of this study is to empirically examine the role of student loan debt in postbaccalaureate decision-making. This project focuses on the impacts of student loan debt on graduate school enrollment and early-career employment. Because loans are not randomly assigned to students and there are only so many

explanatory variables available to researchers, it is unlikely that a selection-on-observables approach would yield unbiased estimates.

While there are studies that address this endogeneity through quasi-experimental (Akers, 2012; Malcom & Dowd, 2012; Rothstein & Rouse, 2011; Zhang, 2013) or experimental (Field, 2009) research designs, this project contributes to the literature by both employing a quasi-experimental research design and examining a more recent cohort of college students.

The following research questions are investigated:

1) To what degree does cumulative student loan debt impact the decision to enroll in a graduate or professional degree program?
2) Does student loan debt impact early-career employment decisions?

To answer these questions, I utilize the most recent iteration of the Baccalaureate and Beyond Longitudinal Study (08/12) made available by the U.S. Department of Education. This dataset includes a randomly sampled cohort of students who graduated during the 2007-08 academic year and follows up with them in 2009 and 2012 to glean information about the graduates' postbaccalaureate educational pursuits and work experiences. By limiting my analyses to college graduates, I do risk missing out on important information about the effects of student borrowing for non-completers, but I also mitigate concerns about my outcomes being driven by differences in degree attainment, rather than different levels of borrowing—a point recently emphasized by Dynarski (2016) in her criticism of a Federal Reserve Bank of New York report on debt and home buying.

In this study, I employ an instrumental variables (IV) research design that exploits plausibly exogenous variation in the federal financial aid need calculation that allocates additional need to students who have siblings concurrently enrolled in college. The allocation of this additional need leads to a subgroup of students borrowing more than students who come from similar household compositions but do not have more than one dependent from that household (e.g., siblings) concurrently enrolled in college. Importantly, one must control for income to ensure that students who come from families with similar financial backgrounds are being compared, as there are certainly some students who receive federal grant aid due to the concurrent enrollment discontinuity. Mine is not the first study to exploit this discontinuity in the federal financial aid formula. Bettinger (2004) and Alon (2005; 2011) use the same discontinuity to investigate the impact of financial aid on college persistence and Akers (2012) employs a similar strategy to look at the effects of debt on the labor supply of 1993 college graduates.

Given the current rhetoric surrounding student loan debt and the inconclusive empirical evidence on the effects of debt on a myriad of post-collegiate outcomes, the present study can help us better understand what role debt plays in early career decision-making for college graduates. The findings from this study could inform a number of policy debates. For instance, the Public Service Loan Forgiveness (PSLF) program is currently in danger of being cut (Powell, 2017). Should the findings from this study suggest that more indebted students are less likely to enroll in a public service profession (e.g., teaching), one implication could be that programs like PSLF are serving an important function that should be weighed against the costs of maintaining the program. Relatedly, if debt is deterring graduate or professional school enrollment or affecting

early career employment decisions, policymakers could consider altering the bevy of current student loan repayment plans to help mitigate the effect that debt obligations might be having on decision-making. One such approach could be to increase the proportion of indebted students who participate in an income-based repayment plan. According to the most recent data released by the Department of Education, only approximately a quarter of all borrowers are enrolled in an income-contingent repayment plan.[1] If cumulative student loan debt is found to impact early career decision-making, policymakers could implement informational interventions or policy nudges to increase enrollment in these less onerous repayment plans.

This dissertation is structured as follows. Chapter 2 provides an overview of the literature related to student loans. The chapter begins by reviewing those studies that estimate the impact of student debt on postsecondary access and success, continues with an examination of the individual and institution-level determinants of student loan repayment, and concludes by reviewing those studies that have empirically examined the effects of undergraduate debt on post-collegiate outcomes such as home buying, employment, graduate or professional school enrollment, and family formation.

In Chapter 3, I present the two conceptual frameworks, human capital theory and debt aversion, that I draw upon to understand why and how students accumulate debt and why cumulative debt may impact decision-making after college. Chapter 4 includes a description of both the data and methods used to investigate the impact of undergraduate debt. The first part of the chapter includes a detailed description of the data, its sources, and the sample restrictions implemented. The second part of the chapter primarily

[1] Authors calculations using FSA's servicer portfolio data from June 2017 found at: https://studentaid.ed.gov/sa/about/data-center/student/portfolio

focuses upon my choice of instrument, discusses the assumptions therein, and provides an argument for my estimation strategy being less biased than a traditional selection-on-observables approach.

Chapter 5 presents the findings of the study. The chapter presents both the naïve and IV impacts of debt on outcomes one and four years after graduation. Chapter 6 concludes with a discussion of the study's findings, couches the study within the larger literature, identifies some limitations of the current study, and points towards some potential directions for future research.

CHAPTER 2

LITERATURE REVIEW

In reviewing the research on the effects of student loan debt, three types of studies emerge: 1) the impact of student loan debt on postsecondary access and success; 2) the individual and institution-level characteristics associated with repayment, delinquency, and default and 3) the effects of cumulative debt on post-collegiate decision-making. The latter category, with few exceptions, can be broken down further into the effects of debt on employment, earnings, graduate school enrollment, family formation, and home buying.

Access & Success

While the evidence is limited, there seems to be little doubt that student loans impact college access. On the one hand, should the federal loan programs shut down tomorrow there would surely be a significant percentage of students who could no longer afford to attend. Because this counterfactual is unlikely to be realized and because few sources of identification (e.g., cross-state comparisons, significant policy changes) exist, some researchers have turned to simulations for evidence on the impact of student loans (Savoca, 1991). On the other hand, there is a growing contingent (Callendar & Jackson, 2005; Goldrick-Rab & Kelchen, 2015; Perna, 2008) who argue our increased reliance upon loans has caused loan-averse students to miss out on postsecondary opportunities. These studies rely upon self-reported measures of loan aversion, cleverly designed lab experiments, and investigations of borrowing across racial groups and income categories.

In sum, they find that traditionally underserved populations (e.g., low-income and racial minorities) are more likely to be loan-averse than the general population.

Those studies that do exploit natural experiments are primarily conducted outside of the United States where credit is less available. Most notably, Solis (2015) finds that access to credit increases immediate enrollment in the Chilean postsecondary system by approximately 100%. Remarkably, his findings suggest that loan access almost eliminates the gap in enrollment between the highest and lowest income quintiles at the margin investigated (the 40th percentile of their national exam—about a 950 on the SAT). Extending these findings to the U.S. context is a dubious proposition, but they at least provide evidence of the impact credit access can have in a developing economy. Within the U.S. context, Dynarski (2003a) exploits a natural experiment and finds that making an additional $1,000 available in subsidized loans results in a 1.7% increase in the probability of postsecondary attendance. Because she exploits a change in the financial aid formula that did away with taxing home equity, her results are only generalizable to those students who were affected by the policy (e.g., those who come from families with home equity on the margin of receiving federal financial aid prior to the policy).

The effect of student borrowing on persistence and attainment is couched within a much larger literature that examines the influences of individual, institutional, and cultural factors on student persistence. This literature rose to prominence primarily through the groundbreaking work attributed to Vincent Tinto (1975; 1993) and Alexander Astin (1975). Relying upon psychological and sociological frameworks, Tinto posited that a student's decision to drop or stop out mostly hinged upon the interaction of that student's background characteristics, expectations, and aspirations with the

organizational influences of the institution. Similarly, Astin (1975) examined the individual and institutional-level determinants of dropout. This work was extended by Bean (1980) and others throughout the 1980s, but it was not until Alberto Cabrera and his colleagues introduced their "ability to pay" model that the impacts of finances were combined with Tinto's integration model. Initially, Cabrera, Stampen, and Hansen (1990) only looked at the differential impact that wealth quartiles had on within-year persistence (e.g., persisting form the fall to the beginning of the spring term), finding that those in the lower quartiles were less likely to persist. Later work (Cabrera, Nora & Castaneda, 1992) included financial aid as an independent variable, and the authors found that financial aid also had a positive and significant impact on persistence. St. John, Andrieu, Oescher, and Starkey (1994) extended this work by disaggregating financial aid into its components: grants, loans, and work-study.

Since then, a number of studies have examined the effects of student loans on persistence (Chen & DesJardins, 2008; 2010; DesJardins, Ahlburg & McCall, 2002; Dowd, 2004; Dowd & Coury, 2006; McKinney & Burridge, 2015; St. John & Starkey, 1995; St. John, Paulsen & Starkey, 1996; St. John, Paulsen & Carter, 2005 Cofer & Somers, 1999; 2000; Paulsen & St. John, 2002; Wiederspan, 2016). Many of these studies are concerned with financial aid generally and, as such, do not spend much time discussing results related to the effects of debt. Generally, the authors find no significant effect of debt on persistence. However, some of the research suggests that the associations between financial aid and student success vary by socioeconomic status and race (Chen & DesJardins, 2008; St. John, Paulsen & Carter, 2005). A review of the most recent studies follows.

Dowd and Coury (2006) examined the effects of student borrowing on within-year persistence and attainment in the community college sector. Utilizing logistic regression, the authors find a negative effect for loan amount on within-year persistence, but find no statistically significant effect for associate's degree attainment. In a review of the student loan literature, Heller (2008) argues that the findings from Dowd and Coury's (2006) study may speak to the temporal nature of financial aid in that student loans may have an effect, negative or otherwise, only in the first year and may become less important with time. A series of papers by Stephen DesJardins and colleagues (Chen & DesJardins, 2008; 2010; DesJardins, Ahlburg & McCall, 2002) explore the effects of financial aid on persistence, accounting for the temporality Heller mentioned. In each of these three studies, they find that loans mitigate dropout.

A study by sociologist Rachel Dwyer and coauthors suggests that the effects of student borrowing on degree attainment may be quadratic (Dwyer, McCloud & Hodson, 2012). In other words, borrowing may aid in persistence up to a given threshold, say $20,000, but for students who borrow beyond that amount, they may have a decreased likelihood of attainment, all else equal. More recently, McKinney and Burridge (2015) examined the impact that student loans have on persistence and graduation within the community college sector. Matching on the propensity to borrow, they find that borrowers are more likely than their non-borrowing counterparts to drop out. The authors suggest limiting access to student loans within the community college sector until more decisive evidence becomes available. Wiederspan (2016) addresses that exact policy issue by examining how student outcomes change when community colleges opt out of the Stafford loan program. Using student-level administrative data from an unnamed

Southern state, he finds that students borrow more when they have access to federal loans, but this increase in borrowing is only met with an increase in attempted credits and not subsequent increases in credits earned nor degree attainment.

As Long (2008) points out, the literature on the effectiveness of grants dwarfs the body of work on student loans. Because student loans are generally available with few sources of exogeneity to exploit, a significant portion of the literature is correlational and likely suffers from omitted variable bias (Alon, 2005; Cellini, 2008; Dowd, 2008; Heller, 2008). The more convincing research designs, however, still produce mixed results. Additional evidence is necessary to come to any definitive conclusions on the impact student loan debt has on access and success within the U.S. postsecondary system.

Repayment

For decades, researchers, politicians, and the general public have debated what level of indebtedness should be deemed burdensome, what percentage of loans in delinquency or default constitute a crisis, and who should be responsible for failure to repay debt obligations: students or institutions. Because almost all of the research on repayment focuses on the negative outcomes potentially associated with debt, what follows is a review of those studies that investigate indebtedness, delinquency, and default.

Gross, Cekic, Hossler, and Hillman (2010) authored the most comprehensive meta-analysis on the debt repayment literature to date. Their review of 41 studies over the span of four decades identifies a number of potential predictors of student loan default including institutional characteristics, student characteristics, collegiate experiences, financial aid, including indebtedness, and post-collegiate employment. Gross et al. (2010)

conclude that the single most important predictor of avoiding default is earning a postsecondary degree (Dynarski, 1994; Volkwein, Szelest, Cabrera & Napierski-Prancl, 1998). As Gladieux and Perna (2005) point out, dropouts who borrow are an especially vulnerable population, because they lack the earnings gained from a credential yet still have repayment obligations, even if they are less indebted than degree completers. On the other hand, there is evidence to suggest that delinquency and default among non-completers may actually be driven by psychological factors (Delisle & Holt, 2014). Students who feel wronged by their institution because they did not graduate or perhaps find their preferred job may try to get back at their institution by not repaying their debts.

Another common question in the literature is: what role do institutions play in student loan default? Evidence on this topic is mixed, as some find that students who attend community colleges and for-profit institutions are more likely to default (Hilman, 2014; Looney & Yannelis, 2015; Podgursky, Ehlert, Monroe, Watson & Wittstruck, 2002; Woo, 2002), while others argue that these interinstitutional differences fall away after controlling for student and family background characteristics (Flint, 1997; Volkwein & Cabrera, 1998; Volkwein et al., 1998; Wilms, Moore & Bolus, 1987). Because students self-select into these open access institutions, it is difficult to disentangle the effects of institutions from student characteristics. Deming et al. (2012) highlight that for-profit institutions are more successful in retaining and graduating non-traditional students, but even those who do successfully earn a credential leave more indebted than their peers in other sectors. Moreover, they urge the reader to consider the heterogeneity within the for-profit sector before condemning all 3,000 institutions as bad actors. Hillman (2014) calls for increased resources in the for-profit sector to address the gaps in

social capital and financial literacy that are potentially leading to increased levels of default. Finally, as Deming et al. (2012) point out, they (and Hillman, 2014) are relying upon nationally representative data that only includes a sample of first-time college-goers, which misses a significant percentage of the for-profit marketplace: re-enrollers.

Intuitively, one might conclude that the amount of debt incurred is a strong predictor of the likelihood of default. In fact, there are a number of studies that investigate debt burden with that as an implication (Chen & Wiederspan, 2014; Hansen & Rhodes, 1988; Price, 2004; Thomas, 2000; Thomas, 2004). However, research (Hillman, 2014; Looney & Yannelis, 2015) has shown that the average student who defaults has less than $10,000 in debt, which reinforces earlier claims that employment and earnings play a much more significant role than borrowing. Looney and Yannelis (2015) suggest that the rise in delinquencies and defaults throughout the 2000s was largely due to an increase in non-traditional students enrolling in community colleges and for-profit institutions. They argue that the uptick in enrollments from this demographic has ceased and that we should see a subsequent decrease in delinquency and default rates in the near future. While an important contribution to this literature, it would seem that there is still work to be done to ensure that the student loan system is working for everyone.

In summary, research suggests that default and delinquency are primarily associated with degree attainment, post-collegiate employment and earnings, and postsecondary sector attended. This paints a different picture of default than the popular narrative. It seems that the average traditionally aged college student is not struggling with delinquency and default after graduation. That said, there is a significant portion of the postsecondary landscape that is. Moreover, default and delinquency are not the only

measures associated with debt that are important. Should cumulative debt affect post-collegiate decision-making like home buying, family formation, or even employment, there would be obvious repercussions for both students and the economy writ large.

Post-collegiate Outcomes

Economists (Akers, 2012; Baum & Saunders, 1998; Field, 2009; Gicheva, 2016; Minicozzi, 2005; Monks, 2001; Rothstein & Rouse, 2011; Schapiro, O'Malley & Litten, 1991; Zhang, 2013), sociologists (Bozick & Estacion, 2014; Houle & Berger, 2015; Nau, Dwyer & Hodson, 2015), and education researchers (Heller, 2001; Kim & Eyermann, 2006; Malcolm & Dowd, 2012; Millett, 2003) have examined the role that student loan debt plays in post-collegiate decision-making. The differing theoretical and methodological approaches provide a strong foundation for future work. That said, these differences also contribute to the mixed and, sometimes, contradictory results found in this literature. A review of that literature begins with an examination of those studies that estimate the effects of debt on graduate school enrollment, continues with a look at debt and employment outcomes, and concludes with a review of the effects of debt on family formation and home buying.

Graduate School Enrollment

As Sanford (1980) points out, researchers and policymakers have been concerned with the effects of student loan debt on post-graduation outcomes, including graduate school enrollment, since the very inception of the Guaranteed Student Loan Program. Researchers from the 1980s and into the early 1990s continually examined the potential effects of debt on graduate school aspiration, application, and enrollment. Most of the studies from this time period (Erkstrom, Goertz, Pollack & Rock, 1991; Sanford, 1980;

Weiler, 1991) utilized the high school longitudinal studies of the day (e.g., the National Longitudinal Study and High School and Beyond), while Schapiro et al. (1991) looked at the elite institutions that participate in the Consortium on Financing Higher Education (COFHE). The research from this body of work suggests that loan debt had either a positive or negligible effect on graduate and professional school outcomes.

More recent studies report mixed findings. Monks (2001) and Rothstein & Rouse (2011) find that student loan debt has no impact on graduate school plans, while other studies make contradictory claims (Malcolm & Dowd, 2012; Millett, 2003; Zhang, 2013). To begin, Rothstein and Rouse (2011) take advantage of a natural experiment in which loans were replaced with grants for students with financial need at a highly selective institution in the early 2000s. Utilizing a difference-in-differences research design, the authors find that students with financial need do not change their graduate and professional school plans when they have higher debt loads. Although Monks (2001) has no natural experiment to exploit, he reports similar findings for graduates at the 27 elite colleges that comprise the COFHE. These two findings, coupled with earlier work, may suggest that students from selective institutions are less affected by debt when making their graduate and professional school plans. This could be explained by these students' propensities to receive better financial aid offers in graduate school, or perhaps parental assistance is unaccounted for by proxies for family resources. It may also be the case that when ability is held relatively constant, debt does not have a role in graduate school decision-making.

On the other hand, Zhang (2013) analyzes a nationally representative sample of bachelor's degree recipients from the early 1990s using an instrumental variables

research design that exploits supply side variation in the awarding of financial aid. She finds that for each additional $1,000 in debt, graduates from public institutions are 2.7 percentage points less likely to enroll in graduate or professional school within four years of earning a degree. Malcolm and Dowd (2012) examine a more recent cohort of STEM graduates and find that after matching on the propensity to borrow, borrowers are less likely to enroll in graduate or professional school.

Employment & Earnings

Compared with the literature on the effects of debt on graduate or professional school outcomes, the body of research on employment decisions is nascent. Early work by Heller (2001), Minicozzi (2005), and Monks (2001) relies upon logistic and linear regression models that control for individual characteristics. Utilizing nationally representative samples, Heller (2001) and Minicozzi (2005) conclude that debt does play a role in earnings, while Monks (2001), using the aforementioned COFHE dataset, finds that debt did not influence employment decisions. Interestingly, Minicozzi (2005) finds that indebted students are more likely to work in jobs with high initial wages immediately following college, but they are less likely to experience wage growth four years later. She argues that students are foregoing jobs with better amenities and long-term earnings potential because borrowers are concerned about immediate debt burdens.

The most convincing research design in this body of literature comes from Rothstein and Rouse (2011). Taking advantage of a newly instituted no-loan program at an unnamed prestigious university, their findings suggest that for each additional $10,000 in debt, students are about 6 percentage points less likely to work in a low-paying public service profession. Further, their findings suggest that for each $10,000 in debt, students

take a job that pays an additional $2,000. Given their sample of students are not representative of the larger college-going population, the authors spend a significant portion of the paper discussing the external validity of their results and conclude that their findings may, in fact, represent a lower bound on the effects of debt on employment decisions. In investigating similar research questions with a nationally representative sample of college graduates, Akers (2012) finds that a $1,000 increase in debt results in about a 2 percentage point increase in the probability of being employed within a year of graduation. Her instrumental variables research design exploits an oft-used quirk in the federal financial aid formula (Alon, 2007; Bettinger, 2004) that makes her local average treatment affect generalizable to students who come from middle and lower-income families. Interestingly, she finds little evidence that supports Rothstein and Rouse's (2011) conclusions about occupational choice and earnings. While not the focus of her paper, Zhang's (2013) work also suggests that student loan debt has little or no impact on occupational choice. Finally, Field (2009) provides experimental evidence that suggests law students from New York University are unexpectedly debt averse. Those students who took on loans but were offered loan forgiveness if they entered a public service profession were much less likely to enter said profession than those students who received tuition assistance throughout law school but would have to repay that assistance if they chose to enter the private sector. She argues that these divergent responses are primarily due to framing effects and those students in the control group wanting to pay off their debts as quickly as possible (e.g., debt aversion). As with the Rothstein and Rouse (2011), the external validity of Field's (2009) findings must be taken into account.

Family Formation

Recently, a number of researchers have investigated the effects of debt on marriage or having children (Addo, 2014; Bozick & Estacion, 2014; Gicheva, 2016; Nau, Dwyer & Hodson, 2015). Consistently, these studies show that debt is negatively associated with marriage, albeit there are differential effects for men and women with indebted women being less likely to marry. Only Gicheva (2016) finds negative associations between student debt and marriage for both men and women. Moreover, she finds that indebted men are even less likely to get married than equally indebted women. This may have to do with her sample, which is limited to those students who earned graduate degrees in business, while other studies rely upon nationally representative datasets like the National Longitudinal Survey for Youth and Baccalaureate and Beyond. Interestingly, Addo (2014) presents findings that suggest high levels of debt result in delayed marriage through cohabitation. Finally, Nau, Dwyer, and Hodson's (2015) findings suggest that debt affects a woman's decision to have children, while no such association between children and debt exists for men. It would seem that the evidence on the effects of cumulative debt on family formation is more consistent than the other post-collegiate outcomes discussed in this review.

Home Buying

Concerned with the potential deleterious effects of student loan debt, researchers have taken quite a few approaches to estimating the impact of debt on future home ownership. Utilizing a series of surveys distributed by Nellie Mae, Baum and her coauthors investigate the associations between debt and the likelihood of owning a home (Baum & O'Malley, 2003; Baum & Saunders, 1998). They find that for each $5,000 in

debt, the probability of owning a home drops by 1 percentage point; moreover, they highlight that 21% of survey respondents reported living with their parents because of student loan debt while another 40% said debt delayed home ownership.

On the other hand, Houle and Berger (2015) and Chiteji (2007) find no evidence to suggest debt influences the decision to purchase a home. Both use nationally representative datasets (e.g., NLSY & the Panel Study of Income Dynamics) and primarily rely upon a selection-on-observables approach, although Houle and Berger (2015) instrument for debt in a series of robustness tests and come to similar conclusions. More recent research from economists at the Board of Governors at the Federal Reserve System suggests that student debt does, in fact, influence home buying (Mezza, Ringo, Sherlund & Sommer, 2016). These researchers make use of a number of administrative datasets to compare cohorts of borrowers across time. They instrument for cohort debt at the county level with public university tuition rates in the years immediately preceding postsecondary entry and find that a 10% increase in student loan debt decreases the probability of homeownership within five years of graduation by 1 to 2 percentage points.

Taken together, researchers exploring the effects of debt on post-collegiate outcomes draw a host of conclusions that are sensitive to the datasets employed, the timing of the outcomes, the covariates included, and the ways in which they deal with omitted variable bias and other threats to internal validity. The studies that do the most compelling job of dealing with endogeneity either 1) use a nationally representative sample that predates the significant expansion of the federal loan program (Akers, 2012; Zhang, 2013) or 2) may not be externally valid because the students sampled are substantively different from the average college graduate (Rothstein & Rouse, 2011).

This project contributes to this literature by implementing an instrumental variables research design that exploits a discontinuity in the federal financial aid formula using a recent nationally representative dataset: Baccalaureate and Beyond (08/12).

CHAPTER 3

CONCEPTUAL FRAMEWORK

A discussion of the theoretical frameworks employed in this study begins with human capital theory, as it is the framework that undergirds the federal student loan programs. Much of this discussion has to do with how loans affect access and the decision to persist or re-enroll. Next, I discuss loan aversion and its potential role in access to the postsecondary system. I conclude with a discussion of debt aversion and its hypothesized effects on post-collegiate outcomes.

Human Capital Theory

Becker (1993) proposed that the decision to enroll in college could most aptly be thought of as a cost-benefit analysis. He argued that students were rational decision-makers who have consistent preferences, long-term goals, and various constraints, all of which play a role in the calculus of their net present value calculations. While some misunderstand this to mean that students only consider the financial benefits and costs, Becker (1993) and those who extended his work saw this decision within a utility maximizing framework. Ultimately, one cannot know what utility a given student assigns to the innumerable factors that influence the decision to invest in his or her own human capital (DesJardins & Toutkoushian, 2005). It may be the case for some students that keeping costs to a minimum provides the most utility, while others may forego cheaper options for the opportunity to attend a more prestigious university. The random utility model makes no value statements about which decision is best, but instead only attempts

to describe this decision-making process by accounting for as many factors as possible in the choice set and evaluating a student's revealed preferences through the decisions that they make (DesJardins & Toutkoushian, 2005).

This net present value calculation includes a host of factors that will influence a student's decision to enroll in and persist through college. For instance, a student must estimate the potential long-term returns to their human capital investment, the opportunity costs of likely being unable to work full-time while enrolled, the time and energy required to go through the application process, the relative value of having money now as opposed to a month from now, a year from now, or even six years from now, and, finally, the direct cost of the institution in the form of tuition, fees, and books (Toutkoushian & Paulsen, 2016). These represent only a few of the factors related to student choice, but they provide a glimpse into how one might decide to invest in their human capital in the form of a postsecondary education. In an effort to evaluate and recommend policy, economists will often take measures of these many factors and use them within a utility maximization framework in order to come up with a comparative statics scenario in which policy levers can be identified and marginal effects can be estimated. This is the foundation upon which student loans, and the financial aid system in general, rests.

Research shows that there is a negative relationship between price and quantity demanded in higher education (Dynarski, 2003b; Heller, 1997; Leslie & Brinkman, 1987). The magnitude, or elasticity, of this relationship is most consistently estimated to be about 5% per $1000 within a higher education context (Leslie & Brinkman, 1987). So, for every thousand-dollar reduction in price, students will be about 5% more likely to

enroll in college, all else equal. This negative relationship between price and quantity demanded is the motivating factor for the most popular policy lever within higher education: financial aid. The federal government, individual states, and institutions understand this and they maximize their own utility using financial aid to affect student demand. Rational choice theorists posit that students will maximize their gains and minimize their losses in whichever choice process they are participating in. Thus, in a world where everything else is held constant, a decrease in price through financial aid will increase the probability of enrollment. This random utility model for access or initial enrollment has also been extended to the choice of institutions across sectors and prestige (Manski & Wise, 1983), as well as to persistence studies (Bettinger, 2004; DesJardins, Ahlburg & McCall, 2002; Paulsen, St. John & Starkey, 1996) in which each semester or year, depending upon the measure of persistence, is seen as another utility maximizing problem where the benefits must exceed the costs for the student to re-enroll.[2]

Student loans, however, are clearly separate and distinct from grants of any sort, and, as such, their effects on human capital investment may be different. Towards that end, researchers (Dynarski, 2003a; McPherson & Schapiro, 1991) have posited that loans are half or even a third as valuable as grant aid to students, as loans only serve as a deferment of costs. Toutkoushian and Paulsen (2016), on the other hand, view loans as a policy lever to increase affordability without affecting the net present value calculus, as the costs are simply deferred to the future. Conceptually, one would posit that because student loans reduce the costs associated with higher education in the short-term (e.g., relax credit constraints), they should have a positive impact on access, persistence, and

[2] It's important to note that the NPV calculation in this context includes different factors than the initial enrollment. For instance, it is likely that transferring after the first-year carries with it additional costs associated with starting over with a new peer group at a new institution (Toutkoushian & Paulsen, 2016).

attainment for many students. However, because student loans must be repaid, there is an inherent risk in funding one's education with loans. Those students who are not as confident in their abilities or are more risk averse may not be willing to utilize, or may underutilize, student loan programs. Because of these and other reasons, researchers have struggled to convincingly estimate the elasticity of student loans (Heller, 2008; Long, 2008).

Within the random utility framework, a student will borrow the amount that maximizes her utility. Taken at face value, that does not have much meaning but if we consider the alternatives available to students, perhaps some insights can be gleaned. For instance, a student may prefer not to work while in school, so instead of working, he may choose to borrow additional monies. Relatedly, another student may have enough financial support from his family to cover the average costs associated with the college he attends, but he may, instead, prefer a standard of living that exceeds the average student, so he borrows additional money to do so. Finally, as there are a variety of loans available to students and families (e.g., private loans, Stafford loans, Perkins loans, PLUS and home equity loans for parents), there may be various utility values associated with each type. For instance, private loans often have less favorable terms than government loans, so a student may choose to borrow more unsubsidized loans from the Stafford loan program rather than taking on debt from a private lender.

Loan and Debt Aversion

Others have argued that information constraints (Scott-Clayton, 2013) or the psychosocial toll of potential debt may lead to access issues (Callendar & Jackson, 2005; Goldrick-Rab & Kelchen, 2015). Those students who come from families or backgrounds

that either have negative impressions of debt or have little experience with debt may not invest in a postsecondary education. Perna (2008) examines the construct of loan aversion more closely in a qualitative study on high school students' willingness to borrow. She investigates this problem by interviewing students at fifteen high schools across five states to determine what influences their perceptions of borrowing decisions and, ultimately, their willingness to borrow. She argues that a student's environment, or habitus, has a significant impact on both of these constructs, as does his peer network and family. In other words, both social (Portes, 1996) and cultural capital (Bourdieu, 1977) frameworks aid in our understanding of loan aversion.

Debt aversion, a related construct to loan aversion, is one of the primary theoretical frameworks used to explain the effects of debt on post-collegiate outcomes (Field, 2009; Gicheva, 2016; Rothstein & Rouse, 2011). Put simply, those students who are averse to holding on to debt may make decisions that enable them to pay down their debts faster. For instance, a student who is debt averse may take a job more quickly than a student with equal abilities and debt levels, yet no aversion to debt. Similarly, a recent graduate who is debt averse may forego graduate or professional school in order take a job that would allow her to begin paying off her student loans as soon as possible. Related to the decision to re-enroll, it should be noted that students can defer their federal loan payments while in a graduate or professional program. While debt averse students would still likely avoid graduate school to become employed as soon as possible, there may be a population of students who are unable to find a job and re-enroll in a postsecondary program to defer repayment, although those students looking to defer repayment have more options than just re-enrolling in a graduate or post-baccalaureate

program, as students can file an economic hardship deferment for a number of reasons, including unemployment (Federal Student Aid, 2017).

Rothstein and Rouse (2011) argue that if we view graduates as life cycle optimizers, then the average cumulative debt burden should not have any impact on a graduate's employment decisions, given that debt only makes up approximately 1% of lifetime earnings. This notion comes from Friedman's (1957) permanent income model in which he argues that a person's consumption at a given point in time is not only determined by her current income but also by her expected income in future years. Because initial salaries for recent graduates are typically much lower than their permanent income, they would need to have access to additional funds to maintain their desired level of consumption. If those funds are unavailable through credit markets or from other sources (e.g., family, friends), then student debt could have an effect on consumption, which, may, in turn, affect early career employment decisions (Rothstein & Rouse, 2011).

The present study draws upon the aforementioned theoretical frameworks and the prior literature to better understand how student loan debt may impact post-baccalaureate decision-making. The theories discussed suggest that more indebted students may be less likely to enroll in graduate or professional school, or alter their employment decisions in order to more quickly pay down their cumulative loan debt. These effects could manifest in a number of ways, including the timing of employment or graduate school enrollment, the amount a student earns, the sector of employment, or even how related a job is to a student's undergraduate major. Each of these effects will be explored in more detail in the chapters to follow.

CHAPTER 4

DATA AND RESEARCH METHODS

In order to avoid the naïve estimation strategies that characterize much of this literature and work our way towards the unattainable goal of causality, a source of exogeneity must be available. These exogenous or "outside influences" are often found through changes in policy or discontinuities in current programs. These pseudo-assignment mechanisms are meant to mimic the gold standard of all scientific research: randomized control trials. While becoming more popular, randomized control trials are not always possible in education research due to ethical concerns or cost constraints (Murnane & Willett, 2011), so many education researchers rely upon the next best option: quasi-experimental approaches. This section begins with a description of the data, continues with a discussion of the analytic strategy, and concludes with an examination of the assumptions embedded within the instrumental variables approach.

Data

The primary data source for this project is the most recent iteration of the Baccalaureate and Beyond Longitudinal Study, which is a subsample of the 2007-08 National Postsecondary Student Aid Study. This dataset includes a nationally representative sample of individuals receiving bachelor's degrees during the 2007-08 academic year. Those students were then resurveyed about their post-collegiate experiences in 2009 and again in 2012. The dataset contains extensive information on student and family demographics, college GPA and course taking, and post-graduation

experiences. Paramount to this study, the dataset includes information on a variety of postbaccalaureate outcomes (e.g., employment, graduate school enrollment, and family formation variables) as well as self-reported cumulative student loan debt totals from all potential sources and official federal loan records from the National Student Loan Data System. The Baccalaureate and Beyond data is supplemented with institution-level characteristics from the Integrated Postsecondary Education Data System (IPEDS) and the Barron's Admission Competitiveness Index.

Sample

I limit the initial sample to those students who earned their *first* bachelor's degree during the 2007-08 academic year, are U.S. citizens and thus eligible for federal financial aid programs, are financially dependent upon their parents, and to those who responded to both follow-up surveys. This reduces the initial sample to approximately 8,000 respondents, as shown in the first two columns of Table 1. I focus on dependent students for a few reasons. First, I believe dependent and independent students to be distinct populations, especially in ways that are unobservable or unmeasured. While there is surely much to learn about the independent student population, modeling their response to student loan debt with dependent students would likely mask substantial variation across both groups. Second, my instrumental variables research design requires that I look at dependent students, as a household dependent's concurrent enrollment in college is not a strong predictor of cumulative loan debt for independent students. This makes sense as the household composition across independent and dependent students are not similar.

Table 1: Summary Statistics

	Full Sample		No Concurrently Enrolled Dependents		Has Concurrently Enrolled Dependents	
	(Mean)	(S.D.)	(Mean)	(S.D.)	(Mean)	(S.D.)
Outcomes						
Employed in 2009	0.740	0.439	0.744	0.436	0.731	0.444
Job Unrelated in 2009	0.229	0.420	0.235	0.424	0.217	0.412
Worked as a teacher in 2009	0.080	0.272	0.083	0.276	0.074	0.262
Enrolled in Grad/Prof School in 2009	0.252	0.434	0.242	0.429	0.273	0.446
2009 Annual Earnings	24,127	19,472	24,386	19,538	23,569	19,320
Employed in 2012	0.755	0.430	0.762	0.426	0.740	0.439
Employed by 2012	0.900	0.299	0.905	0.293	0.891	0.312
Worked as a teacher by 2012	0.148	0.355	0.150	0.358	0.142	0.349
Enrolled in Grad/Prof School in 2012	0.195	0.396	0.189	0.392	0.208	0.406
Enrolled in Grad/Prof School by 2012	0.382	0.486	0.370	0.483	0.407	0.491
2012 Annual Earnings	36,132	25,078	36,175	25,258	36,041	24,691
Debt						
Cumulative Loan Debt	17,088	18,978	15,029	18,306	21,531	19,632
Cumulative Loan Debt>0	0.712	0.453	0.643	0.479	0.860	0.347
Instruments						
Dependents Concurrently Enrolled	0.316	0.465	0.000	0.000	1.000	0.000
Household Size	3.904	1.238	3.608	1.156	4.544	1.167
Individual Characteristics						
Female	0.606	0.489	0.615	0.487	0.585	0.493
Asian	0.076	0.265	0.065	0.246	0.100	0.300
Black	0.068	0.252	0.070	0.255	0.064	0.245
Hispanic	0.078	0.269	0.076	0.265	0.083	0.276
White	0.745	0.436	0.758	0.429	0.718	0.450
Other Race	0.033	0.178	0.032	0.175	0.035	0.183
1st (Lowest) Family Income Quintile	0.068	0.252	0.119	0.324	0.101	0.302
2nd Family Income Quintile	0.164	0.370	0.221	0.415	0.285	0.452
3rd Family Income Quintile	0.222	0.415	0.217	0.412	0.247	0.431
4th Family Income Quintile	0.257	0.437	0.222	0.416	0.178	0.383
5th (Highest) Family Income Quintile	0.289	0.453	0.221	0.415	0.189	0.391
Parent(s) <=High School	0.173	0.378	0.169	0.375	0.180	0.384
Parent(s) Some College	0.242	0.428	0.232	0.422	0.262	0.440
Parent(s) >= Bachelor's Degree	0.586	0.493	0.599	0.490	0.558	0.497
Age	21.665	0.774	21.684	0.776	21.623	0.768
College GPA	3.350	0.439	3.339	0.445	3.374	0.426
SAT/100	11.139	1.773	11.105	1.790	11.214	1.735
Missing SAT	0.015	0.120	0.016	0.124	0.012	0.108
Institution Characteristics						
Public	0.570	0.495	0.589	0.492	0.529	0.499
Barron's Most Competitive	0.070	0.255	0.074	0.261	0.062	0.242
Barron's Highly Competitive	0.120	0.325	0.115	0.319	0.132	0.338
Barron's Very Competitive	0.307	0.461	0.300	0.458	0.325	0.468
Barron's Competitive	0.367	0.482	0.367	0.482	0.366	0.482
Barron's Less Competitive	0.063	0.243	0.066	0.248	0.056	0.231
Barron's Non-Competitive	0.066	0.248	0.071	0.257	0.053	0.226

Barron's Special	0.007	0.082	0.007	0.085	0.006	0.074
Observations	8,000	8,000	5,470	5,470	2,530	2,530

Notes: Observations are rounded to nearest ten, per NCES guidelines. All dollar amounts are in 2008 constant dollars. Respondents with missing SAT scores have imputed scores and are identified with a missing SAT indicator variable. Sample is restricted to financially dependent respondents who earned their first bachelor's degree, U.S. citizens, and those who have non-missing values for cumulative loan debt.

Moreover, the federal financial aid formula provides significantly more need-based aid to independent students. In fact, Denning (2017) recently used the student age cutoff[3] for independent status as an exogenous source of variation to examine the impact of additional federal grant aid on degree attainment. Finally, others (Alon, 2007; Bettinger, 2004; Kane, 1999) who have used this instrument also limit their analyses to dependent students.

Dependent Variables

There are three primary categories of dependent variables in this study. The first category is the probability of employment. To be categorized as employed, the respondent must have reported having a job during the student interview and reported annualized earnings greater than $0. There was no distinction made between full and part-time employment status, but some model specifications delimit the sample by various earnings thresholds to test the sensitivity of the main findings (See Appendix 2). Additional specifications explore employment type and sector, including employment as a K-12 teacher. As with all the outcome variable categories, models are specified one (2009) and four (2012) years after initial bachelor's degree receipt. The second category of dependent variables is graduate or professional school enrollment. Respondents who

[3] Age is one of ten ways in which a student can be classified as independent. Others include being an orphan or ward of the court, being a veteran or active member of the armed forces, and enrolling in graduate school. For a full list, see the Office of Federal Student Aid's Dependency Guide: https://studentaid.ed.gov/sa/fafsa/filling-out/dependency

self-report being enrolled in graduate or professional school are categorized as such in 2009, with no distinction made between full and part-time enrollment. In 2012, I examine the probability of being enrolled in graduate or professional school at any point between graduation and 2012. The final category of dependent variables is annualized earnings. Amounts are self-reported in both 2009 and 2012 and represent a respondent's earnings at her primary job.

As seen in Table 1, about 74% of the sample is employed the year following graduation earning approximately $24,000 on average with minimal differences across those with concurrently enrolled dependents and those with concurrently enrolled dependents. Notably, there is significant variation across respondents in their 2009 earnings with 22% of students earning $5,000 or less and 20% of students earning more than $40,000. The long right tail of the distribution of earnings suggests that a log transformation might improve model fit and reduce the influence of statistical outliers (See Tables B.3 & B.4 in Appendix B for this robustness check). About a quarter of respondents were attending a graduate or professional school the year after earning a bachelor's degree. It should be pointed out that employment and graduate school enrollment are not mutually exclusive, as there are about 14% of respondents who are both employed and enrolled in a graduate degree program. There are robustness checks in Appendix B[4] for the earnings models that focus exclusively on employed respondents—the inferences presented in Chapter 5 do not change across estimation strategies. By 2012, the average salary increased by about 50% to $36,000, but the proportion of respondents employed remained relatively flat at about 76%. Again, this outcome does not differ substantially across the concurrent enrollment instrument ($130). The number

[4] See Tables B.7 & B.8 in Appendix B.

of students in graduate or professional school decreased, but the percentage of respondents who attended graduate or professional school between 2008 and 2012 is 38%.

Explanatory Variables

With the exception of the independent variable of interest, undergraduate student loan debt, and its instruments, the explanatory variables in this study fall into two categories: individual and family characteristics and postsecondary institution-level characteristics. Undergraduate cumulative loan debt is derived from a variety of sources to ensure accuracy: student interviews, National Student Loan Data System administrative files, and institution records. The cumulative loan debt at the time of bachelor's degree receipt is used throughout the analyses to ensure that the propensity to repay student loan debt is not confounding the estimates (Akers, 2012; Zhang, 2013). This total does not include Parent PLUS loans. The number of household dependents, as well as the number of those dependents enrolled during the 2007-08 academic year, is derived from the FAFSA and student interviews during the administration of the NPSAS survey.

Moving on to the individual and family characteristics, the sex and racial background of each respondent are self-reported or gleaned from institutional records. Race is reported as one of five categories (shown in Table 1) with the 'other' category comprised of Native American students, students who identify as being part of more than one race, and students from an unknown racial background. Family income, derived from the FAFSA and respondent interviews, is broken up into quintiles. Derived from the same sources, parental education is aggregated into three categories: high school or less, some

postsecondary experience, including vocational or technical education, and bachelor's degree or higher. The last of the individual and family characteristics are age, SAT score, and marriage status in 2009 and 2012. Each of those variables comes primarily from student interviews with SAT scores being ascertained from the College Board, their postsecondary institution of record, or ACT. ACT scores are converted to an estimated SAT I combined score using a concordance table. Finally, the institution-level characteristics include a public indicator taken from 2005-06 IPEDS and a Barron's Category from the 2004 Barron's Admissions Competitiveness Index.

The descriptive statistics for the explanatory variables can be found in Table 1. Beginning with student borrowing, the average amount borrowed among dependent students is approximately $17,000 ($24,000 for borrowers). As with early career earnings, it is obvious that there is a substantial amount of variation across respondents with almost 30% of respondents borrowing nothing to fund their undergraduate studies, 44% borrowing between $10,000 and $30,000, and 5% borrowing more than $50,000. Of note, given the choice of instrument, slightly more than 30% of respondents have a sibling concurrently enrolled during the 2007-08 academic year with the typical respondent having almost 4 members in her household. Notably, there are significant differences in household size across the population of students with and without a household member concurrently enrolled (3.61 v. 4.54).

Approximately 60% of the sample is female, almost 75% of the students are white, and 15% of students are Hispanic or Black. The median family income is approximately $67,000 with the majority of students (59%) coming from a family where at least one parent had earned a bachelor's degree or higher. As expected, the average age

of a dependent bachelor's degree recipient is about 22 years old, the vast majority has SAT scores on file, and the average score of 1114 is significantly higher than the national average of approximately 1000. Finally, most graduates graduated from a public institution (57%) with approximately half of the students graduating from a school rated 'Very Competitive', 'Highly Competitive', or 'Most Competitive' on the Barron's Admissions Competitiveness Index.

Analytic Approach

In order to estimate the effect of undergraduate cumulative debt on post-baccalaureate decision-making, the following equation was specified:

$$Y_i = \beta_0 + \beta_1 Debt_i + \beta_2 X_i + \varepsilon_i \qquad (1)$$

where $Debt_i$ is the cumulative amount of undergraduate loans borrowed for student i; X_i is vector of individual and institution-level covariates for student i including race, gender, parental education, parental income, college grade point average, SAT score, postsecondary institution type, and Barron's selectivity category. Y_i is the outcome of interest. In the models to follow, Y_i is dichotomous for the majority of specifications, including the probability of employment, the likelihood of having a job unrelated to student i's undergraduate course of study, the probability of becoming a teacher, and the likelihood of enrolling in a graduate or professional degree program. For those models that examine the relationship between debt and early career salary, Y_i is continuous. Estimating this equation using a Maximum Likelihood Estimator or Ordinary Least Squares would result in a naïve estimate of the effect of debt on any of the

aforementioned outcomes, as these selection-on-observables approaches do not control for all of the individual characteristics that affect both post-baccalaureate decision-making and the amount of debt incurred in college. For example, if students who are more confident in their employability or earnings potential were more likely to invest in themselves through undergraduate borrowing, expecting to be able to repay those loans, then a regression of earnings on cumulative debt would be upwardly biased. To overcome this and other avenues of endogeneity, I exploit one of the largest discontinuities in the federal financial aid formula: the number of siblings concurrently enrolled in college.

When filling out the Free Application for Federal Student Aid (FAFSA), filers are required to disclose income, wealth, family size, dependency status, as well a host of additional financial and personal information. One such piece of information is a question that asks filers to disclose the number of dependents within their household who are enrolled in college during that academic year. The information collected from the FAFSA is then used to calculate a student's Expected Family Contribution (EFC). Two applicants who are identical in all other dimensions (e.g., household income, net worth, cost of attendance, etc.) but differ in the number of household dependents who are *concurrently* enrolled in college will have substantially different EFCs. Prior research has leveraged this plausibly exogenous source of variation to examine the effects of Pell grant aid on persistence and completion (Alon, 2011; Bettinger, 2004). Akers (2012), on the other hand, showed that this discontinuity is also a strong predictor of undergraduate borrowing.

There are number of federal, state, and institution-level loan programs that could be impacted by a decrease in EFC. The most notable of which is the subsidized Stafford

loan, as the amount of subsidized Stafford dollars available to a student is constrained by her financial need, as defined by her cost of attendance, less her EFC, and additional financial aid. For the neediest of students, especially those who attend low cost institutions, it may be the case that need-based grant aid covers the majority of, if not all, direct expenses. That said, as Akers (2012) showed, there is a population of students who are needy enough to quality for need-based loans yet not qualify for enough grant aid to cover all of their costs of attendance.

Assumptions of IV

While instrumental variables estimation has been around for almost a century, it has only recently enjoyed a resurgence and reinterpretation (Angrist & Pischke, 2009). In responding to various criticisms, Imbens and Angrist (1994) and Angrist, Imbens, and Rubin (1996) worked out the Local Average Treatment Effect (LATE) interpretation of IV results. This approach considers four potential groups that are a part of any IV estimation: 1) always-takers; 2) never-takers; 3) compliers; and 4) defiers. Estimates of the LATE only apply to those who comply with treatment. As opposed to the traditional two fundamental assumptions that must be defended, the authors argue that researchers employing IV are better served addressing and considering five. A discussion of each follows.

The stable unit treatment value assumption (SUTVA) is the first assumption addressed. In short, when employing IV, one must consider whether or not there will be spillover effects between treatment and control groups. If so, the estimated treatment effect for the compliers, or the LATE, will be biased. Porter (2012) points out that this is a difficult hurdle to clear for a lot of education research, but within the context of the

current study, it seems unlikely that those who borrow more due to concurrent enrollment are impacting their peers who do not have concurrently enrolled siblings. One potential avenue for spillover between treatment and comparison groups is if students in the treatment group are somehow subsidizing the costs of their peers. Perhaps this could occur through living arrangements, but it seems unlikely that students who are able to access additional debt are then using that money to pay more than their share of the rent, food, or other living costs they may be sharing with roommates.

The second assumption is the chosen instrument acts as a randomizer. As others have pointed out (Akers, 2012; Alon, 2007), it is possible that the treatment of having concurrently enrolled siblings is not random. For instance, should families only send the most capable student to college or if the federal financial aid formula causes families to alter the timing of their dependents' college enrollment, then a fundamental assumption of this research design would be violated. Concerned that concurrent enrollment differs across families with different age distributions, Akers (2012) analyzes data from the National Longitudinal Survey of Youth and finds that the differences in age across siblings within a family are not associated with early career earnings nor the timing of college enrollment.

The exclusion restriction, the third assumption, holds if concurrent enrollment only impacts postbaccalaureate outcomes through the amount of student loan debt incurred. In thinking about this "no third path" assumption (Murnane & Willett, 2011), if students are self-selecting into colleges in ways that are not orthogonal to the concurrent enrollment instrument, the internal validity of the research design could be called into question. Because financial aid data is only available for the last year of undergraduate

enrollment, it is not clear how many years a student had a sibling concurrently enrolled. Knowing this information would be advantageous for a number of reasons. For instance, I could more precisely estimate the cumulative effect of concurrent enrollment on undergraduate borrowing combining the proposed instrumental variables research design with an individual fixed-effects strategy. It may be the case that students who had a sibling concurrently enrolled during their initial year of postsecondary enrollment may have attended a more expensive institution than they otherwise would have. It is not necessarily the case that a more expensive institution will impact the outcomes explored in this study (e.g. graduate school enrollment, early career employment and earnings), as higher prices are not uniformly associated with higher quality, but controls for institutional quality are included in full model specifications to mitigate these concerns. Zhang (2013) faces similar concerns in her estimation strategy and combats them by including measures of institutional quality in her models. Moreover, sociodemographic covariates are included as controls in the models, as in Rothstein and Rouse (2011) and Zhang (2013). A full specification of the general model can be found below.

$$Debt_i = \theta_0 + \theta_1 Concurrent_i + \theta_2 X_i + \varepsilon_i \quad (2)$$

$$Y_i = \beta_0 + \beta_1 \widehat{Debt}_i + \beta_2 X_i + \varepsilon_i \quad (3)$$

where $Debt_i$ is the cumulative amount of undergraduate loans borrowed for student i; $Concurrent_i$ is an indicator variable for having concurrently enrolled household dependents in the 2007-08 academic year for student i; X_i is vector of individual and institutional covariates for student i including race, gender, parental education, parental

income, college grade point average, SAT score, postsecondary institution type, and Barron's selectivity category. Y_i is the outcome of interest, which includes the probability and timing of graduate school enrollment, as well as the probability, timing, and sector of early-career employment and earnings for student i.

Akers (2012) raised the concern that the above specification may not be isolating the variation in student loan debt exclusively due to concurrent enrollment. She proposes interacting the concurrent enrollment indicator with household size in the first stage of the IV setup, as in Equation 4 below.

$$Debt_i = \theta_0 + \tau_j(D_{ij}\, x\, Concurrent_i) + \theta_1 X_i + \varepsilon_i \qquad (4)$$

where the concurrent enrollment indicator is interacted with the categorical variable that includes each household size (D_{ij}). This specification compares families with and without concurrently enrolled dependents who come from the same household size. This specification, as well as the just identified specification shown in Equation 3 is utilized in the analyses to follow.

The fourth assumption, the nonzero average causal treatment effect, is testable. Essentially, one can test if the instrument (e.g., concurrent enrollment), net of control variables, has a statistically significant effect on the endogenous regressor (e.g., cumulative debt) in Equations 2 and 4. Stock and Yogo (2005) provide guidelines for various sample sizes, F-values, and critical values that can assist in determining whether an instrument is strong enough to result in unbiased results in the equation of interest. Should F-values be close to these prescribed critical values, estimation strategies other

than two-stage least squares can be implemented. For instance, the limited information maximum likelihood estimator (LIML) in Monte Carlo studies has shown to be a less biased approach to instrumental variables estimation when instruments are weak (Cameron & Trivedi, 2005).

An examination of the instrument's strength can be found in Tables 2 & 3. Column 1 in Table 2 includes the first-stage regression with the concurrent enrollment indicator and a control for household size. One can see that students who have siblings concurrently enrolled borrow approximately $7,200 additional dollars during their undergraduate years with no additional controls in the model. As additional controls are introduced, the estimate decreases slightly, with the estimate in the full specification resulting in at an additional $6,400 in cumulative undergraduate borrowing for students with concurrently enrolled dependents in their household.

Table 2: IV First Stage

	(1) Amount Borrowed	(2) Amount Borrowed	(3) Amount Borrowed	(4) Amount Borrowed
Concurrent Enrollment	7,161.79***	6,784.53***	7,016.53***	6,377.89***
	(489.40)	(502.45)	(499.51)	(484.34)
Household Size	-859.93***	-550.66**	-511.61*	-572.42**
	(201.26)	(205.61)	(204.40)	(197.34)
Female		736.63	1,027.56*	712.25
		(423.63)	(427.91)	(410.95)
Black		2,807.51***	876.35	838.11
		(842.01)	(852.34)	(834.07)
Hispanic		-1,645.43	-2,153.48*	-2,571.72**
		(843.66)	(844.24)	(815.98)
Asian		-6,258.96***	-5,943.84***	-4,966.18***
		(752.64)	(760.55)	(737.99)
Other Race		1,099.79	687.91	772.95
		(1,376.71)	(1,371.47)	(1,303.13)

2nd Income Quintile		2,145.19**	2,233.08**	2,463.70**
		(800.81)	(789.97)	(752.80)
3rd Income Quintile		3,760.04***	3,539.54***	3,810.71***
		(785.16)	(776.96)	(746.91)
4th Income Quintile		3,418.96***	2,954.24***	3,304.19***
		(812.31)	(804.77)	(778.58)
5th Income Quintile		313.21	-96.85	-375.10
		(819.25)	(816.33)	(791.68)
Parent(s) Some College		493.93	626.70	681.73
		(677.33)	(671.55)	(641.74)
Parent(s) >= Bachelor's Degree		-3,513.34***	-3,000.41***	-3,262.93***
		(626.52)	(628.04)	(607.94)
GPA			-418.70**	-768.83***
			(131.48)	(137.55)
SAT/100			-4,512.44***	-3,946.00**
			(1,370.16)	(1,202.70)
Missing SAT				3,995.52***
				(1,062.50)
Barron's Highly Competitive				2,876.88**
				(948.83)
Barron's Very Competitive				2,304.67*
				(965.41)
Barron's Competitive				2,275.93
				(1,164.69)
Barron's Less Competitive				2,083.39
				(1,222.68)
Barron's Non-Competitive				13,966.95***
				(3,733.09)
Barron's Special				-9,855.49***
				(434.45)
Public				-4,740.51***
				(503.90)
Constant	18,140.40***	16,781.35***	37,119.43***	44,631.71***
	(758.27)	(1,058.74)	(2,100.38)	(2,425.06)
Observations	8,000	8,000	8,000	8,000
F Value for Instrument	225.24	189.91	200.72	176.99
R-squared	0.028	0.056	0.072	0.139

Notes: Observations are rounded to nearest ten, per NCES guidelines. Reference categories are white, 1st income quintile (lowest), and Barron's 'Most competitive' category. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05).

Estimates from Equation 4 can be found in Table 3. The magnitudes vary by household size, but it is clear that even within homes with similar or even the same family composition, concurrent enrollment is positively associated with additional debt burden. Statistical significance is not reached in each of the cells in the full specification (Column 4), but the F value of the instruments, while significantly lower than in Table 2, are still above the oft-cited value of 10 from Stock, and Yogo (2005). Because these first stage estimates do not change across the outcomes explored in Chapter 5, these tests of instrument strength will be omitted from future tables.[5]

Table 3: IV First Stage with Interacted Instrument

	(1) Amount Borrowed	(2) Amount Borrowed	(3) Amount Borrowed	(4) Amount Borrowed
Concurrent X Household of 3	3,186.95	3,087.56	4,383.92	4,024.49
	(3,709.59)	(3,728.21)	(4,028.65)	(4,431.53)
Concurrent X Household of 4	5,399.74	5,466.83	6,560.25	5,244.01
	(3,576.36)	(3,576.87)	(3,892.76)	(4,325.25)
Concurrent X Household of 5	8,079.50*	8,117.28*	9,282.59*	7,709.37
	(3,664.24)	(3,671.36)	(3,980.07)	(4,394.94)
Concurrent X Household of 6+	8,835.35*	8,551.54*	9,980.99*	7,998.05
	(3,778.05)	(3,785.20)	(4,081.55)	(4,487.86)
Individual-level controls		Yes	Yes	Yes
Academic controls			Yes	Yes
Institution-level controls				Yes
Constant	17,521.73***	16,351.10***	36,742.56***	43,949.82***
	(609.01)	(951.33)	(2,059.59)	(2,385.29)
Observations	8,000	8,000	8,000	8,000
F Value for Instruments	27.44	23.69	25.11	21.27
R-squared	0.032	0.059	0.076	0.142

Notes: Observations are rounded to nearest ten, per NCES guidelines. Reference categories are white, 1st income quintile (lowest), and Barron's 'Most competitive' category. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05).

[5] While all of the estimates in Chapter 5 utilize the estimation strategy outlined in Table 3 for the first-stage equation, estimates taking a just-identified approach (e.g., no interacted instrument) are presented in Tables B.1 & B.2 in Appendix B. Those estimates do not differ substantively from those presented in Chapter 5.

The fifth and final assumption is monotonicity. Simply put, this assumption requires that the relationship between the treatment and the outcome of interest only moves in one direction. In the current context, it seems unlikely that having concurrently enrolled siblings would *cause* someone to borrow less, or defy, although if a student is awarded more need-based grant aid due to having a lower EFC, there may be a population of students whose costs are covered through this additional grant aid and no longer need loan dollars to cover their costs. As already discussed, the data show that, on average, students with concurrently enrolled siblings borrow more; however, in the event that some students would be caused to borrow less due to being part of the instrumented group, I control for family income to compare those students from similar financial circumstances. Finally, because I only have access to one year of undergraduate financial aid data, it is not possible to see how students respond to having the concurrent enrollment indicator turned on or off, so this assumption cannot be examined in the data.

CHAPTER 5

FINDINGS

This chapter begins with an empirical investigation of the impact of debt on post-collegiate decision-making one year after graduation. The models presented include both the naïve and causal estimates of debt on the probability of employment, the type of employment attained, graduate or professional school enrollment, and debt's impact on earnings. The chapter concludes with an investigation of the impact of debt on a similar set of outcomes four years (2012) after graduation.

Impact of Debt on 2009 Outcomes

Table 4 shows how average cumulative student loan debt varies across the dependent variables to be examined. Additionally, t-tests and their corresponding t-statistic are provided to show whether or not the amount borrowed is statistically different across the binary outcomes. Students who are employed a year after graduating borrowed, on average, $2,672 (18%) more than students who are not employed. Moreover, students who end up in a job unrelated to their degree program have slightly more debt than students who take a job at least somewhat related to their chosen major. Graduates who enter the teaching profession have less debt than those who do not, and students who decide to enroll in graduate or professional school have substantially less debt ($2,742) than their non-enrolled counterparts. Each of these relationships is in line with the prior research and theory previously discussed, although t-tests that show that even these descriptive differences may not be statistically different.

Table 4: Cumulative Borrowing by 2009 Outcome

	No	Yes
Employed in 2009	15,111.02	17,782.58
	(18,174.46)	(19,204.86)
T-test for Difference (t-stat)	Yes (5.534)	
First Job Unrelated to Degree	16,975.44	17,467.52
	(18,741.70)	(18,041.85)
T-test for Difference (t-stat)	No (.975)	
Teacher in 2009	17,123.51	16,685.47
	(19,045.35)	(18,192.97)
T-test for Difference (t-stat)	No (.561)	
Enrolled in Grad/Prof in 2009	17,779.99	15,037.96
	(19,132.07)	(18,364.12)
T-test for Difference (t-stat)	Yes (5.625)	

Notes: Sample size=8,000. Observations are rounded to nearest ten, per NCES guidelines. Estimates represent the average cumulative debt burden at time of graduation in 2007-08. Standard deviations in parentheses.

While these descriptive statistics are interesting, they do not account for individual, family, and institution-level characteristics that may be associated with the outcomes in question. In Column 1 of Table 5, I account for the covariates discussed in the previous chapter to predict the probability of being employed one year following baccalaureate degree attainment. Even after accounting for a host of explanatory variables, one can see that for each $10,000 in student loan debt, a student is 1.1 percentage points more likely to be employed. It should be noted that this point estimate represents an average marginal effect and, as such, can vary across the distribution of debt—a point that will be explored in more detail later in this section. While controlling for these covariates is certainly an improvement over just descriptives, Column 1 still

represents a naïve estimation of the impact of debt on employment, as it does not account for the endogeneity between the take up of debt and early career employment.

Table 5: Binary Probit Models for the Probability of Employment 1 Year after Graduation

	(1) Probit	(2) IV Probit	(3) IV Probit	(4) IV Probit	(5) IV Probit
Cumulative Loans/10,000	0.011***	-0.010	0.004	0.007	0.009
	(0.003)	(0.016)	(0.016)	(0.016)	(0.018)
Female	0.019		0.017	0.017	0.019
	(0.010)		(0.010)	(0.010)	(0.010)
Black	-0.112***		-0.078***	-0.110***	-0.112***
	(0.022)		(0.021)	(0.022)	(0.022)
Hispanic	-0.114***		-0.107***	-0.114***	-0.114***
	(0.021)		(0.020)	(0.021)	(0.021)
Asian	-0.164***		-0.185***	-0.174***	-0.165***
	(0.021)		(0.024)	(0.024)	(0.023)
Other Race	-0.067*		-0.064*	-0.069*	-0.067*
	(0.029)		(0.029)	(0.029)	(0.029)
2nd Income Quintile	0.001		0.002	0.003	0.002
	(0.023)		(0.024)	(0.023)	(0.024)
3rd Income Quintile	0.031		0.038	0.034	0.032
	(0.022)		(0.024)	(0.023)	(0.024)
4th Income Quintile	0.065**		0.075**	0.068**	0.065**
	(0.022)		(0.023)	(0.022)	(0.023)
5th Income Quintile	0.048*		0.049*	0.046*	0.048*
	(0.022)		(0.022)	(0.022)	(0.022)
Parent(s) Some College	-0.016		-0.018	-0.015	-0.016
	(0.015)		(0.015)	(0.015)	(0.015)
Parent(s) >= Bachelor's Degree	-0.045**		-0.060***	-0.049***	-0.046**
	(0.014)		(0.014)	(0.014)	(0.015)
GPA	-0.052***			-0.050***	-0.053***
	(0.012)			(0.014)	(0.015)
SAT/100	-0.005			-0.010***	-0.005
	(0.003)			(0.003)	(0.004)
Missing SAT	-0.085			-0.070	-0.086
	(0.044)			(0.044)	(0.045)
Barron's Highly Competitive	0.022				0.023
	(0.024)				(0.026)
Barron's Very Competitive	0.022				0.023

	(0.022)				(0.023)
Barron's Competitive	0.046*				0.047*
	(0.023)				(0.024)
Barron's Less Competitive	0.073*				0.074*
	(0.029)				(0.029)
Barron's Non-Competitive	0.069*				0.070*
	(0.028)				(0.029)
Barron's Special	0.022				0.025
	(0.066)				(0.071)
Public	0.017				0.015
	(0.010)				(0.021)
Observations	8,000	8,000	8,000	8,000	8,000
Log Pseudo Likelihood	-4,453	-20,924	-20,723	-20,632	-20,327
AIC	8,953	41,877	41,519	41,349	40,765

Notes: Observations are rounded to nearest ten, per NCES guidelines. Average marginal effects reported. Cumulative loan debt is instrumented with concurrent enrollment indicator interacted with household size. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05). Reference categories are white, 1st income quintile (lowest), and Barron's 'Most competitive' category.

The remaining columns in Table 5 account for this endogeneity through an instrumental variables bivariate probit research design. Column 2 only includes the instruments in the first stage OLS regression and no controls. As controls are introduced, the point estimate for cumulative loan debt begins to approach the naïve estimate, albeit it is significantly less precise (Std. errors of .18 vs. .03). Of note, all racial groups are significantly less likely to be employed than white respondents (reference group), students from the most educated families are less likely to be employed, and those from less selective institutions are more likely to have a job. The findings for some of these covariates may seem counterintuitive, until one considers that the choice set also includes graduate or professional school. For instance, for each additional grade point, a student is 5.3 percentage points less likely to be employed. As will be seen in later analyses, the opposite relationship exists between GPA and graduate or professional school

enrollment. This will be empirically examined through a multinomial probit estimation strategy at the end of this section.

In Table 6, the effects of student loan debt on having a job that is unrelated to a graduate's college major are presented.

Table 6: Binary Probit Models for the Probability of Having a Job Unrelated to a Student's College Major 1 Year after Graduation

	(1)	(2)	(3)	(4)	(5)
	Probit	IV Probit	IV Probit	IV Probit	IV Probit
Cumulative Loans/10,000	-0.002	-0.025	-0.022	-0.017	-0.019
	(0.003)	(0.014)	(0.015)	(0.015)	(0.016)
Female	0.028**		0.021*	0.030**	0.029**
	(0.010)		(0.010)	(0.010)	(0.010)
Black	0.004		0.035	0.004	0.005
	(0.020)		(0.021)	(0.020)	(0.020)
Hispanic	-0.006		-0.001	-0.012	-0.010
	(0.018)		(0.018)	(0.018)	(0.018)
Asian	-0.055**		-0.070***	-0.066***	-0.062***
	(0.017)		(0.018)	(0.018)	(0.018)
Other Race	0.009		0.020	0.010	0.011
	(0.027)		(0.027)	(0.027)	(0.027)
2nd Income Quintile	-0.022		-0.020	-0.018	-0.017
	(0.021)		(0.021)	(0.021)	(0.021)
3rd Income Quintile	-0.005		0.005	0.002	0.003
	(0.020)		(0.021)	(0.021)	(0.022)
4th Income Quintile	0.021		0.034	0.026	0.026
	(0.021)		(0.021)	(0.021)	(0.021)
5th Income Quintile	0.015		0.021	0.015	0.014
	(0.021)		(0.020)	(0.020)	(0.020)
Parent(s) Some College	0.022		0.023	0.023	0.024
	(0.015)		(0.016)	(0.015)	(0.015)
Parent(s) >= Bachelor's Degree	-0.012		-0.024	-0.017	-0.017
	(0.014)		(0.015)	(0.015)	(0.015)
GPA	-0.093***			-0.097***	-0.100***
	(0.011)			(0.013)	(0.013)
SAT/100	0.000			-0.002	-0.001
	(0.003)			(0.003)	(0.003)

Missing SAT	0.050			0.037	0.042
	(0.043)			(0.042)	(0.043)
Barron's Highly Competitive	-0.006				0.002
	(0.022)				(0.023)
Barron's Very Competitive	0.020				0.026
	(0.021)				(0.021)
Barron's Competitive	0.015				0.020
	(0.021)				(0.022)
Barron's Less Competitive	0.030				0.034
	(0.028)				(0.028)
Barron's Non-Competitive	-0.002				0.002
	(0.027)				(0.027)
Barron's Special	0.077				0.104
	(0.065)				(0.071)
Public	-0.009				-0.027
	(0.010)				(0.019)
Observations	8,000	8,000	8,000	8,000	8,000
Log Pseudo Likelihood	-4,247	-20,664	-20,526	-20,419	-20,119
AIC	8,540	41,355	41,123	40,922	40,349

Notes: Observations are rounded to nearest ten, per NCES guidelines. Average marginal effects reported. Cumulative loan debt is instrumented with concurrent enrollment indicator interacted with household size. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05). Reference categories are white, 1st income quintile (lowest), and Barron's 'Most competitive' category.

Whether examining the naïve or the IV estimates, the findings suggest that student loan debt has no impact on working in a field outside of a student's course of study. In fact, the sign is in the opposite direction hypothesized for all model specifications. Interestingly, women are more likely than men to be in jobs unrelated to their college major. Because these models include the entire sample, it may be the case that extensive margin of employment (e.g., Table 5) is driving some of these results. The same specifications presented in Table 6 were run conditional on employment, but the results do not differ substantively from those presented.

Next, I examine whether student loan debt affects the sector of employment, as prior research has shown that higher levels of debt lead to fewer graduates working as

teachers or in the non-profit sector. In Table 7, the outcome variable is the probability of working as a teacher a year after graduating with a bachelor's degree.

Table 7: Binary Probit Models for the Probability of Becoming a Teacher within 1 Year of Graduation

	(1)	(2)	(3)	(4)	(5)
	Probit	IV Probit	IV Probit	IV Probit	IV Probit
Cumulative Loans/10,000	-0.000	-0.018	-0.009	-0.011	-0.012
	(0.002)	(0.011)	(0.010)	(0.010)	(0.012)
Female	0.045***		0.055***	0.046***	0.047***
	(0.006)		(0.006)	(0.006)	(0.006)
Black	-0.033**		-0.037***	-0.033**	-0.033**
	(0.011)		(0.011)	(0.011)	(0.011)
Hispanic	-0.023*		-0.032**	-0.029**	-0.026*
	(0.011)		(0.011)	(0.011)	(0.012)
Asian	-0.056***		-0.062***	-0.060***	-0.061***
	(0.009)		(0.010)	(0.010)	(0.010)
Other Race	-0.036*		-0.041**	-0.037*	-0.036*
	(0.015)		(0.015)	(0.015)	(0.016)
2nd Income Quintile	-0.026*		-0.024	-0.024	-0.024
	(0.013)		(0.013)	(0.013)	(0.013)
3rd Income Quintile	0.007		0.012	0.012	0.012
	(0.013)		(0.014)	(0.014)	(0.014)
4th Income Quintile	0.025		0.028*	0.029*	0.030*
	(0.013)		(0.014)	(0.014)	(0.014)
5th Income Quintile	0.011		0.007	0.010	0.010
	(0.013)		(0.013)	(0.013)	(0.013)
Parent(s) Some College	0.009		0.008	0.010	0.011
	(0.010)		(0.010)	(0.010)	(0.010)
Parent(s) >= Bachelor's Degree	0.000		-0.007	-0.003	-0.004
	(0.009)		(0.010)	(0.010)	(0.010)
GPA	0.060***			0.056***	0.056***
	(0.008)			(0.009)	(0.009)
SAT/100	-0.008***			-0.009***	-0.009***
	(0.002)			(0.002)	(0.002)
Missing SAT	-0.061***			-0.065***	-0.065***
	(0.014)			(0.014)	(0.014)
Barron's Highly Competitive	0.021				0.027
	(0.016)				(0.017)

Barron's Very Competitive	-0.007				-0.003
	(0.014)				(0.014)
Barron's Competitive	0.016				0.020
	(0.014)				(0.015)
Barron's Less Competitive	-0.003				0.000
	(0.018)				(0.018)
Barron's Non-Competitive	-0.011				-0.008
	(0.017)				(0.017)
Barron's Special	-0.061**				-0.056*
	(0.019)				(0.022)
Public	0.007				-0.005
	(0.006)				(0.013)
Observations	8,000	8,000	8,000	8,000	8,000
Log Pseudo Likelihood	-2,100	-18,592	-18,391	-18,282	-17,983
AIC	4,247	37,212	36,853	36,648	36,057

Notes: Observations are rounded to nearest ten, per NCES guidelines. Average marginal effects reported. Cumulative loan debt is instrumented with concurrent enrollment indicator interacted with household size. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05). Reference categories are white, 1st income quintile (lowest), and Barron's 'Most competitive' category.

The results from Table 7 show that after controlling for a number of covariates, women are much more likely than men to become teachers. Moreover, whites are far more likely than their non-white counterparts to enter the teaching profession. Given recent research on the effects of same race teachers on minority student success, this seems troubling. Interestingly, an increase of one college grade point is associated with a 5.6 percentage point increase in the probability of becoming a teacher, on average. At the same time, a 100 point increase on the SAT is associated with almost a 1 percentage point decrease in the likelihood of becoming a teacher. Finally, with regard to the main explanatory variable of interest, it seems there is no statistically significant association between debt and the propensity to become a teacher in the naïve probit model. The IV models tell a slightly different story with an increase of $10,000 in student loan debt leading to 1.8 percentage point decrease in the model with no additional controls

(Column 2). This result doesn't reach traditional thresholds of statistical significance, but is significant at the p<.10 level. As additional controls are introduced, the point estimate is reduced by a third and becomes less precise with the full specification in Column 5 showing that an additional $10,000 in debt leads to a 1.2 percentage point decrease in the probability of becoming a teacher.

One of the most consistent findings in the recent literature is the negative effect student loan debt has on graduate or professional school enrollment (Malcolm & Dowd, 2012; Zhang, 2013). This relationship is explored one year after graduation in Table 8. Beginning with the probit estimate that doesn't account for selection (Column 1), it seems that for each $10,000 in student loan debt, graduates are .6 percentage points less likely to enroll in graduate or professional school. This estimate is much lower and less precise than the estimates found in the previous literature.

Table 8: Binary Probit Models for the Probability of Enrolling in Graduate or Professional School within 1 Year of Graduation

	(1) Probit	(2) IV Probit	(3) IV Probit	(4) IV Probit	(5) IV Probit
Cumulative Loans/10,000	-0.006*	0.029	0.031	0.022	0.023
	(0.003)	(0.016)	(0.016)	(0.016)	(0.018)
Female	0.018		0.021*	0.015	0.016
	(0.010)		(0.010)	(0.010)	(0.010)
Black	0.129***		0.038	0.118***	0.124***
	(0.022)		(0.020)	(0.022)	(0.022)
Hispanic	0.067***		0.033	0.061**	0.074***
	(0.020)		(0.019)	(0.020)	(0.020)
Asian	0.065***		0.110***	0.089***	0.079***
	(0.019)		(0.022)	(0.021)	(0.021)
Other Race	0.082**		0.062*	0.080**	0.078**
	(0.029)		(0.029)	(0.029)	(0.029)
2nd Income Quintile	0.017		0.013	0.008	0.008
	(0.022)		(0.023)	(0.022)	(0.022)

3rd Income Quintile	-0.021		-0.042	-0.035	-0.035
	(0.021)		(0.022)	(0.022)	(0.022)
4th Income Quintile	-0.029		-0.053*	-0.039	-0.038
	(0.021)		(0.022)	(0.021)	(0.022)
5th Income Quintile	-0.009		-0.018	-0.010	-0.007
	(0.021)		(0.022)	(0.021)	(0.021)
Parent(s) Some College	0.015		0.017	0.012	0.012
	(0.015)		(0.015)	(0.015)	(0.015)
Parent(s) >= Bachelor's Degree	0.035*		0.068***	0.044**	0.044**
	(0.014)		(0.014)	(0.014)	(0.015)
GPA	0.159***			0.165***	0.171***
	(0.013)			(0.014)	(0.014)
SAT/100	0.016***			0.019***	0.018***
	(0.003)			(0.003)	(0.004)
Missing SAT	-0.006			-0.015	0.006
	(0.039)			(0.039)	(0.040)
Barron's Highly Competitive	0.010				-0.004
	(0.023)				(0.025)
Barron's Very Competitive	0.010				-0.001
	(0.021)				(0.022)
Barron's Competitive	-0.012				-0.020
	(0.022)				(0.023)
Barron's Less Competitive	-0.036				-0.044
	(0.028)				(0.028)
Barron's Non-Competitive	-0.079**				-0.085**
	(0.026)				(0.027)
Barron's Special	-0.126*				-0.155**
	(0.053)				(0.053)
Public	0.026*				0.055**
	(0.010)				(0.020)
Observations	8,000	8,000	8,000	8,000	8,000
Log Pseudo Likelihood	-4,318	-20,885	-20,705	-20,502	-20,189
AIC	8,682	41,739	41,483	41,088	40,491

Notes: Observations are rounded to nearest ten, per NCES guidelines. Average marginal effects reported. Cumulative loan debt is instrumented with concurrent enrollment indicator interacted with household size. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05). Reference categories are white, 1st income quintile (lowest), and Barron's 'Most competitive' category.

Moving on to the IV models in Columns 2 thru 5, the sign on the point estimate of interest becomes positive and almost reaches conventional levels of statistical significance in the second and third specifications. Notably, after controlling for academic achievement and university prestige, graduates from each of the non-white ethnicities become significantly more likely to enroll in graduate or professional school. In fact, all else equal, Black students are approximately 12 percentage points more likely than whites to continue their education beyond the baccalaureate. Beyond race, it seems that parental educational attainment is a strong and significant predictor of graduate school enrollment, as are college GPA and even SAT scores.

As previous research has shown, debt may not only impact the probability of employment or graduate school enrollment, but it may also affect early career earnings. The IV models in Table 9 differ from those already presented in that the second stage equation is linear and the outcome (annual salary) is continuous. Models accounting for selection into debt (Columns 2-5) are estimated using two-stage least squares, although estimates utilizing limited information maximum likelihood or jackknife statistical approaches do not differ substantively from the 2SLS estimates shown.

Table 9: OLS/2SLS Models Explaining the Impact of Debt on Earnings 1 Year after Graduation

	(1)	(2)	(3)	(4)	(5)
	OLS	2SLS	2SLS	2SLS	2SLS
Cumulative Loans/10,000	534.64***	-824.53	-580.37	-568.34	-405.49
	(121.20)	(642.03)	(664.38)	(649.52)	(725.15)
Female	-4,418.37***		-4,383.34***	-4,314.25***	-4,365.65***
	(467.473)		(466.59)	(472.85)	(469.94)
Black	-3,807.90***		-2,740.08**	-3,262.91***	-3,725.64***
	(869.75)		(849.12)	(862.63)	(869.82)
Hispanic	-2,875.16***		-2,580.80**	-2,525.66**	-3,105.85***

	(854.19)		(843.89)	(856.70)	(873.57)
Asian	-3,526.87***		-3,464.42**	-3,366.46**	-3,951.21***
	(984.99)		(1,055.53)	(1,043.83)	(1,038.71)
Other Race	-704.53		-371.14	-460.20	-621.52
	(1,516.40)		(1,541.47)	(1,541.51)	(1,528.10)
2nd Income Quintile	-1,059.98		-710.52	-719.89	-778.46
	(1,046.22)		(1,069.43)	(1,068.09)	(1,071.11)
3rd Income Quintile	-849.05		-305.66	-406.38	-417.92
	(999.70)		(1,054.39)	(1,047.41)	(1,054.71)
4th Income Quintile	335.33		698.14	523.38	637.34
	(1,000.15)		(1,035.93)	(1,027.77)	(1,031.43)
5th Income Quintile	1,944.39		2,102.79*	1,924.79	1,897.48
	(1,028.19)		(1,036.05)	(1,035.15)	(1,030.40)
Parent(s) Some College	-953.22		-882.76	-855.44	-868.10
	(668.10)		(671.21)	(672.74)	(673.06)
Parent(s) >= Bachelor's Degree	-2,181.32***		-2,576.91***	-2,458.38***	-2,491.43***
	(630.01)		(673.89)	(666.17)	(677.54)
GPA	-477.24			-1,173.39*	-906.20
	(510.50)			(578.70)	(602.78)
SAT/100	-356.63*			-104.03	-426.54**
	(149.43)			(141.77)	(159.92)
Missing SAT	-4,284.85**			-4,751.83**	-4,685.07**
	(1,634.40)			(1,629.71)	(1,653.25)
Barron's Highly Competitive	-1,912.64				-1,482.70
	(1,290.29)				(1,328.79)
Barron's Very Competitive	-4,881.05***				-4,558.04***
	(1,170.99)				(1,194.48)
Barron's Competitive	-5,196.74***				-4,928.34***
	(1,186.31)				(1,202.30)
Barron's Less Competitive	-3,518.68*				-3,273.92*
	(1,408.37)				(1,417.40)
Barron's Non-Competitive	-3,431.15*				-3,224.29*
	(1,406.14)				(1,414.82)
Barron's Special	-5,644.78*				-4,326.43
	(2,572.18)				(2,695.36)
Public	1,171.60*				210.18
	(460.88)				(866.33)
Observations	8,000	8,000	8,000	8,000	8,000
R-Squared	0.029	0.005	0.012	0.014	0.021

Notes: Observations are rounded to nearest ten, per NCES guidelines. Cumulative loan debt is instrumented with concurrent enrollment indicator interacted with household size. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05). Reference categories are white, 1st income quintile (lowest), and Barron's 'Most competitive' category.

The OLS estimate of cumulative student loan debt on annual earnings is in the direction that prior research and theory predict. For each $10,000 in cumulative loan debt, a graduate earns an additional $535 dollars on average in 2009. This estimate is smaller than other studies have suggested (Minicozzi, 2005; Rothstein & Rouse, 2011) with some estimates as high 20%, or a $2,000 increase in salary for every $10,000 in student loans incurred.

Consistent across specifications is the wage differential between men and women. On average, women earn around $4,300 less than their male counterparts, all else equal. Interestingly, as you may recall, women are more likely than men to be employed one year after graduation. On the other hand, each of the non-white ethnicities are less likely to be employed and more likely to be enrolled in graduate school in 2009, and their earnings likely reflect those circumstances. Concerned that graduate school enrollment might be driving these earnings differentials, I ran specifications that delimited the sample to respondents who were employed and not enrolled in graduate or professional school. The inferences related to the impact of student loan debt on earnings do not change. Moreover, I ran one specification in which I again limited to the sample to only employed respondents and controlled for their undergraduate academic major. While these models had significantly increased explanatory power, debt still had no discernable impact on the annual salary for that subpopulation of students. These robustness checks can be found in Table B.7 in Appendix B.

In reviewing the effect of debt on these post-graduation decisions one year after earning a bachelor's degree, none of the full specifications suggest debt has a statistically significant impact. As mentioned, these impacts represent the *average* marginal effects of

debt on post-baccalaureate behavior. As such, the effects across the distribution of debt can be explored. In fact, one might expect the impact of debt to be non-linear.[6] To determine if the effects of debt differ across the amount of debt incurred, marginal effects at a number of cumulative student loan amounts are reported in Table 10. In short, these estimates represent simulated effects of increased debt at each of the values specified. The other variables in the model are held at their respective means.

Table 10: Marginal Effects at Representative Values of Student Loan Debt on 2009 Outcomes

	(1)	(2)	(3)	(4)
	2009 Employed	2009 Job Unrelated	2009 Teacher	2009 Grad School
$5,000 in Cum. Loans	0.010	-0.021	-0.013	0.022
	(0.019)	(0.018)	(0.014)	(0.016)
$10,000 in Cum. Loans	0.009	-0.020	-0.012	0.023
	(0.019)	(0.018)	(0.012)	(0.018)
$15,000 in Cum. Loans	0.009	-0.020	-0.012	0.024
	(0.018)	(0.017)	(0.011)	(0.019)
$20,000 in Cum. Loans	0.009	-0.019	-0.011	0.024
	(0.018)	(0.016)	(0.010)	(0.020)
$25,000 in Cum. Loans	0.009	-0.019	-0.010	0.025
	(0.018)	(0.015)	(0.009)	(0.020)
$30,000 in Cum. Loans	0.009	-0.018	-0.010	0.026
	(0.017)	(0.015)	(0.007)	(0.021)
$35,000 in Cum. Loans	0.009	-0.018	-0.009	0.026
	(0.017)	(0.014)	(0.006)	(0.022)
$40,000 in Cum. Loans	0.009	-0.017	-0.008	0.027
	(0.016)	(0.013)	(0.005)	(0.023)
$45,000 in Cum. Loans	0.009	-0.017	-0.008	0.027
	(0.016)	(0.012)	(0.004)	(0.024)
$50,000 in Cum. Loans	0.009	-0.016	-0.007*	0.028
	(0.016)	(0.011)	(0.004)	(0.024)
$55,000 in Cum. Loans	0.009	-0.016	-0.007*	0.028

[6] It may also be the case that there are heterogeneous effects across student subpopulations. To test this hypothesis, I ran disaggregated models by student group across each of the 2009 outcomes presented. These results can be found in Table B.5. In short, there are no statistically significant effects across these subpopulations.

	(0.015)	(0.010)	(0.003)	(0.025)
$60,000 in Cum. Loans	0.009	-0.015	-0.006**	0.029
	(0.015)	(0.009)	(0.002)	(0.025)
$65,000 in Cum. Loans	0.008	-0.015	-0.006***	0.029
	(0.014)	(0.009)	(0.002)	(0.025)
$70,000 in Cum. Loans	0.008	-0.014	-0.005***	0.029
	(0.014)	(0.008)	(0.001)	(0.026)
$75,000 in Cum. Loans	0.008	-0.014*	-0.005***	0.030
	(0.014)	(0.007)	(0.000)	(0.026)

Notes: Sample size=8,000. Observations are rounded to nearest ten, per NCES guidelines. Marginal effects at each value of student loan debt shown. Models include all controls from Column 5 in Tables 5 thru 8. Control variables are held at their mean values. Cumulative loan debt is instrumented with concurrent enrollment indicator interacted with household size. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05).

Beginning with the effect of debt on employment (Column 1), it is somewhat surprising that both the point estimate and the standard error do not change substantially across the distribution of debt. The estimates become slightly more precise, as cumulative debt increases, but none approach conventional levels of statistical significance. The remaining three models do result in substantive changes in the effects of debt. Most notably, while the negative effect of debt on the decision to teach shrinks as debt increases, it does become much more precise, suggesting that those with debt levels of $50,000 and higher are between .5 and .7 percentage points less likely to become teachers. This may seem like a paltry effect, but considering that only 8% of graduates sampled were teachers in 2009 (See Table 1), this effect is significantly larger than it seems (.006/.08=7.5% decrease).

While the prior literature (Akers, 2012; Rothstein & Rouse, 2011; Zhang, 2012) models each of the binary outcomes already discussed (e.g., employment and graduate/professional school enrollment) independently, one could argue that the decision

to become employed, enroll in a graduate or professional degree program, or do both are related and, as such, should be modeled jointly within a multinomial framework.[7] In Table 11, one can see that while the effect of debt again does not reach traditional levels of significance, it seems that the positive effect of debt on graduate school enrollment was driven primarily by those students who were enrolled in a graduate degree program and working. While the impact of debt on only graduate school enrollment is negative, the point estimate is imprecise, as is the impact of debt on the probability of employment. As with the earlier models, African American students are less likely to be employed but also more likely to be enrolled in graduate or professional school, after academic characteristics are controlled for. Moreover, academic characteristics like college GPA and SAT scores are positively associated with graduate school enrollment, regardless of whether or not someone is employed while enrolled in graduate school. Lastly, it seems that students who graduate from the least prestigious universities are less likely to enroll in a graduate degree program without working, which suggests that students from more prestigious institutions do not need to work while enrolled perhaps due to fellowships or scholarships.

[7] Being unemployed and not being enrolled in a graduate or professional degree program serves as the reference category. To account for the endogeneity of borrowing already discussed, a Seemingly Unrelated Regression (SUR) estimation strategy is employed using Stata's cmp command in which the first equation uses the instruments from the previous models to predict cumulative student loan debt and the second equation has four outcomes: 1) no job or graduate school enrollment 2) only employed 3) only enrolled in graduate school and 4) employed *and* enrolled in graduate school. For more information about cmp, see Roodman (2011).

Table 11: Multinomial Probit Models for the Probability of Becoming Employed, Enrolling in Graduate or Professional School, or both within 1 Year of Graduation

	(1)	(2)	(3)
	Employed	Grad/Prof	Employed & Grad/Prof
Cumulative Loans/10,000	-0.005	-0.010	0.048
	(0.017)	(0.040)	(0.039)
Female	0.016	0.020	0.067**
	(0.011)	(0.024)	(0.023)
Black	-0.089***	0.134**	0.022
	(0.027)	(0.048)	(0.045)
Hispanic	-0.106***	0.037	-0.062
	(0.025)	(0.042)	(0.043)
Asian	-0.142***	0.056	-0.151***
	(0.029)	(0.044)	(0.044)
Other Race	-0.085*	0.002	0.016
	(0.036)	(0.062)	(0.059)
2nd Income Quintile	0.047*	0.081*	0.040
	(0.022)	(0.040)	(0.041)
3rd Income Quintile	0.061**	0.014	0.031
	(0.023)	(0.042)	(0.042)
4th Income Quintile	0.084***	0.057	0.099*
	(0.022)	(0.043)	(0.042)
5th Income Quintile	0.051*	0.025	0.075
	(0.023)	(0.043)	(0.043)
Parent(s) HS thru Some College	-0.005	0.043	-0.013
	(0.015)	(0.036)	(0.036)
Parent(s) >= Bachelor's Degree	-0.028	0.079*	-0.012
	(0.015)	(0.036)	(0.035)
GPA	-0.010	0.304***	0.209***
	(0.014)	(0.036)	(0.032)
SAT/100	0.002	0.037***	0.024**
	(0.004)	(0.009)	(0.008)
Barron's Highly Competitive	-0.006	-0.055	0.050
	(0.028)	(0.056)	(0.057)
Barron's Very Competitive	-0.003	-0.034	0.050
	(0.025)	(0.051)	(0.051)
Barron's Competitive	0.024	-0.032	0.062
	(0.025)	(0.052)	(0.053)
Barron's Less Competitive	0.011	-0.184**	0.068
	(0.032)	(0.067)	(0.066)

Barron's Non-Competitive	0.028	-0.166**	-0.025
	(0.030)	(0.064)	(0.067)
Barron's Special	-0.012	-0.286*	-0.212
	(0.072)	(0.133)	(0.135)
Public	0.006	0.049	0.120**
	(0.020)	(0.047)	(0.045)
Observations	8,000	8,000	8,000

Notes: Observations are rounded to nearest ten, per NCES guidelines. Average marginal effects reported. Log pseudo likelihood is -24,396.56. "No employment or graduate/professional school enrollment" serves as the base category. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05). Reference categories are white, 1st income quintile (lowest), and Barron's 'Most competitive' category.

Impact of Debt on 2012 Outcomes

Moving on to the effect of debt on outcomes four years after graduation, the average cumulative debt incurred for each binary outcome of interest is presented in Table 12. As was the case in 2009, those employed in 2012 had accumulated substantially more debt than their unemployed peers.

Table 12: Cumulative Borrowing by 2012 Outcomes

	No	Yes
Employed by 2012	13,682.65	17,464.94
	(18,279.35)	(19,017.01)
T-test for Difference (t-stat)	Yes (5.348)	
Teacher by 2012	17,039.53	17,369.62
	(18,798.29)	(19,985.86)
T-test for Difference (t-stat)	No (.552)	
Enrolled in Grad/Prof by 2012	17,914.52	15,751.31
	(19,073.56)	(18,747.28)
T-test for Difference (t-stat)	Yes (4.962)	

Notes: Sample size=8,000. Observations are rounded to nearest ten, per NCES guidelines. Estimates represent the average cumulative debt burden at time of graduation in 2007-08. Standard deviations in parentheses.

Similarly, those respondents who never enrolled in graduate and professional school before the 2nd follow-up survey have almost $18,000 dollars in undergraduate debt, while those students who had or were enrolled in graduate school in 2012 borrowed closer to $15,750. In contrast to the 2009 descriptive statistics, it seems that respondents with higher levels of student loan debt became teachers at any point between earning their bachelor's degree and 2012, although a t-test of the difference in means across these groups does not reach traditional levels of statistical significance.

Turning to the first outcome of interest, employment in 2012, it seems that the naïve estimate is remarkably similar to its 2009 counterpart. Again, the non-white races are all substantially less likely to be employed, college GPA has a negative relationship with employment, and students who come from the most educated families are employed at lower rates.. In the model with no controls (Column 2), it seems that an additional $10,000 in student loan debt leads to an almost 1.1 percentage point increase in the probability of employment.

Table 13: Binary Probit Models for the Probability of Employment within 4 Years of Graduation

	(1) Probit	(2) IVProbit	(3) IVProbit	(4) IVProbit	(5) IVProbit
Cumulative Loans/10,000	0.009***	0.011	0.010	0.008	0.009
	(0.002)	(0.009)	(0.010)	(0.010)	(0.011)
Female	0.014		0.011	0.013	0.013
	(0.007)		(0.007)	(0.007)	(0.007)
Black	-0.080***		-0.064***	-0.083***	-0.080***
	(0.017)		(0.016)	(0.017)	(0.017)
Hispanic	-0.074***		-0.071***	-0.078***	-0.073***
	(0.015)		(0.015)	(0.015)	(0.015)
Asian	-0.127***		-0.138***	-0.133***	-0.126***
	(0.017)		(0.020)	(0.019)	(0.019)

Other Race	-0.057**		-0.056**	-0.059**	-0.057**
	(0.021)		(0.021)	(0.021)	(0.021)
2nd Income Quintile	-0.002		-0.002	-0.001	-0.002
	(0.013)		(0.014)	(0.013)	(0.013)
3rd Income Quintile	0.030*		0.035*	0.032*	0.030*
	(0.013)		(0.014)	(0.013)	(0.013)
4th Income Quintile	0.051***		0.054***	0.051***	0.050***
	(0.013)		(0.013)	(0.013)	(0.013)
5th Income Quintile	0.044***		0.043**	0.041**	0.043**
	(0.013)		(0.013)	(0.013)	(0.013)
Parent(s) HS thru Some College	-0.013		-0.014	-0.012	-0.013
	(0.009)		(0.009)	(0.009)	(0.009)
Parent(s) >= Bachelor's Degree	-0.028**		-0.035***	-0.030**	-0.028**
	(0.009)		(0.009)	(0.009)	(0.010)
GPA	-0.042***			-0.040***	-0.042***
	(0.009)			(0.010)	(0.010)
SAT/100	-0.000			-0.004	-0.000
	(0.002)			(0.002)	(0.002)
Missing SAT	0.029				0.030
	(0.017)				(0.018)
Barron's Highly Competitive	0.042*				0.042*
	(0.016)				(0.017)
Barron's Very Competitive	0.039*				0.040*
	(0.017)				(0.017)
Barron's Competitive	0.059**				0.060**
	(0.020)				(0.021)
Barron's Less Competitive	0.040*				0.040*
	(0.020)				(0.021)
Barron's Non-Competitive	0.063				0.063
	(0.042)				(0.044)
Public	0.012				0.012
	(0.007)				(0.013)
Observations	8,000	8,000	8,000	8,000	8,000
AIC	4,931.08	37,887.96	37,473.75	37,312.36	36,729.30
Log Pseudo Likelihood	-2,443.54	-18,929.98	-18,700.88	-18,616.18	-18,310.65

Notes: Observations are rounded to nearest ten, per NCES guidelines. Average marginal effects reported. Cumulative loan debt is instrumented with concurrent enrollment indicator interacted with household size. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05). Reference categories are white, 1st income quintile (lowest), and Barron's 'Most competitive' category.

As additional controls are introduced, this effect is does not change substantially, although the estimates are not very precise.

The next outcome of interest is the probability of working as a teacher at any point between earning a bachelor's degree and the second follow-up survey. The results of the naïve bivariate probit model in Column 1 of Table 14 suggest that there is little to no relationship between cumulative loan debt and working as a teacher. This is in line with the 2009 naïve findings in Table 7. Again, one can see that all else equal women are much more likely to work as teachers than men and college GPA has a positive and significant relationship with the decision to teach. In the IV models, the average effects of debt are similar to the 2009 findings as well; however, the standard errors are about 20% larger.

Table 14: Binary Probit Models for the Probability of Becoming a Teacher within 4 Years of Graduation

	(1)	(2)	(3)	(4)	(5)
	Probit	IV Probit	IV Probit	IV Probit	IV Probit
Cumulative Loans/10,000	0.001	-0.020	-0.006	-0.008	-0.012
	(0.002)	(0.013)	(0.013)	(0.013)	(0.015)
Female	0.083***		0.094***	0.084***	0.084***
	(0.008)		(0.008)	(0.008)	(0.008)
Black	-0.005		-0.013	-0.004	-0.004
	(0.017)		(0.016)	(0.017)	(0.017)
Hispanic	-0.021		-0.032*	-0.025	-0.024
	(0.015)		(0.015)	(0.015)	(0.015)
Asian	-0.080***		-0.084***	-0.083***	-0.084***
	(0.012)		(0.013)	(0.013)	(0.013)
Other Race	-0.001		-0.008	-0.001	0.000
	(0.023)		(0.022)	(0.023)	(0.023)
2nd Income Quintile	-0.009		-0.006	-0.006	-0.006
	(0.017)		(0.017)	(0.017)	(0.017)
3rd Income Quintile	0.027		0.031	0.031	0.033

	(0.016)		(0.017)	(0.017)	(0.017)
4th Income Quintile	0.051**		0.051**	0.053**	0.055**
	(0.017)		(0.017)	(0.017)	(0.017)
5th Income Quintile	0.039*		0.035*	0.038*	0.038*
	(0.016)		(0.016)	(0.016)	(0.016)
Parent(s) Some College	0.021		0.021	0.022	0.023
	(0.013)		(0.013)	(0.013)	(0.013)
Parent(s) >= Bachelor's Degree	0.010		0.006	0.008	0.006
	(0.011)		(0.012)	(0.012)	(0.012)
GPA	0.077***			0.073***	0.071***
	(0.010)			(0.012)	(0.012)
SAT/100	-0.009**			-0.009***	-0.010***
	(0.003)			(0.003)	(0.003)
Missing SAT	-0.100***			-0.103***	-0.103***
	(0.021)			(0.021)	(0.021)
Barron's Highly Competitive	0.016				0.022
	(0.020)				(0.021)
Barron's Very Competitive	-0.011				-0.006
	(0.018)				(0.018)
Barron's Competitive	0.012				0.016
	(0.019)				(0.019)
Barron's Less Competitive	-0.018				-0.015
	(0.023)				(0.023)
Barron's Non-Competitive	-0.008				-0.005
	(0.023)				(0.023)
Barron's Special	-0.033				-0.017
	(0.045)				(0.051)
Public	-0.004				-0.017
	(0.008)				(0.017)
Observations	8,000	8,000	8,000	8,000	8,000
Log Pseudo Likelihood	-3,197	-19,707	-19,478	-19,372	-19,069
AIC	6,440	39,442	39,029	38,828	38,251

Notes: Observations are rounded to nearest ten, per NCES guidelines. Average marginal effects reported. Cumulative loan debt is instrumented with concurrent enrollment indicator interacted with household size. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05). Reference categories are white, 1st income quintile (lowest), and Barron's 'Most competitive' category.

The last binary outcome of interest is the probability of enrolling in graduate or professional school prior to 2012. In the naïve model (Column 1 of Table 15), the average marginal effect of student loan debt on graduate school enrollment is not

statistically significant. In the first IV model, the sign of the effect becomes positive and is statistically significant at the p<.01 level. As additional controls are introduced, the marginal effect decreases by approximately 25% (4.2 pp to 3.1 pp) and in the full specification (Column 5), the effect is statistically significant at the p<.10 level. With regard to the other explanatory variables, those students who enjoyed more academic success, attended more selective institutions, and come from underrepresented racial groups were more likely to enroll in a graduate or professional degree program.

Table 15: Binary Probit Models for the Probability of Enrolling in Graduate or Professional School within 4 Years of Graduation

	(1)	(2)	(3)	(4)	(5)
	Probit	IV Probit	IV Probit	IV Probit	IV Probit
Cumulative Loans/10,000	-0.004	0.045**	0.042*	0.030	0.031
	(0.003)	(0.017)	(0.018)	(0.017)	(0.020)
Female	0.016		0.018	0.015	0.014
	(0.011)		(0.011)	(0.011)	(0.011)
Black	0.189***		0.073**	0.180***	0.182***
	(0.023)		(0.023)	(0.023)	(0.023)
Hispanic	0.072***		0.033	0.071***	0.079***
	(0.021)		(0.020)	(0.021)	(0.021)
Asian	0.109***		0.171***	0.145***	0.123***
	(0.021)		(0.021)	(0.022)	(0.022)
Other Race	0.089**		0.066*	0.089**	0.084**
	(0.031)		(0.031)	(0.031)	(0.031)
2nd Income Quintile	0.021		0.014	0.009	0.009
	(0.024)		(0.025)	(0.024)	(0.024)
3rd Income Quintile	-0.008		-0.036	-0.026	-0.025
	(0.023)		(0.024)	(0.024)	(0.024)
4th Income Quintile	-0.035		-0.068**	-0.050*	-0.045
	(0.023)		(0.023)	(0.023)	(0.023)
5th Income Quintile	-0.006		-0.013	-0.005	-0.004
	(0.023)		(0.023)	(0.023)	(0.023)
Parent(s) Some College	-0.001		0.004	-0.004	-0.004
	(0.017)		(0.016)	(0.017)	(0.017)
Parent(s) >= Bachelor's Degree	0.028		0.077***	0.041**	0.039*

	(0.016)		(0.015)	(0.016)	(0.016)
GPA	0.203***			0.203***	0.214***
	(0.014)			(0.014)	(0.014)
SAT/100	0.020***			0.031***	0.022***
	(0.004)			(0.003)	(0.004)
Missing SAT	-0.012			-0.033	0.004
	(0.043)			(0.043)	(0.044)
Barron's Highly Competitive	-0.025				-0.042
	(0.026)				(0.028)
Barron's Very Competitive	-0.064**				-0.075**
	(0.024)				(0.024)
Barron's Competitive	-0.091***				-0.100***
	(0.025)				(0.025)
Barron's Less Competitive	-0.135***				-0.142***
	(0.032)				(0.031)
Barron's Non-Competitive	-0.183***				-0.188***
	(0.031)				(0.030)
Barron's Special	-0.227***				-0.264***
	(0.064)				(0.064)
Public	0.012				0.047*
	(0.011)				(0.022)
Observations	8,000	8,000	8,000	8,000	8,000
Log Pseudo Likelihood	-5,016	-21,659	-21,487	-21,212	-20,887
AIC	10,078	43,346	43,045	42,509	41,886

Notes: Observations are rounded to nearest ten, per NCES guidelines. Average marginal effects reported. Cumulative loan debt is instrumented with concurrent enrollment indicator interacted with household size. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05). Reference categories are white, 1st income quintile (lowest), and Barron's 'Most competitive' category.

Because debt may not only affect the probability of employment, but may also affect the type of employment sought, Table 16 includes models where annual earnings are the outcome of interest. The OLS estimate of cumulative student loan debt on annual earnings is in the direction that prior research and theory predict. For each $10,000 in cumulative loan debt, a graduate earns an additional $490 dollars on average.

Unfortunately, the wage gap between men and women grew between 2009 and 2012. On average, women earn around $6,800 less in 2012 than their male counterparts,

which is an increase of approximately $2,500. The inferences related to the impact of debt on earnings are no different than in 2009. If anything, the relationship became more variable over time. In fact, the standard errors increased by approximately 30%, although the coefficients are relatively similar and are statistically indistinguishable from each other.

Table 16: OLS/2SLS Models Explaining the Impact of Debt on Earnings 4 Years after Graduation

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
Cumulative Loans/10,000	490.06**	-958.89	-420.49	-524.69	-365.83
	(166.43)	(831.90)	(850.42)	(831.58)	(928.98)
Female	-6,868.87***		-7,093.62***	-6,700.85***	-6,820.87***
	(605.62)		(597.38)	(608.80)	(606.14)
Black	-4,087.99***		-4,849.74***	-3,552.60***	-4,013.11***
	(1,042.42)		(1,021.34)	(1,036.57)	(1,042.73)
Hispanic	-2,460.61*		-3,039.33**	-2,235.79*	-2,670.63*
	(1,065.79)		(1,063.58)	(1,083.85)	(1,092.76)
Asian	-1,391.53		20.26	-497.14	-1,777.84
	(1,383.48)		(1,512.00)	(1,480.28)	(1,472.22)
Other Race	-2,159.14		-1,838.62	-1,717.47	-2,083.57
	(1,598.42)		(1,604.04)	(1,610.26)	(1,605.13)
2nd Income Quintile	-564.46		-115.31	-279.42	-308.16
	(1,257.08)		(1,286.71)	(1,281.82)	(1,286.70)
3rd Income Quintile	-1,211.32		-821.81	-866.26	-818.82
	(1,211.31)		(1,278.73)	(1,264.64)	(1,279.34)
4th Income Quintile	-278.00		-268.23	-261.97	-4.05
	(1,188.08)		(1,232.37)	(1,214.79)	(1,224.71)
5th Income Quintile	3,537.88**		3,903.30**	3,590.97**	3,495.18**
	(1,256.56)		(1,268.26)	(1,260.47)	(1,252.40)
Parent(s) Some College	-815.20		-481.07	-771.56	-737.71
	(814.93)		(825.53)	(822.17)	(821.58)
Parent(s) >= Bachelor's Degree	-1,486.47		-816.45	-1,604.72*	-1,768.78*
	(779.00)		(826.91)	(811.51)	(825.85)
GPA	1,171.46			172.03	780.93
	(651.15)			(730.45)	(764.24)

SAT/100	368.90			963.98***	305.25
	(195.25)			(187.52)	(209.91)
Missing SAT	-4,443.48*			-6,212.50**	-4,807.83*
	(2,157.35)			(2,182.66)	(2,192.00)
Barron's Highly Competitive	-4,279.70*				-3,888.28*
	(1,819.26)				(1,864.73)
Barron's Very Competitive	-7,394.54***				-7,100.47***
	(1,710.09)				(1,736.82)
Barron's Competitive	-9,333.93***				-9,089.59***
	(1,712.84)				(1,729.74)
Barron's Less Competitive	-8,117.16***				-7,894.34***
	(1,979.18)				(1,987.45)
Barron's Non-Competitive	-10,259.9***				-10,071.6***
	(1,958.15)				(1,969.40)
Barron's Special	-10,894.9***				-9,694.56**
	(3,042.29)				(3,273.50)
Public	1,827.52**				952.26
	(583.37)				(1,110.23)
Observations	8,000	8,000	8,000	8,000	8,000
R-Squared	0.046	0.003	0.028	0.032	0.042

Notes: Observations are rounded to nearest ten, per NCES guidelines. Cumulative loan debt is instrumented with concurrent enrollment indicator interacted with household size. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05). Reference categories are white, 1st income quintile (lowest), and Barron's 'Most competitive' category.

As with the 2009 outcomes, the effect of debt on post-graduation decisions four years after earning a bachelor's degree, none of the full specifications suggest debt has a statistically significant impact. Again, these impacts represent the average marginal effects of debt on post-baccalaureate behavior. To determine if the effects of debt differ across the amount of debt incurred, marginal effects at a number of cumulative student loan amounts are reported in Table 17. In short, these estimates represent simulated effects of debt at each of the values specified. The other variables in the model are held at their respective means.

In reviewing the marginal effects in Table 17, it seems that there is significantly less variation across the loan amounts than with the 2009 outcomes. The probability of

teaching by 2012 changes the most across the debt distribution ranging from a decline of .8 percentage points at $75,000 in loans to a decline of 1.3 percentage points at $5,000 in loans. None of the values reported reach traditional levels of statistical significance.

Table 17: Marginal Effects at Representative Values of Student Loan Debt on 2012 Outcomes

	(1) Employed in 2012	(2) Teacher By 2012	(3) Grad School By 2012
$5,000 in Cum. Loans	-0.020	-0.013	0.032
	(0.015)	(0.017)	(0.020)
$10,000 in Cum. Loans	-0.021	-0.012	0.033
	(0.016)	(0.016)	(0.021)
$15,000 in Cum. Loans	-0.021	-0.012	0.033
	(0.016)	(0.015)	(0.021)
$20,000 in Cum. Loans	-0.022	-0.012	0.033
	(0.017)	(0.014)	(0.022)
$25,000 in Cum. Loans	-0.022	-0.011	0.034
	(0.018)	(0.013)	(0.022)
$30,000 in Cum. Loans	-0.023	-0.011	0.034
	(0.019)	(0.012)	(0.023)
$35,000 in Cum. Loans	-0.023	-0.011	0.034
	(0.019)	(0.011)	(0.023)
$40,000 in Cum. Loans	-0.024	-0.010	0.035
	(0.020)	(0.011)	(0.023)
$45,000 in Cum. Loans	-0.024	-0.010	0.035
	(0.021)	(0.010)	(0.023)
$50,000 in Cum. Loans	-0.025	-0.010	0.035
	(0.021)	(0.009)	(0.023)
$55,000 in Cum. Loans	-0.025	-0.009	0.035
	(0.022)	(0.008)	(0.022)
$60,000 in Cum. Loans	-0.025	-0.009	0.035
	(0.022)	(0.008)	(0.022)
$65,000 in Cum. Loans	-0.026	-0.009	0.035
	(0.022)	(0.007)	(0.021)
$70,000 in Cum. Loans	-0.026	-0.008	0.035
	(0.023)	(0.006)	(0.021)

$75,000 in Cum. Loans	-0.026	-0.008	0.034
	(0.023)	(0.006)	(0.020)

Notes: Sample size=8,000. Observations are rounded to nearest ten, per NCES guidelines. Marginal effects at each value of student loan debt shown. Models include all controls from Column 5 in Tables 13 thru 15. Control variables are held at their mean values. Cumulative loan debt is instrumented with concurrent enrollment indicator interacted with household size. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05).

As with the outcomes 1 year after graduation, I also rerun the same analyses 4 years after graduation within a multinomial framework. In Table 18, one can see that even after accounting for the outcomes being related, that the effect of debt on any of the choices a recent college graduate faces is negligible. Again, college GPA and SAT scores are associated with the decision to enroll in a graduate or professional degree program, and a few of the racial groups are more likely to attend graduate school, once academic and institution-level characteristics are taken into account. Lastly, as with the 2009 outcomes, students from less prestigious institutions are less likely to attend graduate school.

Table 18: Multinomial Probit Models for the Probability of Becoming Employed, Enrolling in Graduate or Professional School, or both within 4 Years of Graduation

	(1)	(2)	(3)
	Employed	Grad/Prof	Employed & Grad/Prof
Cumulative Loans/10,000	-0.003	0.017	0.008
	(0.007)	(0.056)	(0.018)
Female	-0.004	-0.080*	0.004
	(0.004)	(0.033)	(0.011)
Black	-0.032*	0.167**	0.018
	(0.013)	(0.054)	(0.015)
Hispanic	-0.028*	0.100	-0.030
	(0.011)	(0.052)	(0.022)
Asian	-0.055**	0.126*	-0.060*
	(0.018)	(0.050)	(0.028)
Other Race	-0.045*	-0.055	-0.038
	(0.020)	(0.085)	(0.032)
2nd Income Quintile	0.003	0.015	0.011
	(0.010)	(0.054)	(0.022)
3rd Income Quintile	0.016	-0.022	0.022
	(0.009)	(0.059)	(0.022)
4th Income Quintile	0.022*	0.000	0.050*
	(0.009)	(0.061)	(0.021)
5th Income Quintile	0.018	0.002	0.044*
	(0.009)	(0.062)	(0.021)
Parent(s) HS thru Some College	0.002	0.086	-0.002
	(0.005)	(0.052)	(0.015)
Parent(s) >= Bachelor's Degree	-0.005	0.123*	-0.002
	(0.006)	(0.051)	(0.015)
GPA	-0.007	0.327***	0.082***
	(0.006)	(0.046)	(0.014)
SAT/100	0.001	0.034**	0.013***
	(0.001)	(0.012)	(0.004)
Barron's Highly Competitive	0.014	-0.014	0.013
	(0.013)	(0.071)	(0.022)
Barron's Very Competitive	0.015	-0.065	0.004
	(0.012)	(0.063)	(0.020)
Barron's Competitive	0.010	-0.128*	-0.020
	(0.013)	(0.065)	(0.022)
Barron's Less Competitive	0.010	-0.296**	-0.036

	(0.015)	(0.096)	(0.032)
Barron's Non-Competitive	0.014	-0.210*	-0.083*
	(0.014)	(0.084)	(0.035)
Public	0.000	0.056	0.024
	(0.008)	(0.065)	(0.021)
Observations	8,000	8,000	8,000

Notes: Observations are rounded to nearest ten, per NCES guidelines. Average marginal effects reported. Log pseudo likelihood is -23,206.13. No employment nor gradaute or professional school enrollment serves as the base category. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05). Reference categories are white, 1st income quintile (lowest), and Barron's 'Most competitive' category.

CHAPTER 6

CONCLUSION

Student loan debt is one the most discussed and politicized elements of the U.S. postsecondary system. Policymakers, advocacy groups, and media organizations have increasingly raised concerns about our growing reliance upon student loans. The upward trends in borrowing are undeniable, but given the increased private returns to a postsecondary degree (Avery & Turner, 2012), there are those who have argued that the investment in human capital is optimal for individuals and society alike. Those troubled by the upward trends in student borrowing have two primary concerns. First, some are worried that loan averse students may be less likely to enroll in a college or university if they must borrow to do so (Goldrick-Rab & Kelchen, 2015). Second, the debt accumulated while pursuing a postsecondary degree may affect the decisions students make during young adulthood. In this study, I sought to empirically examine the latter concern.

To examine the impact of cumulative student loan debt on post-baccalaureate decisions, I implemented an identification strategy similar to Alon (2005; 2011), Bettinger (2004), and Akers (2012). Specifically, I exploited a discontinuity in the federal financial aid formula that awards additional aid to households with multiple dependents concurrently enrolled in college. My findings suggest that cumulative student loan debt has relatively little impact on student decision-making following graduation. Specifically, I find limited evidence to suggest that college graduates with higher debt loads are likely

to find a job more quickly than students with lower debt loads. Beyond the extensive margin, there seems to be no evidence that the amount of student loan debt is associated with early career earnings, as theory and prior research suggest. Finally, the findings from this study do not support the notion that students who borrow more for college are less likely to enroll in a graduate or professional degree program. If anything, the findings point towards students with higher amounts of debt being more likely to enroll in a graduate degree program within four years of graduation.

The findings from this study emphasize the importance of utilizing a more sophisticated research design than the naïve approaches that have characterized this literature until the 2010s. In comparing the naïve to the IV estimates in this study, one can see that it is not only a matter of determining the magnitude of the effects, but in a number of instances, the direction of the estimated effect in the IV model was different than the probit or OLS estimate. That said, the LATE interpretation popularized by Angrist, Imbens, and Rubin (1996) suggests that the results presented in Chapter 5 can only be extrapolated to those students who borrowed more as a result of having a household dependent concurrently enrolled in college (e.g., the compliers). If the assumptions undergirding the IV approach held, then the effects presented account for unobservable characteristics and, thus, represent a more internally valid estimate, but the external validity of these findings are less clear. Surely, by limiting the sample to only dependent students, there is little the findings from this study can say about the effects of debt on independent students. Moreover, while utilizing a sample of bachelor's degree recipients mitigated concerns about educational differences accounting for the differences in early career decision-making, I can say nothing about the impact of debt on students

who enroll in college but do not finish. Given that these are the students with the worst student loan repayment outcomes (Looney & Yannelis, 2015), this is a population of students who may also struggle in the labor market.

In reconciling the findings from this study with other studies that have accounted for self-selection into the take up of loans, it seems that differences in research design and sample selection are likely the culprits. Akers (2012), for instance, includes both independent and dependent students in her final sample and does not provide results disaggregated by each group. Moreover, her sample of students precedes the significant expansion of the loan program that took place in the early 1990s. That said, her estimates suffer from imprecision, as mine do, which is likely due to our mutual choice of research design—instrumental variables (Wooldridge, 2010). Perhaps with an increased sample size, the average marginal effects reported would reach conventional levels of statistical significance. Zhang's (2013) conclusions are similar to mine. One exception is her finding that for each $1,000 increase in student loan debt, graduates from public universities are 2.7 percentage points less likely to enroll in graduate or professional school. This result is markedly different from the rest of the literature and could be the result of a biased instrument. Lastly, with the exception of Zhang (2013), none of the other studies that utilize the Baccalaureate and Beyond Longitudinal dataset delimit the sample to first-time bachelor's degree recipients. Because the variable for cumulative loan debt includes all prior loans, regardless of degree program, it could be that students who are earning an additional bachelor's degree may both have additional student loan debt and professional work experience. Because these post-baccalaureate decisions are dynamic in that they coincide with other early life outcomes such as marriage, family

formation, and home buying, modeling their behavior with traditional age graduates seems troubling.

Implications for Future Research

Future work on this topic could benefit from a number of improvements over this study and the studies that preceded it. First, a cleaner source of exogenous variation in the take up of loans would lead to more precise estimates within an instrumental variables framework. One potential source is the cutoff for merit aid eligibility. Many states use high school grade point average, standardized test scores, or a combination of the two to determine a student's eligibility for merit aid. One could look at debt accumulation on either side of the eligibility cutoff to determine if being awarded merit aid results in lower levels of debt and then examine any number of outcomes in the second stage equation. This approach would be best served with state administrative data, given the sample size needed near the merit aid eligibility cutoff. Relatedly, there a handful of randomized control trials currently underway related to the take up of debt (Barr, Bird & Castleman, 2017; Marx & Turner, 2016). In time, researchers can use the experimental design as a first stage to predict cumulative debt and then use that debt total to predict any number of post-collegiate outcomes, including home buying, marriage, family formation, employment, and debt repayment.

Second, future research on this topic needs to be more transparent in how samples are delimited and covariates are chosen. Mine is one of the few to provide nested models to show how the effect of debt changes as different groups of predictors are introduced. In order to better understand the relationship between debt and post-collegiate outcomes, this seems like a necessary step. Otherwise, model selection could become outcome

driven. As for delimiting samples, replicating prior work with more recent data in this study was a difficult task. With the exception of Zhang (2013), it was rarely clear who exactly researchers were dropping from their analyses and why. To be able to compare results over time, this is an important step to grow this body of literature, especially given the significant variation in sample sizes, covariates chosen, and research designs employed. It is important that these steps are taken, as the research and policy community continue to monitor the effect that debt has on student outcomes.

Third, future research would benefit from looking at other subpopulations of students, including adult or non-traditional students and non-completers. Given the growing wage differential between college graduates and non-graduates (Autor, 2014), as well as the significant number of non-traditional students enrolling or returning to pursue a postsecondary credential (Deming, Goldin & Katz, 2012), researchers and policymakers need to closely monitor how these student populations interact with the current student loan system, especially as recent evidence suggests that these are the very students who are struggling with debt (Looney & Yannelis, 2015).

Implications for Policy

After accounting for the endogeneity between the take up of debt and the outcomes examined in this study, there seems to be little evidence that student loans impact post-collegiate decision-making. Because the sample for this study only included dependent undergraduates, the results cannot be extrapolated to other student populations. That said, as intermediary organizations, federal and state legislatures, and the Department of Education consider new policies related to postsecondary finance, the following takeaways from this study warrant consideration.

When talking about increases in cumulative loan debt, more nuanced conversations regarding which populations of students are taking on this additional debt are warranted. Adult students make up a significant portion of the postsecondary marketplace (NCES, 2017), so policymakers that focus exclusively on the traditional undergraduate population are missing out on a sizable group of students. Moreover, as is evident from the Table 1 in Chapter 4, independent students are more disadvantaged than their dependent counterparts. This, coupled with their aforementioned poor student loan repayment outcomes, suggests that these students could perhaps be subject to different policies. Right now, the annual and cumulative federal loan limits differ by student dependency status, but future interventions should target these students separately.[8] Moreover, the conversations we have regarding student debt should be clear about which student groups we are referring to. A "one size fits all" approach to federal financial aid is detrimental both to students and the taxpayers who fund the system.

Concerned that borrowing has gotten out of control, policy proposals that limit student debt have become fashionable in recent years. One such proposal by the National Association for Student Financial Aid Administrators suggests that borrowing should be limited to students who are academically prepared (NASFAA, 2013). Borrowing from the NCAA eligibility guidelines, authors of this NASFAA report suggest that a student loan eligibility index should be implemented to limit borrowing to only those students with the appropriate combination of high school grades and standardized test scores. Given the results from this study and how little we know about the role borrowing plays

[8] Another student population that warrants separate consideration is graduate and professional school students. The one trillion dollar figure that is often cited includes federal student loan debt from all sources, including graduate and professional school students. Given that there are no limits beyond the full cost of attendance on the Graduate PLUS loan program and that medical and law students face exorbitant costs, a non-trivial percentage of the federal government's loan portfolio surely includes graduate student loan debt.

for academically marginal students, it seems premature to limit borrowing for this subpopulation of students. It may be the case that these academically at-risk students are the very population who need access to the federal student loan programs. Making them ineligible for student loans may have unintended consequences for postsecondary access and success for those students on the margin of attendance.

While the findings from this study suggest that debt does not substantively impact post-collegiate decision-making, there are, of course, additional outcomes and student populations that lie outside the scope of this study. It could be that debt does have a sizable impact on other decisions or for different groups of students. Whether debt has a measurable effect on post-collegiate decision-making or not, it would behoove policymakers to make improvements to the current student loan repayment process. Right now, students have a host of repayment options after college, including multiple income-based repayment programs, a conventional repayment plan, and a number of deferment and forbearance options. Streamlining these programs into a smaller set of choices, as well as making efforts to inform students about their options seems prudent for all involved. In fact, the best policy proposal related to student loan repayment involves making income-based repayment the default repayment plan.

Summary

In this study, I find evidence to suggest that student borrowing does not influence postbaccalaureate decision-making. Hopefully, my transparent approach to sample selection as well as my nested modeling approach begets future transparency in this line of research, so we can better understand what role debt plays in post-collegiate outcomes. As college prices continue to rise and students are increasingly expected to meet these

increased costs, likely through borrowing, it is important that researchers continue to investigate what impact, if any, debt has on outcomes after college.

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APPENDIX A

Variable Descriptions

Variable	NCES Name	NCES Variable Description
Employed in 2009	B1APRLFP	Describes the respondent's labor force participation in April 2009. Source: B&B:09 Interview.
Enrolled in Grad/Prof School in 2009	B1ENRST	Indicates the respondent's enrollment in a degree or certificate program at the time of the B&B:09 interview. Source: B&B:09 Interview.
2009 Annual Earnings	B1ERNINC	Indicates the respondent's earnings, calculated on an annual basis, at the time of the B&B:09 interview. For respondents with multiple jobs, earnings are only for the primary job, the job at which the respondent worked the most hours. For teachers, earnings refer only to income from the school. For short-term substitutes and student teachers, earnings were allowed to equal $0. Source: B&B:09 Interview.
Employed in 2012	B2LFP12	Summary of respondent's full-time/part-time employment and enrollment status as reported as of the B&B:12 interview. Source: B&B:12 Interview.
Enrolled in Grad/Prof School in 2012	B2CURDEG	Indicates the type of degree or certificate program in which the respondent was enrolled as of the B&B:12 interview. Source: B&B:12 Interview.
2012 Annual Earnings	B2CJSAL	Indicates the respondent's income from their primary job as of the B&B:12 interview, multiplied to compute an annual salary if reported as an annual, monthly, weekly, or hourly rate. Primary job is defined as the respondent's current or most recent job that lasted more than 3 months; if more than one job meets these criteria, the job with the highest number of hours per week is selected. Respondents could report salary in annual, monthly, weekly, or hourly amounts. Source: B&B:12 Interview.
Cumulative Loan Debt	B1BORAT	Cumulative loan amount borrowed for undergraduate through 2007-08. Indicates the cumulative amount borrowed from all sources for the respondent's undergraduate education through June 30, 2008. Does not include Parent PLUS loans. Sources: B&B:09 Interview, NPSAS:08 Interview, National Student Loan Data System (NSLDS) files, and NPSAS:08 Institutional Records.
Concurrent Enrollment (Dep. Students)	C08070	Parents/Student's number in college. Always count yourself as a college student. Do not include your parents. Include others only if they will attend, at least half time in 2007-2008, a program that leads to a college degree or certificate. Source: CPS 07-08 (e.g., FAFSA)

Concurrent Enrollment (Ind. Students)	C08094	Go to page 5. How many people in the question above will be college students in 2007-2008? Always count yourself. Do not include your parents. Include others only if they will attend college at least half time in 2007-2008 in a program that leads to a college degree or certificate. Source: FAFSA: 08.
Household Size	HSIZE	Indicates the respondent's family size in 2007-08. For dependent respondents, this is equal to the family size of the respondent's parents. For independent respondents, this is equal to the respondent's own family size. Sources: NPSAS:08 Interview, FAFSA: 08.
Sex	GENDER	Indicates the respondent's sex. Sources: NPSAS:08 Interview, NPSAS: 08 Institutional Records, FAFSA: 08.
Race	RACE	Indicates the respondent's race/ethnicity. Sources: NSPAS 08 Interview, NPSAS: 08 Institutional Records.
Family Income	CINCOME	Income (dependents' parents and independents) in 2006 Indicates the total 2006 income of independent respondents and parents of dependent respondents. The 2006 calendar year income was used in the federal need analysis to determine financial aid eligibility for the 2007-08 academic year. Sources: NPSAS:08 Interview, FAFSA: 08.
Parental Education	PAREDUC	Indicates the highest level of education attained by either of the respondent's parents as of the NPSAS:08 interview. Source: NPSAS:08 Interview.
Age	AGE	Indicates the respondent's age as of 12/31/2007. NPSAS:08 Interview, NPSAS: 08 Institutional Records, FAFSA: 08.
SAT	TESATDER	Indicates the respondent's SAT I combined score, derived as either the sum of SAT I verbal and math scores or the ACT composite score converted to an estimated SAT I combined score using a concordance table. Sources: NPSAS: 08 Institutional Records, College Board, ACT.
Public Institution	SECTOR9	Indicates the sector of the respondent's 2007-08 bachelor's degree-granting institution. Source: 2005-06 IPEDS.
Barron's Category	BARRONS	Indicates the Barron's Admissions Competitiveness Index Institutional Category. Source: Barron's 04 File.

APPENDIX B

Robustness Checks

Table B.1: Marginal Effects for 2009 Outcomes using Just Identified IV Approach

	(1)	(2)	(3)	(4)	(5)
	Employed	Job Unrelated	Graduate School	Teaching	Earnings
Cumulative Loans/10,000	-0.000	-0.014	0.021	-0.014	-706.672
	(0.018)	(0.017)	(0.017)	(0.012)	(775.714)
Number of Dependents	-0.001	-0.005	0.011*	0.003	-213.653
	(0.005)	(0.004)	(0.004)	(0.003)	(206.925)
Female	0.019	0.029**	0.017	0.047***	-4,366.259***
	(0.010)	(0.010)	(0.010)	(0.007)	(473.160)
Black	-0.111***	0.005	0.124***	-0.033**	-3,558.707***
	(0.022)	(0.020)	(0.022)	(0.012)	(871.996)
Hispanic	-0.116***	-0.008	0.071***	-0.027*	-3,085.644***
	(0.021)	(0.019)	(0.020)	(0.012)	(878.963)
Asian	-0.169***	-0.058**	0.073***	-0.062***	-3,928.744***
	(0.023)	(0.018)	(0.021)	(0.011)	(1,051.162)
Other Race	-0.065*	0.011	0.077**	-0.036*	-521.093
	(0.029)	(0.027)	(0.029)	(0.016)	(1,534.244)
2nd Income Quintile	0.005	-0.018	0.006	-0.025	-358.789
	(0.024)	(0.021)	(0.023)	(0.013)	(852.670)
3rd Income Quintile	0.037	0.003	-0.041	0.011	1,035.770
	(0.024)	(0.022)	(0.022)	(0.015)	(876.140)
4th Income Quintile	0.069**	0.027	-0.045*	0.028	1,578.609
	(0.023)	(0.021)	(0.022)	(0.015)	(875.903)
5th Income Quintile	0.049*	0.018	-0.016	0.007	2,768.946**
	(0.023)	(0.021)	(0.022)	(0.013)	(920.609)
Parent(s) Some College	-0.015	0.023	0.013	0.011	-866.776
	(0.015)	(0.015)	(0.015)	(0.010)	(677.365)
Parent(s) >= Bachelor's Degree	-0.049***	-0.016	0.044**	-0.004	-2,661.612***
	(0.015)	(0.015)	(0.015)	(0.010)	(685.759)
GPA	-0.057***	-0.098***	0.169***	0.055***	-980.532
	(0.015)	(0.013)	(0.014)	(0.009)	(622.531)
SAT/100	-0.006	-0.000	0.018***	-0.010***	-449.676**
	(0.004)	(0.003)	(0.004)	(0.002)	(161.805)

Missing SAT	-0.090*	0.044	0.005	-0.066***	-4,763.847**
	(0.045)	(0.043)	(0.040)	(0.015)	(1,654.292)
Barron's Highly Competitive	0.028	-0.001	-0.004	0.028	-1,283.546
	(0.026)	(0.023)	(0.024)	(0.017)	(1,337.757)
Barron's Very Competitive	0.026	0.024	-0.001	-0.003	-4,410.924***
	(0.023)	(0.021)	(0.022)	(0.014)	(1,199.585)
Barron's Competitive	0.050*	0.019	-0.020	0.021	-4,779.711***
	(0.024)	(0.022)	(0.023)	(0.015)	(1,207.020)
Barron's Less Competitive	0.076*	0.033	-0.043	0.001	-3,164.153*
	(0.030)	(0.028)	(0.028)	(0.018)	(1,421.489)
Barron's Non-Competitive	0.072*	0.000	-0.085**	-0.008	-3,095.569*
	(0.029)	(0.027)	(0.027)	(0.017)	(1,419.903)
Barron's Special	0.038	0.096	-0.155**	-0.056*	-3,891.321
	(0.069)	(0.071)	(0.052)	(0.023)	(2,705.396)
Public	0.006	-0.022	0.054**	-0.006	-107.524
	(0.021)	(0.020)	(0.019)	(0.014)	(907.270)
Constant					42,426.573***
					(4,188.854)
Observations	8,000	8,000	8,000	8,000	8,000
Log Likelihood/R-Squared	-20,337	-20,129	-20,197	-17,973	0.017

Notes: Observations are rounded to nearest ten, per NCES guidelines. Average marginal effects reported in Columns 1-4. Cumulative loan debt instrumented with concurrent enrollment indicator. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05). Reference categories are white, 1st income quintile (lowest), and Barron's 'Most competitive' category.

Table B.2: Marginal Effects for 2012 Outcomes using Just Identified IV Approach

	(1)	(2)	(3)	(4)
	Employed	Graduate School	Teaching	Earnings
Cumulative Loans/10,000	-0.015	0.027	-0.017	-178.612
	(0.017)	(0.018)	(0.015)	(974.585)
Number of Dependents	-0.001	0.007	0.007	-39.859
	(0.004)	(0.005)	(0.004)	(261.337)
Female	-0.001	0.015	0.085***	-6,825.008***
	(0.010)	(0.011)	(0.008)	(608.437)
Black	-0.106***	0.183***	-0.004	-3,943.025***
	(0.022)	(0.023)	(0.017)	(1,038.930)
Hispanic	-0.082***	0.077***	-0.027	-2,588.683*
	(0.020)	(0.021)	(0.015)	(1,098.016)
Asian	-0.174***	0.119***	-0.088***	-1,638.877
	(0.022)	(0.022)	(0.013)	(1,479.402)
Other Race	-0.087**	0.084**	-0.000	-2,003.085
	(0.029)	(0.031)	(0.023)	(1,607.792)
2nd Income Quintile	0.022	0.010	-0.006	-428.150
	(0.023)	(0.024)	(0.017)	(1,034.176)
3rd Income Quintile	0.043	-0.027	0.032	-612.201
	(0.023)	(0.024)	(0.018)	(1,041.578)
4th Income Quintile	0.100***	-0.049*	0.052**	1,222.708
	(0.022)	(0.024)	(0.017)	(1,062.607)
5th Income Quintile	0.072**	-0.010	0.032	4,448.480***
	(0.022)	(0.024)	(0.017)	(1,178.944)
Parent(s) Some College	-0.005	-0.003	0.024	-738.671
	(0.015)	(0.017)	(0.013)	(820.540)
Parent(s) >= Bachelor's Degree	-0.034*	0.038*	0.004	-1,743.798*
	(0.014)	(0.016)	(0.012)	(825.811)
GPA	-0.059***	0.213***	0.069***	891.917
	(0.014)	(0.014)	(0.012)	(782.422)
SAT/100	0.003	0.022***	-0.010***	327.897
	(0.004)	(0.004)	(0.003)	(210.209)
Missing SAT	-0.090*	0.002	-0.104***	-4,807.643*
	(0.044)	(0.044)	(0.021)	(2,194.524)
Barron's Highly Competitive	0.081**	-0.040	0.024	-3,871.516*
	(0.026)	(0.027)	(0.021)	(1,865.591)
Barron's Very Competitive	0.103***	-0.074**	-0.005	-7,025.394***
	(0.024)	(0.024)	(0.018)	(1,738.626)
Barron's Competitive	0.100***	-0.099***	0.017	-8,960.491***

	(0.024)	(0.025)	(0.019)	(1,731.467)
Barron's Less Competitive	0.143***	-0.142***	-0.013	-7,744.613***
	(0.029)	(0.031)	(0.023)	(1,988.907)
Barron's Non-Competitive	0.086**	-0.187***	-0.004	-9,802.300***
	(0.030)	(0.031)	(0.023)	(1,973.543)
Barron's Special	0.220***	-0.261***	-0.012	-9,839.912**
	(0.051)	(0.064)	(0.052)	(3,304.874)
Public	0.009	0.044*	-0.023	1,157.285
	(0.020)	(0.021)	(0.017)	(1,148.858)
Constant				41,522.226***
				(5,426.943)
Observations	8,000	8,000	8,000	8,000
Log Likelihood/R-Squared	-20,193	-20,897	-19,078	0.044

Notes: Observations are rounded to nearest ten, per NCES guidelines. Average marginal effects reported in Columns 1-3. Cumulative loan debt instrumented with concurrent enrollment indicator. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05). Reference categories are white, 1st income quintile (lowest), and Barron's 'Most competitive' category.

Table B.3: Marginal Effects from 2009 Outcomes Models (Logged Student Debt)

	(1)	(2)	(3)	(4)	(5)
	Employed	Job Unrelated	Graduate School	Teaching	Log Earnings
Cumulative Loans Logged	0.001	-0.006	-0.003	-0.003	-0.028
	(0.005)	(0.005)	(0.003)	(0.003)	(0.045)
Female	0.019	0.029**	0.046***	0.046***	0.011
	(0.010)	(0.010)	(0.006)	(0.006)	(0.095)
Black	-0.111***	0.005	-0.033**	-0.033**	-1.151***
	(0.022)	(0.020)	(0.011)	(0.011)	(0.198)
Hispanic	-0.116***	-0.010	-0.025*	-0.026*	-0.958***
	(0.021)	(0.018)	(0.011)	(0.011)	(0.187)
Asian	-0.168***	-0.061***	-0.059***	-0.060***	-1.748***
	(0.022)	(0.018)	(0.009)	(0.009)	(0.218)
Other Race	-0.066*	0.010	-0.036*	-0.038**	-0.356
	(0.029)	(0.027)	(0.015)	(0.015)	(0.255)
2nd Income Quintile	0.004	-0.019	-0.026	0.010	-0.111
	(0.023)	(0.021)	(0.013)	(0.010)	(0.218)
3rd Income Quintile	0.035	-0.002	0.009	0.032**	0.131
	(0.022)	(0.021)	(0.014)	(0.011)	(0.208)
4th Income Quintile	0.069**	0.017	0.024	0.034**	0.384
	(0.022)	(0.021)	(0.014)	(0.011)	(0.203)
5th Income Quintile	0.049*	0.005	0.006	0.016	0.428*
	(0.024)	(0.022)	(0.014)	(0.012)	(0.216)
Parent(s) Some College	-0.015	0.024	0.010	0.010	-0.091
	(0.015)	(0.015)	(0.010)	(0.010)	(0.137)
Parent(s) >= Bachelor's Degree	-0.048***	-0.016	-0.002	-0.002	-0.563***
	(0.014)	(0.014)	(0.009)	(0.009)	(0.135)
GPA	-0.056***	-0.096***	0.059***	0.058***	-0.585***
	(0.013)	(0.012)	(0.009)	(0.009)	(0.115)
SAT/100	-0.005	-0.000	-0.009***	-0.009***	-0.125***
	(0.004)	(0.003)	(0.002)	(0.002)	(0.032)
Missing SAT	-0.089*	0.046	-0.063***	-0.062***	-0.737
	(0.044)	(0.043)	(0.014)	(0.014)	(0.411)
Barron's Highly Competitive	0.027	-0.001	0.024	0.023	0.100
	(0.024)	(0.022)	(0.016)	(0.016)	(0.247)
Barron's Very Competitive	0.025	0.026	-0.004	-0.005	0.026
	(0.023)	(0.021)	(0.014)	(0.014)	(0.229)
Barron's Competitive	0.049*	0.021	0.020	0.019	0.226
	(0.024)	(0.022)	(0.015)	(0.015)	(0.234)
Barron's Less Competitive	0.075*	0.034	-0.000	-0.002	0.660*

	(0.029)	(0.028)	(0.017)	(0.018)	(0.278)
Barron's Non-Competitive	0.072*	0.000	-0.009	-0.010	0.371
	(0.029)	(0.027)	(0.017)	(0.017)	(0.277)
Barron's Special	0.037	0.084	-0.059**	-0.061**	0.360
	(0.065)	(0.065)	(0.019)	(0.019)	(0.545)
Public	0.008	-0.018	0.002	0.002	-0.000
	(0.013)	(0.012)	(0.008)	(0.008)	(0.118)
Constant					11.975***
					(0.769)
Observations	8,000	8,000	8,000	8,000	8,000
Log Likelihood/R-Squared	-27,144	-26,939	-27,007	-24,794	0.032

Notes: Observations are rounded to nearest ten, per NCES guidelines. Average marginal effects reported in Columns 1-4. Cumulative loan debt instrumented with concurrent enrollment indicator interacted with household size. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05). Reference categories are white, 1st income quintile (lowest), and Barron's 'Most competitive' category.

Table B.4: Marginal Effects from 2012 Outcomes Models (Logged Student Debt)

	(1)	(2)	(3)	(4)
	Employed	Graduate School	Teaching	Earnings
Cumulative Loans Logged	-0.007	0.009	-0.003	-0.045
	(0.005)	(0.006)	(0.004)	(0.030)
Female	-0.001	0.015	0.084***	-0.049
	(0.010)	(0.011)	(0.008)	(0.064)
Black	-0.106***	0.185***	-0.004	-0.742***
	(0.022)	(0.023)	(0.017)	(0.153)
Hispanic	-0.082***	0.078***	-0.023	-0.615***
	(0.020)	(0.021)	(0.015)	(0.138)
Asian	-0.175***	0.120***	-0.082***	-1.274***
	(0.022)	(0.022)	(0.013)	(0.173)
Other Race	-0.087**	0.087**	-0.001	-0.304
	(0.029)	(0.031)	(0.023)	(0.169)
2nd Income Quintile	0.021	0.014	-0.008	-0.020
	(0.023)	(0.024)	(0.017)	(0.160)
3rd Income Quintile	0.039	-0.016	0.029	0.016
	(0.022)	(0.023)	(0.017)	(0.151)
4th Income Quintile	0.091***	-0.032	0.050**	0.192
	(0.022)	(0.023)	(0.017)	(0.145)
5th Income Quintile	0.060*	0.008	0.035	0.210
	(0.023)	(0.025)	(0.018)	(0.153)
Parent(s) Some College	-0.005	-0.003	0.022	0.028
	(0.015)	(0.017)	(0.013)	(0.100)
Parent(s) >= Bachelor's Degree	-0.035*	0.036*	0.008	-0.180
	(0.014)	(0.016)	(0.012)	(0.099)
GPA	-0.057***	0.208***	0.075***	-0.282***
	(0.012)	(0.014)	(0.010)	(0.075)
SAT/100	0.003	0.022***	-0.009***	0.057*
	(0.003)	(0.004)	(0.003)	(0.023)
Missing SAT	-0.087*	-0.004	-0.101***	-0.917*
	(0.044)	(0.044)	(0.021)	(0.370)
Barron's Highly Competitive	0.080**	-0.035	0.018	0.085
	(0.025)	(0.027)	(0.020)	(0.151)
Barron's Very Competitive	0.104***	-0.073**	-0.008	0.044
	(0.024)	(0.025)	(0.018)	(0.141)
Barron's Competitive	0.103***	-0.100***	0.015	-0.109
	(0.024)	(0.025)	(0.019)	(0.148)
Barron's Less Competitive	0.145***	-0.143***	-0.016	0.134

	(0.029)	(0.032)	(0.023)	(0.181)
Barron's Non-Competitive	0.086**	-0.187***	-0.007	-0.398*
	(0.030)	(0.031)	(0.023)	(0.202)
Barron's Special	0.212***	-0.241***	-0.029	0.213
	(0.050)	(0.063)	(0.045)	(0.307)
Public	0.014	0.030*	-0.009	0.062
	(0.013)	(0.014)	(0.011)	(0.080)
Constant				10.528***
				(0.508)
Observations	8,000	8,000	8,000	8,000
Log Likelihood/R-Squared	-26,991	-27,704	-25,891	0.021

Notes: Observations are rounded to nearest ten, per NCES guidelines. Average marginal effects reported in Columns 1-3. Cumulative loan debt instrumented with concurrent enrollment indicator interacted with household size. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05). Reference categories are white, 1st income quintile (lowest), and Barron's 'Most competitive' category.

Table B.5: Heterogeneous Effects of Student Loan Debt on 2009 Outcomes

	(1)	(2)	(3)	(4)	(5)
	Employed	Job Unrelated	Graduate School	Teaching	Earnings
Female	-0.004	0.001	0.023	-0.008	-891.682
	(0.022)	(0.022)	(0.022)	(0.015)	(887.977)
Male	0.016	-0.038	0.014	-0.009	249.252
	(0.024)	(0.023)	(0.024)	(0.012)	(1,236.339)
Low Income	-0.135	-0.031	0.099	0.109	-2,212.614
	(0.111)	(0.077)	(0.090)	(0.065)	(4,046.731)
High Income	0.038*	-0.002	0.005	-0.000	293.359
	(0.015)	(0.016)	(0.016)	(0.010)	(730.741)
Black	-0.135	-0.011	0.160	0.078	-2,899.756
	(0.142)	(0.118)	(0.152)	(0.079)	(5,203.619)
Hispanic	0.115	0.021	0.033	0.005	-302.036
	(0.070)	(0.057)	(0.060)	(0.030)	(2,732.555)
White	0.018	-0.004	0.010	-0.011	-109.241
	(0.015)	(0.016)	(0.016)	(0.011)	(693.654)
First-Generation	-0.013	-0.044	0.047	-0.012	161.740
	(0.038)	(0.039)	(0.039)	(0.025)	(1,695.904)

Notes: Observations are rounded to nearest ten, per NCES guidelines. Each cell is a separate model for the subgroup and outcome specified utilizing a 2SLS/LPM approach. Marginal effects of $10,000 in cumulative student loan debt reported. Cumulative loan debt instrumented with concurrent enrollment indicator interacted with household size. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05).

Table B.6: Heterogeneous Effects of Student Loan Debt on 2012 Outcomes

	(1)	(2)	(3)	(4)
	Employed	Graduate School	Teaching	Earnings
Female	-0.026	0.033	-0.006	-1,674.466
	(0.022)	(0.024)	(0.020)	(1,134.361)
Male	-0.023	0.017	-0.012	567.846
	(0.024)	(0.026)	(0.016)	(1,589.363)
Low Income	-0.034	0.090	0.012	-4,568.501
	(0.090)	(0.092)	(0.058)	(4,797.113)
High Income	-0.016	0.016	0.022	-264.100
	(0.016)	(0.017)	(0.014)	(1,022.577)
Black	-0.135	0.225	0.178	-4,852.960
	(0.149)	(0.174)	(0.126)	(6,297.364)
Hispanic	-0.049	0.003	0.001	132.928
	(0.069)	(0.065)	(0.043)	(3,396.213)
White	-0.012	0.023	-0.017	-505.675
	(0.015)	(0.017)	(0.014)	(889.626)
First-Generation	-0.014	0.113*	-0.046	495.683
	(0.039)	(0.046)	(0.033)	(2,072.365)

Notes: Observations are rounded to nearest ten, per NCES guidelines. Each cell is a separate model for the subgroup and outcome specified utilizing a 2SLS/LPM approach. Marginal effects of $10,000 in cumulative student loan debt reported. Cumulative loan debt instrumented with concurrent enrollment indicator interacted with household size. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05).

Table B.7: OLS/2SLS Models Explaining the Impact of Debt on Earnings 1 Year after Graduation with Major Fixed Effects

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
Cumulative Loans/10,000	142.51	511.89	375.62	900.21	87.58
	(120.65)	(690.94)	(681.11)	(765.62)	(667.92)
Female	-3,573.70***	-6,846.37***	-6,721.00***	-6,848.08***	-3,569.57***
	(498.08)	(517.10)	(517.36)	(513.36)	(498.33)
Black	-620.18	-1,759.10	453.16	20.96	-618.52
	(945.33)	(997.64)	(1,008.03)	(1,014.27)	(941.80)
Hispanic	334.38	-157.53	650.85	-18.67	327.35
	(888.60)	(962.58)	(963.13)	(963.78)	(890.70)
Asian	1,122.97	4,512.60***	3,990.58**	2,859.05*	1,097.10
	(993.43)	(1,263.79)	(1,235.48)	(1,220.33)	(1,054.00)
Other Race	1,746.93	854.01	1,321.29	862.18	1,753.62
	(1,957.18)	(2,114.01)	(2,097.65)	(2,058.95)	(1,954.28)
2nd Income Quintile	-224.48	-492.59	-514.74	-801.06	-207.64
	(782.72)	(942.83)	(925.34)	(914.11)	(797.89)
3rd Income Quintile	92.83	-1,371.31	-1,178.88	-1,176.49	112.95
	(816.82)	(975.14)	(957.86)	(949.92)	(843.15)
4th Income Quintile	1,556.70	-414.77	-95.95	41.22	1,567.08
	(844.96)	(971.00)	(953.62)	(941.59)	(850.36)
5th Income Quintile	3,723.69***	2,602.78**	2,696.81**	2,574.29**	3,712.71***
	(858.64)	(982.39)	(970.12)	(963.12)	(863.63)
Parent(s) HS thru Some College	-137.25	-753.97	-895.17	-945.97	-135.82
	(670.97)	(747.48)	(740.88)	(736.88)	(668.10)
Parent(s) >= Bachelor's Degree	-588.17	-323.28	-1,043.36	-1,123.84	-612.11
	(614.74)	(764.98)	(750.75)	(769.88)	(692.07)
GPA	2,854.40***		3,062.77***	3,823.90***	2,831.26***
	(504.34)		(594.91)	(614.31)	(564.78)
SAT/100	218.99		921.91***	362.19*	215.34
	(150.59)		(154.17)	(169.86)	(155.96)
Barron's Highly Competitive	-5,039.73***			-3,175.33*	-5,010.06***
	(1,384.00)			(1,561.66)	(1,405.68)
Barron's Very Competitive	-8,632.00***			-7,348.98***	-8,610.20***
	(1,309.38)			(1,438.68)	(1,314.48)
Barron's Competitive	-10,302.4***			-9,200.39***	-10,280.7***
	(1,328.63)			(1,448.25)	(1,333.91)
Barron's Less Competitive	-10,016.4***			-8,258.93***	-10,002.3***
	(1,563.87)			(1,668.91)	(1,558.91)
Barron's Non-Competitive	-11,362.5***			-7,701.20***	-11,356.3***
	(1,517.56)			(1,638.48)	(1,512.53)

Barron's Special	-8,400.1**			-12,211.8***	-8,323.9**
	(2,689.10)			(2,979.96)	(2,807.97)
Public	1,458.17**			2,732.57**	1,401.05
	(464.72)			(910.68)	(816.65)
Constant	31,273.20***	35,820.34***	15,830.46***	24,584.39***	28,267.12***
	(1,256.46)	(1,628.35)	(3,274.55)	(4,284.49)	(3,960.83)
College Major Fixed Effects	Y	N	N	N	Y
Observations	4,820	4,820	4,820	4,820	4,820
R-Squared	0.26	0.05	0.07	0.08	0.26

Notes: Observations are rounded to nearest ten, per NCES guidelines. Models are limited to only those who reported having a job in 2009. Cumulative loan debt is instrumented with concurrent enrollment indicator interacted with household size. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05). Reference categories are white, 1st income quintile (lowest), and Barron's 'Most competitive' category.

Table B.8: OLS/2SLS Models Explaining the Impact of Debt on Earnings 4 Years after Graduation with Major Fixed Effects

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
Cumulative Loans/10,000	333.86	-640.21	-897.26	-669.49	-1,599.96
	(190.33)	(1,041.20)	(1,016.95)	(1,148.00)	(1,088.88)
Female	-5,850.22***	-9,905.20***	-9,392.88***	-9,643.81***	-5,606.65***
	(767.00)	(749.24)	(761.43)	(755.54)	(773.47)
Black	-2,136.95	-3,627.04**	-451.06	-1,095.31	-2,014.36
	(1,261.64)	(1,298.60)	(1,319.45)	(1,306.68)	(1,266.30)
Hispanic	-1,073.53	-1,746.11	-472.50	-1,504.88	-1,528.14
	(1,247.70)	(1,315.17)	(1,338.62)	(1,343.91)	(1,294.26)
Asian	4,789.87*	9,595.06***	8,860.35***	6,593.02**	3,872.37
	(1,991.30)	(2,362.88)	(2,264.24)	(2,196.74)	(2,130.54)
Other Race	533.75	-113.51	357.44	-115.61	687.51
	(2,126.21)	(2,250.37)	(2,280.62)	(2,291.71)	(2,191.87)
2nd Income Quintile	461.19	941.96	805.80	536.36	1,168.44
	(1,173.85)	(1,324.61)	(1,302.36)	(1,280.38)	(1,223.68)
3rd Income Quintile	137.39	-1,269.24	-1,044.22	-980.68	934.74
	(1,180.58)	(1,339.16)	(1,310.08)	(1,294.84)	(1,251.59)
4th Income Quintile	2,808.39*	519.43	868.96	1,118.72	3,216.90*
	(1,231.88)	(1,342.03)	(1,318.43)	(1,300.99)	(1,264.01)
5th Income Quintile	6,198.42***	4,770.10**	4,616.91**	4,004.23**	5,809.76***
	(1,408.62)	(1,477.49)	(1,455.10)	(1,432.11)	(1,421.04)
Parent(s) HS thru Some College	-1,724.73	-1,863.47	-2,211.78*	-2,395.47*	-1,608.94
	(902.25)	(986.38)	(973.54)	(957.39)	(916.16)
Parent(s) >= Bachelor's Degree	-859.01	-350.63	-1,608.36	-2,146.39*	-1,729.69
	(873.74)	(1,040.14)	(1,012.91)	(1,043.40)	(994.93)
GPA	3,296.25***		2,362.40**	3,353.38***	2,484.75**
	(756.90)		(867.69)	(905.82)	(881.46)
SAT/100	402.48		1,715.32***	614.18*	290.87
	(240.04)		(244.79)	(257.21)	(256.56)
Barron's Highly Competitive	-10,322.7***			-7,336.31*	-9,226.39**
	(2,743.10)			(2,920.25)	(2,819.44)
Barron's Very Competitive	-15,149.7***			-13,313.9***	-14,469.6***
	(2,640.51)			(2,749.67)	(2,669.85)
Barron's Competitive	-18,031.7***			-16,384.4***	-17,253.0***
	(2,624.77)			(2,738.79)	(2,659.57)
Barron's Less Competitive	-17,867.0***			-15,847.7***	-17,451.5***
	(2,801.97)			(2,879.84)	(2,807.17)
Barron's Non-Competitive	-21,108.4***			-17,118.6***	-20,517.6***
	(2,821.43)			(2,921.24)	(2,848.69)

Barron's Special	-14,514.0***			-15,047.1***	-11,328.78**
	(3,862.33)			(4,308.32)	(4,258.02)
Public	1,306.52			221.76	-693.52
	(711.25)			(1,384.67)	(1,347.35)
Constant	34,239.60***	46,061.68***	20,185.15***	42,981.37***	42,078.78***
	(4,704.87)	(2,379.13)	(5,193.95)	(6,658.62)	(6,616.36)
College Major Fixed Effects	Y	N	N	N	Y
Observations	4,680	4,680	4,680	4,680	4,680
R-Squared	0.19	0.06	0.08	0.10	0.17

Notes: Observations are rounded to nearest ten, per NCES guidelines. Models are limited to only those who reported having a job in 2012. Cumulative loan debt is instrumented with concurrent enrollment indicator interacted with household size. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05). Reference categories are white, 1st income quintile (lowest), and Barron's 'Most competitive' category.

Table B.9: Binary Probit Models for the Probability of Becoming a Teacher or Having a Job Unrelated to a Student's College Major Limited to those Employed

	(1)	(2)	(3)
	Teacher 2009	Teacher 2012	Job Unrelated 2009
Cumulative Loans/10,000	0.005	-0.007	-0.026
	(0.016)	(0.019)	(0.023)
Female	0.055***	0.084***	0.027*
	(0.008)	(0.010)	(0.013)
Black	-0.032	-0.012	0.037
	(0.018)	(0.023)	(0.029)
Hispanic	-0.032*	-0.024	0.011
	(0.016)	(0.019)	(0.026)
Asian	-0.069***	-0.073***	-0.026
	(0.013)	(0.019)	(0.029)
Other Race	-0.052*	0.006	0.020
	(0.021)	(0.032)	(0.039)
2nd Income Quintile	0.018	0.037*	-0.012
	(0.015)	(0.018)	(0.026)
3rd Income Quintile	0.034*	0.046*	0.002
	(0.016)	(0.019)	(0.026)
4th Income Quintile	0.045**	0.062***	-0.007
	(0.015)	(0.018)	(0.026)
5th Income Quintile	0.035*	0.035	-0.022
	(0.016)	(0.018)	(0.026)
Parent(s) HS thru Some College	0.020	0.024	0.021
	(0.013)	(0.016)	(0.021)
Parent(s) >= Bachelor's Degree	0.016	0.019	-0.011
	(0.014)	(0.016)	(0.021)
GPA	0.095***	0.089***	-0.112***
	(0.015)	(0.015)	(0.017)
SAT/100	-0.007*	-0.007	0.007
	(0.003)	(0.004)	(0.005)
Barron's Highly Competitive	0.039	0.034	0.006
	(0.024)	(0.029)	(0.034)
Barron's Very Competitive	0.002	0.015	0.034
	(0.020)	(0.025)	(0.030)
Barron's Competitive	0.034	0.023	0.021
	(0.021)	(0.026)	(0.031)
Barron's Less Competitive	0.011	0.017	0.022
	(0.024)	(0.031)	(0.039)

Barron's Non-Competitive	-0.015	0.000	0.004
	(0.023)	(0.030)	(0.037)
Public	0.018	-0.009	-0.043
	(0.019)	(0.022)	(0.027)
Observations	4,820	4,680	4,820
AIC	22,144.00	22,210.00	24,979.00
Log Pseudo Likelihood	-11,020.00	-11,051.00	-12,438.00

Notes: Observations are rounded to nearest ten, per NCES guidelines. Average marginal effects reported. Models are limited to only those who reported having a job. Cumulative loan debt is instrumented with concurrent enrollment indicator interacted with household size. Robust standard errors in parentheses (*** p<0.001, ** p<0.01, * p<0.05). Reference categories are white, 1st income quintile (lowest), and Barron's 'Most competitive' category.