

Effects of Undergraduate Financing

The Effects of Undergraduate Financing on Advanced Degree Attainment

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This study examines the effects of undergraduate financing on subsequent advanced degree attainment in a context characterized by a shift away from traditional grant aid programs and toward widespread student loans. Using data from the National Survey of College Graduates, 2SLS Lewbel method regressions estimate the effects of having received undergraduate grant aid and having student loan debt on the chances of attaining an advanced degree during the next ten years. Results suggest a large positive influence of receiving undergraduate grant aid on advanced degree attainment (+8.5%), thus boosting higher education attainment far beyond only an undergraduate degree across college graduation cohorts between 1986 and 2007. Conversely, having loan debt upon college graduation affected the chances of advanced degree attainment negatively. The increased reliance on loans during undergraduate studies coincided with its long-term (or “spillover”) effect on advanced degree attainment being null in the late 1980s to a substantive deficit of more than 4 percentage—points from the 2000s onward. Counterfactual projection models suggest that loan-taking after the 1992 Higher Education Act suppressed the number of advanced degree holders in the US labor market and will continue to do so given current undergraduate financing patterns.

Introduction

Higher education expansion, in particular in terms of the increasing number of conferred advanced degrees, is associated with positive outcomes for both macroeconomic progress and the socioeconomic wellbeing of degree holders (Hout 2012). Neoclassical theory posits that more college graduates pursuing

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an advanced degree boosts economic growth because having more “high-skill” members of the workforce raises productivity (Hulten 2019). In addition, sociological research suggests that higher education expansion, coinciding with improved access to the upper tiers of the system, should positively impact the equality of opportunity within both education and the labor market (Halsey 1977; Mare 1981; Torche 2011). This implies educational selection and allocation that is primarily reliant on merit and achievement as long as students are not confronted with impassable barriers for attendance (Treiman 1970).

The US higher education system traditionally relies on considerable family contributions to college tuition (Carnegie Commission on Higher Education 1973), but it also includes a combination of grant aid and student loans at the federal and state level to facilitate college attendance for students who could otherwise not enroll. As the model of undergraduate financing underwent several changes in recent decades (i.e., the 1992 reauthorization of the Higher Education Act), this study evaluates the effectiveness of the two pillars of higher education financial assistance—*undergraduate* grant aid and student loans—regarding the chances of obtaining advanced degrees from US institutions in the future. In this study, the term “grant aid” refers to both merit- and need-based scholarships.

Both grant aid and student loans have been studied extensively by sociologists and educational researchers regarding their capacity to attract high school graduates to college, expand college choices, and encourage college persistence and completion (Goldrick-Rab, Harris, and Trostel 2009). Many studies that examine need-based grant aid and student loans report positive effects on many intended educational outcomes, albeit with some thresholds (Dwyer, McCloud, and Hodson 2012). Findings that contradict these patterns (e.g., Paulsen and St. John 2002) undergo rigorous methodological reflections (e.g., Alon’s [2005] caution regarding model misspecification in studies of college completion) and are frequently revisited and tested using new data. Given the increasing relevance of graduate school attainment for labor market stratification, it is paramount to examine the accessibility of advanced degrees and to pay close attention to the financial opportunities *and* the financial hurdles that remain part of the system. This paper focuses on the effects of the type of financing of the undergraduate degree on attaining an advanced degree: master’s, professional degrees, and doctorates.

The influence of undergraduate finance sources on *post*-baccalaureate educational attainment is important to explore for two reasons. First, there is a growing advantage of holding at least a master’s degree for entry into high-paying occupations, including those for which a bachelor’s degree previously sufficed. The rising demand for higher education credentials implies that advanced degrees are becoming more critical for access to middle-class jobs and, therefore, access to the financial means to pursue such degrees are paramount for maintaining current levels of equality of opportunity. Second, financing US undergraduate education has changed dramatically over the past three decades. The 1992 reauthorization of the Higher Education Act was significant because it steered undergraduate financing away from grant aid—a shift that also allowed

unsubsidized Stafford loans (Dwyer, McCloud, and Hodson 2012; Dynarski 2003; Hillman 2015; Perna 2001, 2006). At the same time, tuition at both public and private colleges increased dramatically and the purchasing power of the Pell Grant steadily decreased (Goldrick-Rab 2016; Perna 2006).

These developments mean that student loans have become an important, and often necessary, financing instrument for a growing number of college attendees. They raise the question of whether disparate forms of financial aid received early during a student's undergraduate studies spill over to post-baccalaureate education and continue to encourage, or possibly discourage, pursuit of advanced degrees. We ask whether provision of the different forms of financial means to attend an undergraduate program creates a sufficient boost to influence advanced degree attainment and, thereby, affect educational opportunity. This study reports the treatment effects of two antipodal undergraduate financing resources—receiving grant aid and taking out a student loan—on earning an advanced degree within ten years after earning a bachelor's degree. The reported treatment effects can be interpreted as the counterfactual scenarios to never receiving grant aid and having no student loan debt, respectively, on the chances of attaining a master's degree or higher.

A literature review discusses the increasing relevance of advanced degree attainment for social inequality, and the known associations between both forms of undergraduate financing and milestones in higher education. To identify the effects of undergraduate financing sources, our modeling includes statistical techniques that address confounding variables and selection bias. A series of estimation models are used to obtain robust treatment effects of grant aid and student loans, net of each other, alternative financing strategies (e.g., family or student contributions), and several sociodemographic and education-context covariates. We also discuss potential limitations due to remaining overcontrol bias and collider bias. Sample sizes from the NSF's National Survey of College Graduates (2017) also allow us to analyze how these effects changed across undergraduate cohorts (i.e., post-1992 Higher Education Act) and test for heterogeneous effects along race/ethnicity and parental background. Finally, fitted estimation models were used to measure what a hypothetical “no loan-taking” higher education environment would have meant for the number of advanced degree graduates who entered the US labor force among pre- and post-1992 cohorts.

Literature Review

Stratification along Advanced Degrees

Advanced degree attainment plays an increasing role in two important trends of concern to scholarship on stratification and inequality. First, skill and degree requirements have risen across post-industrial societies, especially in the United States, where advanced degrees yield higher returns than ever before (Lindley and Machin 2016). As a result, college students are commonly encouraged to

pursue graduate degrees to advance their careers in a highly competitive labor market (Baum, Ma, and Payea 2010; Pyne and Grodsky 2020; Valletta 2015; Wendler et al. 2010). Such academic goals are also common among college first-years; a nationally representative Fall 2015 survey suggested that 38 percent expect to attend graduate school (Eagan et al. 2015). In part resulting from persistent competition in the higher-educated segment of the US labor market (Horowitz 2018), the share of advanced degree holders nearly doubled during the first decades of the 21st century: from about 8.6 percent (2000) to 14.1 percent (2020) (Kena et al. 2016; U.S. Census 2021).

Second, rising higher education attendance has been theorized to improve the equality of opportunity within both education and the labor market (Treiman 1970) and, as a result, yield higher levels of social mobility. While the temporal trends of educational equalization vary across countries (Breen 2010; Breen and Jonsson 2005), research on the United States has shown that educational attainment has increased most among children from high-income families, thereby inducing more inequality. Regarding the labor market outcomes of college graduates, some sociologists found that US higher education expansion indeed corresponded to declining role of ascriptive factors (i.e., social origin) in destination class, occupation, and earnings level (Hout 1984, 1988; Torche 2011). However, studies have since reported contradictory findings (Witteveen and Attewell 2017; Zhou 2019), including persisting origin effects on the labor outcomes among advanced degree holders (Torche 2011; Manzoni 2021; Witteveen and Attewell 2020). Some of these findings can be explained by the compositional effect of educational expansion (Hout 1988), which implies that higher education increases social fluidity but could simultaneously dampen it through selective attainment of advanced degrees (Pfeffer and Hertel 2015). This is because the relationship between offspring and postgraduate attainment remains strong. More specifically, US higher education expansion, consisting of ever more attendees at the master's, professional, and doctoral levels, has thus far been insufficient to offset the growing inequalities within the educational system (Bloome, Dyer, and Zhou et al. 2018).

Higher Education Financing Policy and Access

The bottleneck of persisting educational inequality may be rooted in the system's costs and financing system. The United States pioneered the developed world by expanding its higher education system and providing access to students of a wide variety of socioeconomic backgrounds. This expansion was in large part driven by the 1965 Higher Education Act that nearly tripled the fiscal support of states to their public universities between the early 1960s and the late 1970s (Mortensen 2015). Despite these substantial public financing streams, the system has always been predicated on the assumption of families (parents) contributing to students' college attendance costs, including the tuition and fees (Carnegie Commission on Higher Education 1973). However, from the 1980s onward, state appropriations of public higher education significantly dropped from about

\$10 per \$1,000 of state income to just over \$6 per \$1,000 in 2010 in constant dollars (Goldrick-Rab 2016).

Higher education policies of the 1990s mark a critical turning point. The emphasis shifted from financing through need-based grants for low-income students to mass provision of student loans (Paulsen and St. John 2002), as well as merit-based grants (Tierney and Venegas 2009). Critically, the 1992 Higher Education Act authorized unsubsidized Stafford Loans and expanded the eligibility of subsidized loans. Federal student loans became the key financial resource for students and families who could otherwise not afford tuition costs (Paulsen and St. John 2002; Perna 2001). Furthermore, states funded smaller amounts of the costs of higher education, thereby passing on an increasingly larger share to students and families in the form of tuition (Archibald and Feldman 2011; Baum and Ma 2014). The costs of college attendance skyrocketed in the 2000s and 2010s, while middle-class income growth stagnated, outpacing average growth of household financial means (Bozick 2007; Goldrick-Rab 2016; Perna 2006).

These trends and policy shifts have had major consequences for the loan-taking behavior of college students. As of 2018, a majority of undergraduates utilized federal or nonfederal student loans (Sallie Mae 2019), while some parents are asked to contribute substantial amounts through the Parent PLUS Loan or private loans (Cha, Weagley, and Reynolds 2005). Of all costs for education—tuition and fees—43 percent comes from families, 33 percent from grant aid, and 24 percent from borrowed money (Sallie Mae 2019). As argued by Choy and Berker (2003), the current financing system has led to a “middle-class squeeze” as families in the middle of the income distribution are most vulnerable for large loan debts and defaults. They often do not qualify for need-based grant aid and lack the savings to fund a college degree.

Effects of Grant Aid

Research on college completion provides robust evidence of a positive effect of grant aid, including need-based scholarships and tuition remission programs, on college access (e.g., Perna 1998), undergraduate persistence (e.g., Bettinger 2015), and completion of bachelor’s degrees (e.g., Goldrick-Rab et al. 2016; Nguyen, Kramer, and Evans 2019). These positive effects are also evident among institutional or merit-based undergraduate grants (e.g., Gross, Hossler, and Ziskin 2007). Designed to enable students of disadvantaged socioeconomic backgrounds to attend higher education institutions undergraduate grant aid functions as a subsidy, directly reducing the amount of family and student contributions to college tuition. Grant aid programs also reduce the number of required student work hours so that more time can be devoted to studying, resulting in greater chances of graduation.

We argue that undergraduate grant aid is *also* relevant for future advanced degree attainment. Since grant aid reduces pressure on family resources directly, individuals who receive grant aid as undergraduates presumably enjoy greater financial leverage to make new investments after college graduation. In other

words, grant aid can avoid depletion of family resources during one's undergraduate studies which, all else equal, improves the chances of future attendance of graduate school. Besides the evident positive effects on students' undergraduate studies (a short-term outcome), it is plausible that one component of undergraduate grant aid's total impact on higher education attendance comprises of a "spillover effect" on post-baccalaureate education. This assumed positive relationship should be considered a long-term effect of decreasing financial hurdles in the early stages of the higher education career.

Aside from a conceptual model of grant aid affecting post-baccalaureate student decisions (Heath and Tuckman 1987), few studies examine the relationship between undergraduate grant aid and advanced degree attainment, and none use nationally representative data. The most prominent is an evaluation of the Kentucky Educational Excellence Scholarship (KEES), a merit-based aid program analogous to Georgia's HOPE scholarship. Delaney (2011) finds that receiving the KEES scholarship positively predicted graduate school enrollment between 1990 and 2005. Although the KEES scholarship does not provide funds for graduate school, the author uses price theory to explain the results. Net of covariates of KEES eligibility and other predictors of advanced degree attainment, grant aid recipients have greater financial resources available to cover the cost of graduate school.

Effects of Loans

Research assessing the effects of college loans on indicators of undergraduate success, such as college persistence (e.g., Chen & DesJardins 2010) and bachelor's degree completion (e.g., Dwyer, McCloud, and Hodson 2012), identifies moderate positive effects of smaller and subsidized loans. Regarding post-baccalaureate educational attainment, early studies focus on initial transitions after college graduation, such as applying to or enrolling in a graduate program. Studies using data from the 1980s cohorts and older consistently report null effects of undergraduate borrowing on the chances of graduate school application and enrollment (Baum and Saunders 1998; Schapiro, O'Malley, and Litten 1991; Weiler 1991), using the National Student Loan Survey, the Consortium on Financing Higher Education (selective private institutions only), and the High School & Beyond 1980, respectively. One exception is Fox (1992), who finds that undergraduate loan debt predicts graduate school enrollment among women negatively, but not among men, in the Survey of College Graduates 1986.

Studies that concentrate on the relationship between undergraduate loans and post-college education in cohorts who graduated after 1992 report more inconsistent findings, partially due to using a variety of (successful) post-baccalaureate educational behavior definitions. The most recent empirical study, by English and Umbach (2016), uses Beginning Postsecondary Study 2000/2001 data to assess the association between the amount of undergraduate debt and three sequential indicators of graduate school attendance—graduate school aspirations, applications, and enrollments. The authors expected a negative relationship based on price theory, but they instead find null effects; among

college freshmen from 2000, loan debt did not appear to influence any stage of entering graduate school.

Assessing the transition period in higher education financing across the late 1980s and early 1990s, Kim and Eyermann (2006) use nationally representative data from the Cooperative Institutional Research Program 2006 to compare the association between undergraduate borrowing and graduate school attendance in cohorts before (1985–1989) and after (1994–1998) the 1992 Higher Education Act (1985–1989). A small negative effect was found in the former, but analysis of the post-1992 cohort suggested a positive effect of borrowing on graduate school attendance, particularly among middle-class students.¹

Few studies report negative associations between undergraduate loan debt and indicators of advanced degree attainment (Choi 2014), though they are based on a variety of specific subgroups of college graduates and advanced degree types. Millett (2003) assesses a sample of undergraduate students who intended to pursue a doctorate degree in the Baccalaureate and Beyond 1993 (B&B'93) data, finding that students who carried loan debts were less likely to apply to graduate school after college graduation but were not less likely to obtain a degree conditional on enrollment.

Only two studies use statistical techniques that counter confounding variables and selection bias (see Alon 2005; Dowd 2008). Malcom and Dowd (2012) measure the effect of the amount of undergraduate borrowing on graduate school enrollment among a subsample of STEM graduates in the National Survey of Recent College Graduates 2003, finding negative effects of debt across all ethnic/racial groups. Relying on observables, the study addresses selection bias by using a propensity-score matching design. Using an instrumental variable (IV) approach to further account for endogeneity due to unobservables, Zhang (2013) similarly finds that undergraduate loan debt affects graduate school enrollment negatively among public college graduates in the B&B'93 data, with null effects among a subsample of private college graduates.

Analytical Approach

Several gaps regarding the relationship between undergraduate financing and graduate school appear in extant research, the most salient being the absence of estimating the effects of undergraduate grant aid and student loans on the propensity of attaining an advanced degree, and no study estimates this relationship using a representative sample of US college graduates. Combining evidence from various stages of obtaining an advanced degree, researchers report conflicting undergraduate financing effects on graduate school enrollment (i.e., null, negative, and positive), as well as for completing advanced degrees conditional on graduate school enrollment (i.e., null). This study concentrates solely the *long-term* effects of grant aid and loan-taking by employing a modeling strategy to identify the treatment effect of both types of undergraduate financial aid, versus not receiving them, on completing a master's degree or higher.

Although no prior study has examined the effect of undergraduate grant aid on advanced degree attainment using nationally representative data, we hypothesize a positive effect. Using price theory (see [Delaney 2011](#)), we argue that grant aid leaves more financial means available for college graduates to enter graduate school and to then complete the program. Similarly, we hypothesize a negative effect for student loan-taking, assuming that loan-takers have fewer resources available for graduate school because their financial means have already been exhausted, and college graduates thus must make loan repayments. Research suggests that financial pressures resulting from undergraduate borrowing are associated with multiple lower levels of post-baccalaureate investments, including purchasing a house and marriage ([Baker, Andrews, and McDaniel 2017](#)).² Since such post-college (financial) hurdles contain inequalities along family background and race and ethnicity (see [Houle 2013](#); [Perna 2004](#); [Pyne and Grodsky 2020](#)), we also test for sociodemographic heterogeneous effects through interactions with the treatment variables.

We further argue that a study of the relationship between undergraduate financing and advanced degree attainment should systematically compare bachelor's degree cohorts who graduated after the 1992 Higher Education Act with previous cohorts (here as early as 1986). Although higher education financing behaviors have changed gradually since the 1980s ([Goldrick-Rab 2016](#)), the 1992 Higher Education Act marks a markedly reduced availability and coverage of undergraduate grant aid, as well as loans becoming the most prominent financing strategy for bachelor's degree students. Using cohort interactions, our analyses examine whether the effects of undergraduate financing on the propensity to attain an advanced degree changes over time—both in terms of direction and size.

The fitted “counterfactual” prediction models are then used to answer a series of policy-relevant questions concerning counterfactual scenarios to the current student loan crisis. First, we ask how many more advanced degree graduates would have been created in the US labor force had students not taken out substantive student loans—an exercise that mimics a higher education context in which college students did not have to take out loans. These analyses are conducted separately for cohorts of college graduates who were enrolled prior to (1986–1996) and after (1997–2007); the 1992 Higher Education Act was enacted. Second, using data from the most recent cohorts of college graduates (2008–2016)—not used during model fitting—we repeat the exercise, estimating how many college graduates would have entered the US labor market had they not graduated with substantive student loan debt.

Finally, as argued by [DesJardins and Toutkoushian \(2005\)](#), [Alon \(2005\)](#), and [Dowd \(2008\)](#), some observed variation in the propensity of advanced degree attainment is a function of unmeasured factors that are typically not controlled for in models of education decision-making or other attainment outcomes. Since [Zhang's \(2013\)](#) analysis of the effect of undergraduate loan debt on graduate school enrollment in the B&B'93 cohort using an IV approach, no study has addressed endogeneity bias. In addition to unobserved variables, causal inferences might suffer due to bias from selection into treatment

(Alon 2005; Dowd 2008)—i.e., receiving grant aid and taking out a student loan. One way to address this is to artificially balance treatment and control groups using propensity-score matching (see Malcom and Dowd, 2012). We employ a combination of several different estimators (generated IVs, inverse-probability-weighted regressions, and autoregressive methods) to estimate the treatment effects of undergraduate financing.

Data

Nationally representative data from the National Survey of College Graduates of 2017 (NSCG'17) are used to address the research questions. The survey draws on sampling by the American Community Survey (ACS) and was administered by the Census Bureau and the National Science Foundation (NSF 2017). The dataset represents individuals with at least a bachelor's degree graduates who reside in the United States. The initial NSCG'17 sample consists of 76,000 cases, representative of 61 million college graduates in the United States. The NSCG'17 was built by the Census Bureau and draws on a returning sample from the NSCG'10 (selected from the 2009 ACS), a returning sample from the NSCG'13 (selected from the 2011 ACS), a returning sample from the NSCG'15 (selected from the 2013 ACS), and a new sample selected from the 2015 ACS, with a total response rate of 71 percent. Their sampling frame is based on demographic group (age, race, ethnicity, sex, and citizenship), highest degree earned, bachelor's degree major, and occupation. The NSCG (Census Bureau) provides sample weights based on sampling selection and nonresponse, and corrections for complex sampling techniques (i.e., trimming, raking, overlap procedures).

For comparability, the study sample includes only participants who obtained their first bachelor's degree in the United States and who were between the ages of 18 and 30 when they graduated. Cases are selected for the sample from graduation cohorts between 1986 and 2007, so that it (1) covers both pre-1992 cohorts and as many post-1992 cohorts as possible, and (2) allows for sufficient time (i.e., ten years) between conferment of a bachelor's degree and advanced degree attainment. After selections, the study sample consists of 43,734 cases.

We define the dependent variable as having completed *any* advanced degree within ten years after college graduation, including master's degrees and equivalents, professional degrees (e.g., JD and MD), and doctoral degrees. This operationalization is preferred because a large number of students who went beyond the bachelor's degree obtained multiple graduate school credentials (22.3 percent), such as combinations of master's degrees and professional degrees and likely "en route" masters to a doctoral degree. Selection of the control variables is based on identified correlates of advanced program attendance and treatments in extant research (see Bedard and Herman 2008; Mullen, Goyette, and Soares 2003), which we discuss below. One variable unavailable in the NSCG'17 is undergraduate GPA, a limitation discussed and addressed during modeling.

Methods

The treatments are having received undergraduate grant aid (dichotomous), undergraduate loan-taking (dichotomous), and undergraduate loan amount (ordinal), indicated as X_i in the functional form equations. The grant aid variable is derived from answering the combined option “tuition waivers, fellowships, grants, scholarships” on the NSCG survey question “how did you finance your undergraduate degree?” The loan-taking variable is derived from confirming the combined option of “[undergraduate] loans from schools, banks, federate or state governments.” The total loan amount was obtained using an ordinal scale in the survey and is transformed into a simpler categorical variable, specifying categories form “no loan,” “small loan” (less than \$10,000), and “heavy loan” (\$10,000 or more). While the meaning and interpretation of what counts as a heavy loan is debated among higher education scholars, the cut-off of \$10,000 is based on the students’ loan amount being above the median in our data. About 50 percent of college graduates in our 1986–2007 sample held either no loan debt or debt less than \$10,000 upon graduation, which is in line with averages reported by [College Board \(2007, table 4\)](#). [Supplementary Appendix A](#) presents a robustness check with slightly different cut-offs.

The information from the respondent’s *first* bachelor’s degree is used for measurement referring to the undergraduate program. Any subsequent educational attainment behavior is likely influenced by the earliest stages in the higher education trajectory ([Alon 2005](#)), which is why we do not control for factors related to undergraduate degree attainment after the first bachelor’s degree. All models adjust for a sociodemographics matrix D (i.e., gender, race, parental education, childhood geographic U.S. region, and foreign-born), an undergraduate matrix C (i.e., Carnegie class, major, type of institution, prior community college attendance, graduation year, and age at graduation), and an “other financing streams” matrix F (i.e., family contribution [dichotomous], student’s own contribution through savings [dichotomous], and the grant aid [dichotomous] or loan amount [ordinal]), depending on which treatment measurement is optimized. The functional form of predicting the probability of attaining an advanced degree within ten years after a bachelor’s degree (Y_p) is defined by

$$Y_p = X_i\beta + D_i\gamma + C_i\omega + F_i\phi + \varepsilon_i$$

Three techniques are used to measure the net effect of undergraduate financing on advanced degree attainment using linear probability models.³ First, [Lewbel’s \(2012\)](#) two-stage least squares method is used to account for omitted variables, which if ignored, cause bias in treatment variable estimates. The approach is based on a standard IV or 2SLS method, which overcomes the most common problem encountered in IVs—instruments that violate the exclusion restriction. In the absence of appropriate IV parameters, the Lewbel 2SLS procedure builds external instruments from regressors that are uncorrelated with the product of heteroskedastic errors, which is possible when the (sum of the) error correlations reflect an unobserved predictor variable. During the first-stage

regression, instruments are constructed from standard equation residuals, which should have no covariance, multiplied by each of the mean-centered control variables. The products of these multiplications are sizeable in case of scale heteroskedasticity in relation to predictor variables, and thus the greater the scale heteroscedasticity, the greater the correlation of the generated instruments with the treatment variable. These generated (exogenous) instruments must be homoscedastic (Baum and Lewbel 2019). In other words, the theoretical assumption is that the remaining errors are completely idiosyncratic and not correlated with the generated instruments. This can be confirmed using a Pagan and Hall (1983) test (Supplementary Appendix B). The second stage includes the generated IV and calculated the treatment coefficient of the Lewbel 2SLS.

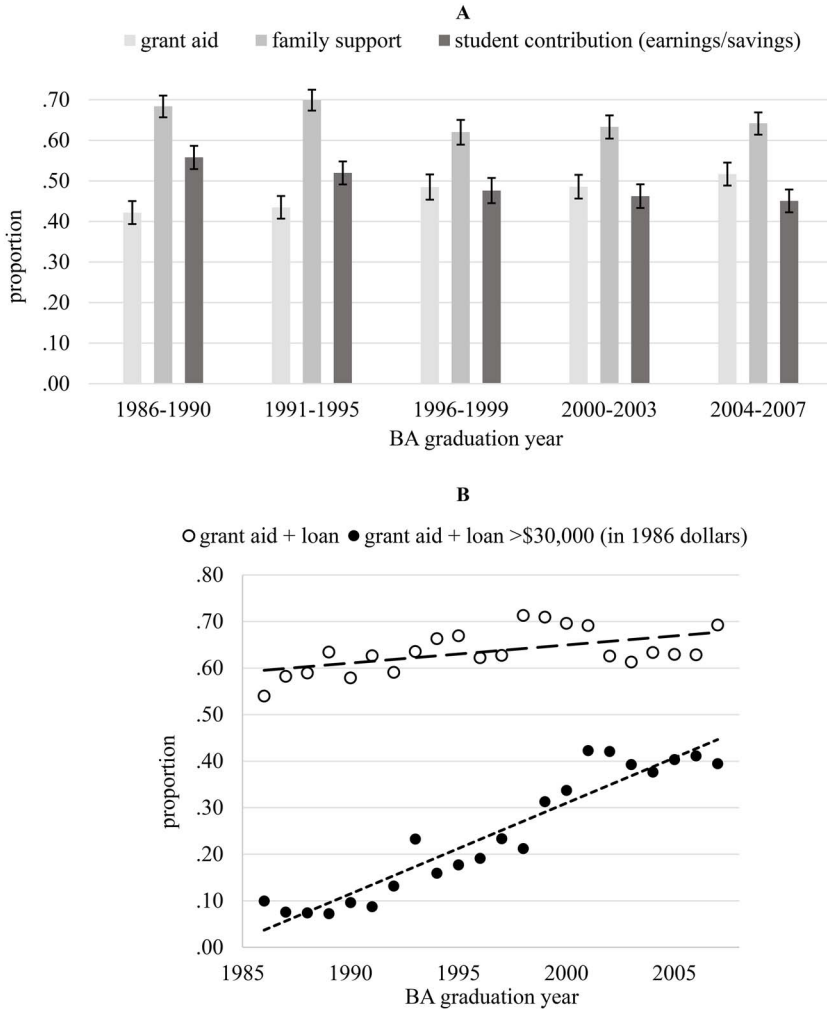
Second, improving on standard ordinary least squares regression, the cross-validation method of double-lasso (“least absolute shrinkage and selection operator”) regressions, which originates in machine learning, fits an autoregressive model (Belloni, Chernozhukov, and Hansen 2014). It optimizes both sensitivity and specificity among our large number of predictors, thereby avoiding overfitting and strengthening the external validity of the treatment effects. Third, augmented inverse-probability weighted (AIPW) regressions account for bias due to selection into treatment (Funk et al. 2010; Imbens 2004), a technique that has commonalities with the propensity-score matching used by Malcom and Dowd (2012). AIPWs overcome selection bias by reweighting treatment and control groups such that cases have pseudo-counterfactuals. To avoid redundancy in the presentation of the analysis, the main section of the paper only reports the results from the Lewbel 2SLS method. The estimates from the double-lasso and AIWP regressions are presented in Supplementary Appendices B and C, respectively. The three methods produce very similar results.

Findings

Descriptive Statistics

Figure 1 shows two changes observed across the cohorts. In figure 1A, first bachelor’s graduation cohorts are split into five larger groups, showing the propensity of receiving grant aid (leftmost bar), family support (middle bar), and tuition contributions from the student (rightmost bar). Although the purchasing power of grant aid has decreased over time—the Pell Grant particularly—a noticeable higher proportion of recent graduation cohorts had received it during their undergraduate studies as compared with the late-1980s and early-1990s. Despite rising costs of college attendance, the share of students who self-contribute decreased only slightly between the 1986 and 2007 cohorts, while the share of students who relied on family support remained around 65% on average across the same time span.

Figure 1B, however, shows the most important change over time. The graph reports the loan-taking behavior of grant aid recipients *only*. In most cases, undergraduate students receiving grant aid supplemented their college financing

Figure 1. Undergraduate Financing Resources (1986–2007).

Source. Author's calculations of the National Survey of College Graduates 2017. Notes. Graph A contains data from the full study sample, consisting of first-time BA recipients from US institutions between 1986 and 2007, obtained under age 30 ($N = 27,944$). Graph B only selects BA recipients who had received grant aid ($N = 14,823$). Loans reflect the amount owed upon BA graduation. Sample weights are applied.

with a loan (hollow dots), and this propensity increased only slightly between the late-1980s (60 percent) and mid-2000s (65 percent). Importantly, the combination of receiving grant aid and “heavy” undergraduate borrowing (i.e., a loan of \$30,000 or more in 1986-constant dollars) increased steeply from around 10–40 percent across the same time span. A similar pattern appears if the undergraduate

Table 1. Descriptive Statistics of Dependent and Treatment Variables: Proportions by Race/Ethnicity and Parental Background

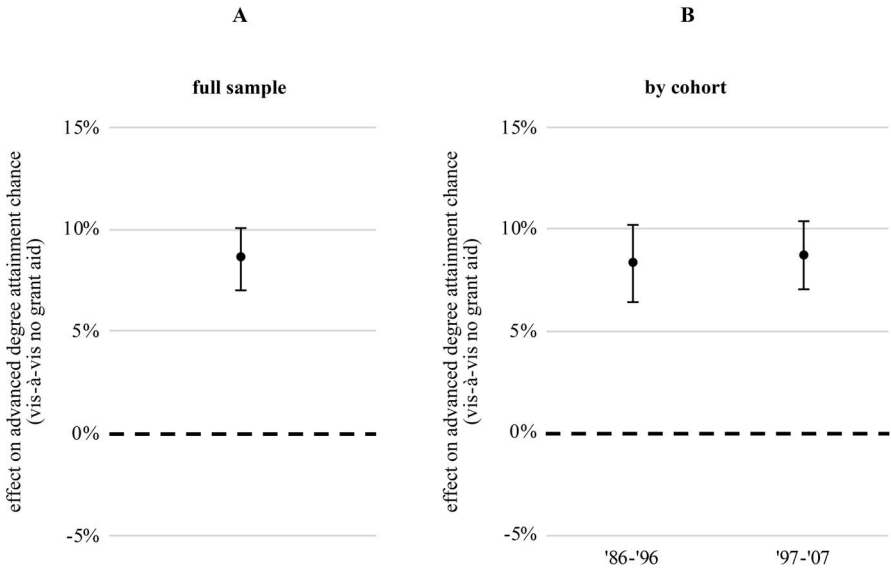
	Dependent Variable	Treatment Variables		Controls: Substitutes/Supplements	
		Grant Aid	Loan-Taking	Family Support	Student Contribution
Race/Ethnicity					
White	.385	.455	.492	.687	.512
Black	.412	.582	.717	.471	.408
Hispanic	.365	.540	.560	.524	.452
Asian	.439	.422	.447	.697	.416
Parental background					
Non-college educated	.336	.511	.614	.544	.537
College educated	.427	.438	.434	.740	.461
Study sample	.388	.469	.511	.657	.493

Source. Author's calculations of the National Survey of College Graduates 2017.

Notes. Study sample consists of first-time BA recipients from US institutions between 1986 and 2007, obtained under age 30. Loan-taking is based on the loan amount owed upon college graduation, and 95% confidence intervals between parentheses. Student contribution includes both earnings and savings. Sample weights are applied.

loan amounts were not inflation-adjusted. In other words, graduates with the most urgent financial need of receiving grant aid were increasingly more likely to borrow large amounts for their undergraduate degrees.

Table 1 shows descriptive statistics for the dependent variable (i.e., advanced degree), the treatment variables (i.e., grant aid and loan-taking), and substitutes or supplements of undergraduate financing (i.e., family support and student contributions), both the totals and split by race and parental background. Corroborating extant research, the propensity of attaining an advanced degree does not vary across racial/ethnic groups but does so along parental background groups (i.e., students from higher-educated families more commonly attaining advanced degrees). Historically disadvantaged groups (i.e., first-generation college students and racial/ethnic minorities) are more likely to receive forms of grant aid, as expected, but they are also more likely to take out student loans and less likely to receive family support. Whites and first-generation students are more likely to contribute to college costs using their current earnings or savings. Henceforth, models include the substitutes and supplements of undergraduate financing, while interactions with parental education and race/ethnicity groups assess whether the effects of grant aid and loans operate differently.

Figure 2. Grant Aid Effect on Advanced Degree Attainment (1986–2007).

Source. Author's calculations of the National Survey of College Graduates 2017. Notes. Study sample consists of first-time BA recipients from US institutions between 1986 and 2007, obtained under age 30 (Graph A). Graph B plots estimates by college graduation cohort group: '86–'96 ($N = 10,800$) and '97–'07 ($N = 17,105$). Estimates are adjusted for sociodemographics, educational and institutional factors, and college financing substitutes/supplements: loan-taking, family support, and student contribution (earnings/savings). Results are replicated using double-selection lasso regressions (Supplementary Appendix D) and augmented inverse probably weighted regressions (Supplementary Appendix E), and 95% confidence levels (two-tailed tests).

Grant Aid

Results from 2SLS Lewbel (IV) regressions appear in figure 2, with all plotted estimates adjusting for the full set of control variables (all coefficients in Supplementary Appendix C). Shown in figure 2A, the plotted main effect across the full study sample indicates a substantial positive impact of having received grant aid as an undergraduate on obtaining an advanced degree across the study sample: 8.5 percentage points. Figure 2B splits the study sample into cohorts who had started their undergraduate studies prior to the 1992 Higher Education act (college graduation years 1986–1996) and those who started after its implementation (1997–2007). The significant positive effect of receiving grant aid on the probability of advanced degree attainment is rather similar for both cohort groups (8.3 and 8.7 percentage points, respectively). These stable returns over time suggest that the relationship between grant aid and advanced degree attainment has not been affected by the 1992 policy changes.

Results from double-lasso and AIPW regressions, reported in the appendices, do not deviate from these 2SLS estimations. Both alternative strategies indicate

similar statistically significant effects sizes of grant aid on the chance of advanced degree attainment. The estimates in the subsamples for the earlier and later BA graduation cohort display only marginally smaller magnitudes (7.5 and 7.6 percentage points, respectively). Consistencies are also found with regard to grant aid effects on obtaining a master's/professional degree (7.3 percentage points) and a doctorate degree (7.6 percentage points), with no substantive differences between the two cohort groups (see [Supplementary Appendices D–F](#)).

Loan-Taking

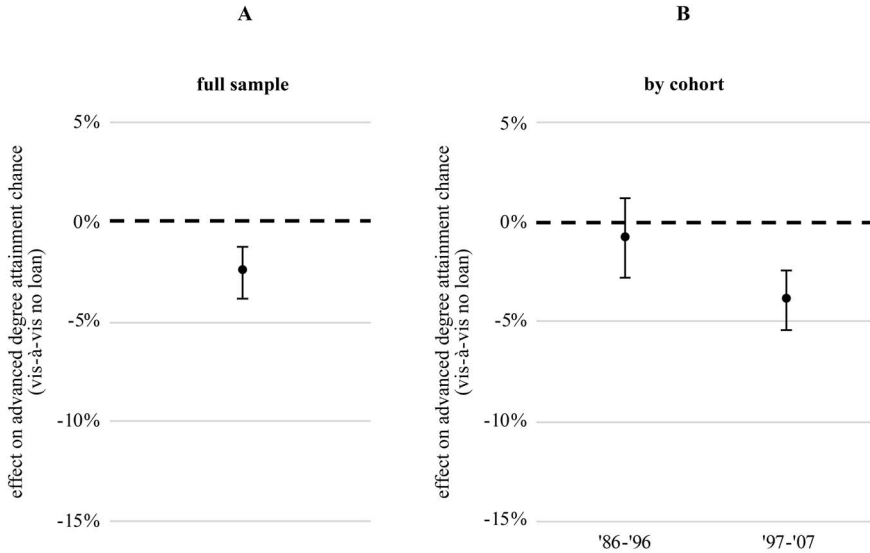
In contrast to the strong positive effects of receiving undergraduate grant aid, taking out an undergraduate student loan (binary) reduces the chances of earning an advanced degree by 2.6 percentage points; plotted in [figure 3A](#). However, as shown in [figure 3B](#), this is not the case among undergraduate students who were enrolled in college prior to the 1992 Higher Education Act (i.e., graduated prior to 1997). When splitting the analyses by the two cohort groups, we observe a null effect among the 1986–1996 college graduation cohorts and a significant negative effect among the post-1996 cohorts: a 3.9 percentage point reduction in the probability of earning an advanced degree.

Robustness checks with double-lasso regressions yield similar significant effect sizes ([Supplementary Appendix D](#)), while noting that the AIWP-estimates of loan-taking among the full study sample cease to be statistically significant ([Supplementary Appendix E](#)). Furthermore, the negative effect of loan-taking appears similar for both master's/professional degrees and doctorate degrees, excepting a relatively small significant negative effect (–1.9 percentage points) among the older cohort group ([Supplementary Appendix F](#)).

Given the negative undergraduate loan-taking effect among college graduation cohorts after 1996, we fit an interaction with multiple smaller cohort groups in order to examine whether loan debt effects on advanced degree attainment have changed over time (in a possibly nonlinear fashion). The marginal effects of this interaction are plotted in [figure 4](#) and indicate that the loan-taking effect on advanced degree attainment indeed changed over time—from small and nonsignificant to a substantial negative effect among recent cohorts of college graduates. Specifically, the effect of undergraduate loan-taking on advanced degree attainment is positive (yet nonsignificant) in the late-1980s, then appeared unrelated, followed by growing deficits for students who graduated college in the 2000s: –3.2 and –4.5 percent for 2000–2004 and 2005–2007, respectively.

Loan Amount

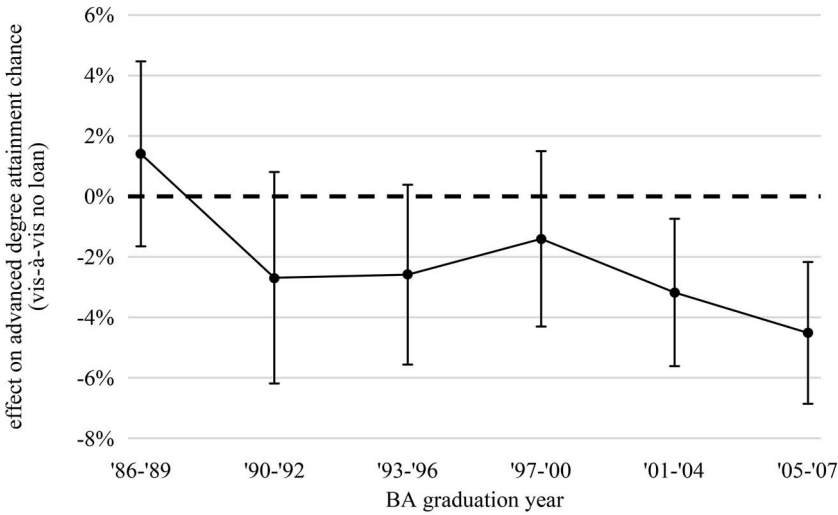
A final series of inferential models use the ordinal treatment variable for loan-taking, which contrasts (1) no loans, (2) loans of less than \$10,000, and (3) “heavy” loans of more than \$10,000. Using the “no loan” category as the reference, [figure 5A](#) shows that holding even a small student loan debt upon college graduation affects the propensity of attaining an advanced degree (–2.1 percentage points vis-à-vis no loan debt). The heavy loan point estimate

Figure 3. Loan-Taking Effect on Advanced Degree Attainment (1986–2007).

Source. Author's calculations of the National Survey of College Graduates 2017. Notes. Study sample consists of first-time BA recipients from US institutions between 1986 and 2007, obtained under age 30 (Graph A). Graph B plots estimates from models by college graduation cohort group: '86–'96 ($N = 10,800$) and '97–'07 ($N = 17,105$). Estimates are adjusted for sociodemographics, educational and institutional factors, and college financing substitutes/supplements: grant aid, family support, and student contribution (earnings/savings). Results are replicated using double-selection lasso regressions (Supplementary Appendix D) and augmented inverse probably weighted regressions (Supplementary Appendix E), and 95% confidence levels (two-tailed tests).

indicates a much larger penalty on the chances of earning an advanced degree (–5.2 percentage points), suggesting that the amount of student loan debt is progressively negatively predictive of completing a master's degree or higher. Shown in figure 5B, a comparison of the 1986–1996 and the 1997–2007 BA graduation cohorts, separately, indicates that a small loan was statistically unrelated to the chance of graduate school completion in the former period and negatively predictive in the latter cohort groups. Moreover, the negative effect of a heavy undergraduate loan (>\$10,000) on advanced degree attainment is substantially larger among the 1997–2007 cohorts (–6.7 percentage points) as compared with any other loan debt status across the observed time span.

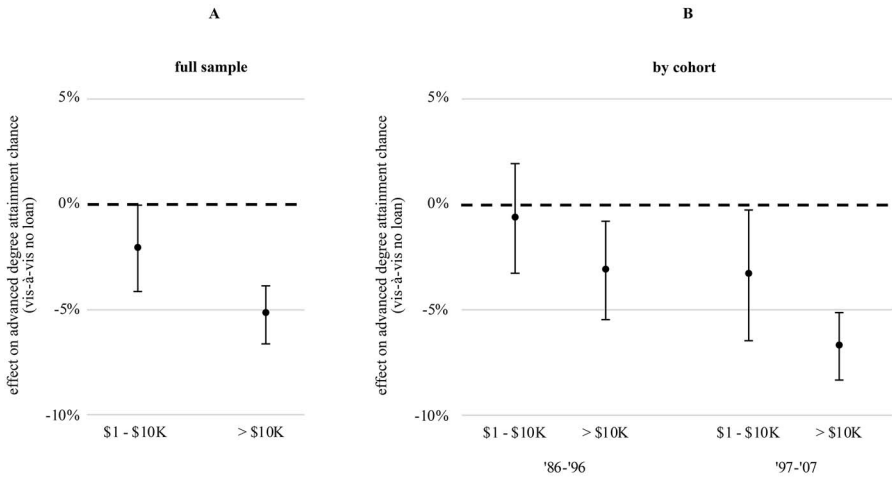
We test the changing effect of loan amounts over time using an interaction between college cohort groups and loan debt amount upon college graduation. Figure 6A displays the marginal effects of a heavy loan (more than \$10,000) vis-à-vis no loan, suppressing the nonsignificant margins of a small loan throughout the observed time span. These interaction estimates indicate a progressively negative effect of a heavy loan on advanced degree attainment over time and

Figure 4. Loan-Taking * Graduation Cohorts Interaction on Advanced Degree Attainment.

Source. Author's calculations of the National Survey of College Graduates 2017. Notes. Study sample of first-time BA recipients from US institutions between 1986 and 2007, obtained under age 30 ($N = 27,905$). The plotted interaction estimates are the marginal effects from double-lasso selected regressions. The estimates are adjusted for the main effect of loan-taking (binary), as well as sociodemographics, educational and institutional factors, and college financing substitutes/supplements: grant aid, family support, and student contribution (earnings/savings), and 95% confidence levels (two-tailed tests).

from nonsignificant effects in the late-1980s and early-1990s to substantive negative effects in subsequent years (excepting the 1997–2000 estimate, which remained nonsignificant). More precisely, a large undergraduate loan debt had no effect prior to 1992, yet has since been growing to a sizable *negative* 8.2 percentage points effect on the advanced degree attainment probability, in comparison to college graduates who had not borrowed money during their undergraduate studies. [Supplementary Appendix A](#) replicates this analysis using slightly different loan amount cut-offs (\$20,000 and \$30,000) and shows the same pattern of larger loan debts becoming more detrimental to the chances of advanced degree attainment.

[Figure 6B](#) contrasts the same loan amounts in interactions with college graduation groups but instead retained a small loan debt (less than \$10,000) as a reference category. Here, all “no loan” marginal effects remained statistically nonsignificant and therefore are suppressed. The interaction effects presented in this graph indicate that the relative disadvantage of a heavy loan debt, over a smaller loan debt, only appears in the youngest college graduation cohorts—the 2005–2007 estimate (–6.2 percentage points). In summary, larger undergraduate loan debts are predictive of significantly lower chances of advanced degree

Figure 5. Loan Amount Effect on Advanced Degree Attainment (1986–2007).

Source. Author's calculations of the National Survey of College Graduates 2017. Notes. Study sample consists of first-time BA recipients from US institutions between 1986 and 2007, obtained under age 30 (Graph A). Graph B plots estimates from models by college graduation cohort group: '86-'96 ($N = 10,800$) and '97-'07 ($N = 17,105$). Estimates are adjusted for sociodemographics, educational and institutional factors, and college financing substitutes/supplements: grant aid, family support, and student contribution (earnings/savings). Results are replicated using double-lasso regressions (Supplementary Appendix D) and augmented inverse probably weighted regressions (Supplementary Appendix E), and 95% confidence levels (two-tailed tests).

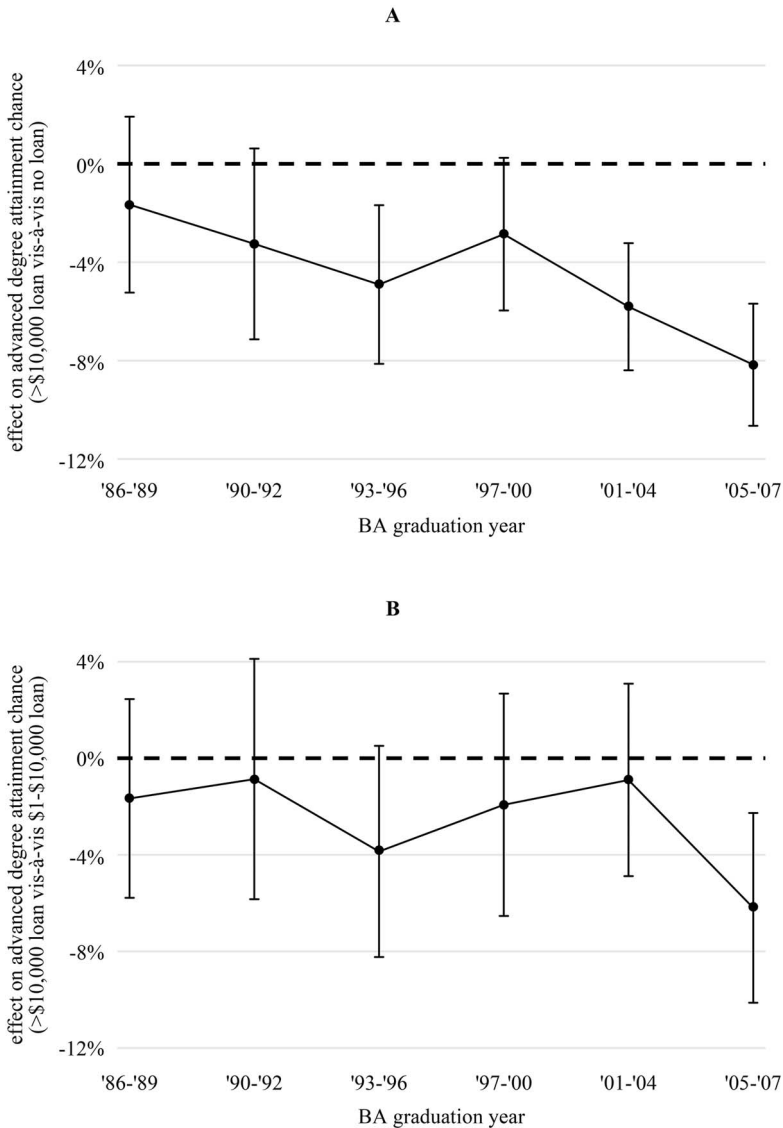
attainment, all else equal, and this negative impact has become exacerbated in the 2000s.

Counterfactual Projection

Baker, Andrews, and McDaniel (2017) argue that analysis of cohort-specific data sources, such as the U.S. Baccalaureate and Beyond of 1993 and 2008, can only observe the effects on the chances of graduate school attainment and completion many years later and therefore consistently lags current mechanisms. One advantage of the large sample sizes of the NSCG datasets is that they capture a range of BA graduation cohorts, which allows us to run counterfactual projections for the postbaccalaureate educational attainment of recent college graduates.

Table 2 reports the results from three counterfactual projection exercises that assess the extent to which undergraduate loan-taking increases or decreases advanced degree attainment, and whether this will be the case for thus far unobserved cohorts (2008–2016). In the top panel, we concentrate on the oldest cohort group: college graduates who *completed* their undergraduate degrees before the 1992 Higher Education Act (1986–1996). Analysis suggests

Figure 6. Heavy Loan (>\$10,000) * Graduation Cohorts Interaction on Advanced Degree Attainment.



Source. Author's calculations of the National Survey of College Graduates 2017. Notes. Study sample consists of first-time BA recipients from US institutions between 1986 and 2007, obtained under age 30 ($N = 27,905$). Interaction estimates are adjusted for the main effect of loan amount, as well as sociodemographics, educational and institutional factors, and college financing substitutes/supplements: grant aid, family support, and student contribution (earnings/savings). The suppressed categories ("small loan" in Graph A) and ("no loan" in Graph B) remained nonsignificant across all cohorts fitted in the model, and 95% confidence levels (two-tailed tests).

Table 2. Predicted and Projected Attainment of Advanced Degrees: The Role of Undergraduate Loan Debt

	Proportion	95% CI	
		Lower	Upper
BA graduation cohorts 1986–1996			
Observed: advanced degree attained	.383	.377	.389
Observed: no advanced degree attained			
predicted to attain with loan debt, as well as in case of no loan debt (“false negative”)	.092	.082	.103
predicted <i>not</i> to attain, but also not in case of no loan debt	.515	.496	.535
predicted <i>not</i> to attain with loan debt but predicted to attain in case of no loan debt	.010	.006	.015
BA graduation cohorts 1997–2007			
Observed: advanced degree attained	.393	.388	.399
Observed: no advanced degree attained			
predicted to attain with loan debt [false negative], as well as no loan debt	.098	.088	.108
predicted <i>not</i> to attain, but also not in case of no loan debt	.469	.451	.487
predicted <i>not</i> to attain with loan debt but predicted to attain in case of no loan debt	.040	.034	.047
BA graduation cohorts 2008–2016			
Predicted to attain an advanced degree (with their current loan debts)	.368	.362	.378
Predicted to attain an advanced degree (if no loan debt was assumed)	.406	.398	.414
	.039		

Source. Author’s calculations of the National Survey of College Graduates 2017.

Notes. Study sample consists of first-time BA recipients from US institutions between 1986 and 2016, obtained under age 30: cohorts 1986–1996 ($N = 10,823$), 1997–2007 ($N = 17,121$), and 2008–2016 ($N = 15,617$).

that 38.3 percent obtained an advanced degree within ten years, regardless of loan-taking. Among those who did not, the chances of advanced degree attainment are generated using the prediction model for this subgroup of cohorts, whereby loan amounts are set to zero. The approach mimics a context in which the negative loan-taking effect on advanced degree attainment is eliminated. Shown in the top panel, this means a 1 percent increase in the total number advanced degree graduates.

The second panel repeats the same exercise of setting all loan debts to zero but uses a prediction model fitted (betas) on the 1997–2007 cohort of college graduates to predict the chances of advanced degree attainment. The number of

advanced degree graduates is affected to a much greater degree; respondents with at least a master's degree would be 4 percent higher in a hypothetical "no-loan debt" context. The US labor force thus misses out on a substantive number of advanced degree holders because loan debts suppress college graduates' chances of completing graduate school within the next ten years. The bottom panel of [table 2](#) uses the same model fitted on the 1997–2007 cohorts, but it reports predictions for the previously nonincluded cases of 2008–2016 cohorts. This counterfactual scenario assumes that if the world did not change between the early 2000s and early 2010s in terms of predictor–outcome relationships and, crucially, no college student graduated with loan debt. Results suggest that the number of advanced degree holders would be 4 percent higher for the 2008–2016 cohorts.

Robustness Checks

All models reported in this study are also fitted using alternative estimators to the 2SLS Lewbel method: double-lasso regressions ([Supplementary Appendix D](#)) and AIWP regressions ([Supplementary Appendix E](#)). These robustness checks indicated similar (significant) effect sizes, which validates the substantive results and demonstrates the reliability of these three estimators. [Supplementary Appendix F](#) splits the main results by advanced degree type, finding no reason to believe that operationalizing the dependent variable as "any advanced degree" misses an essential part of the effects on completing a graduate school program. Furthermore, linear probability models were employed in all models because of their simpler application in the 2SLS Lewbel models, maintaining consistency across estimators. Margins of logistic regressions indicate nearly the same estimates in terms of significance tests and effect sizes.

A series of interactions between the treatments (i.e., grant aid and loans) and race/ethnicity, parental education, and college graduation cohort are used to find relevant heterogeneous effects on advanced degree attainment chance. While the interactions with cohorts yield significant associations, those with race/ethnicity and parental education do not ([Supplementary Appendix G](#)). This implies that, even though there are statistically significant main effects of race/ethnicity and parental education on the chance of attaining an advanced degree (see [Supplementary Appendix C](#)), the relationships between the two undergraduate financing strategies and advanced degree attainment do not appear to operate differently along these sociodemographic dimensions.

Finally, robustness checks include measurement of the effects of undergraduate grant aid and loans on (shorter) master's degree and professional degree attainment and (longer) doctoral degree attainment, separately. These yield similar results. The simpler "any advanced degree attainment," which could also be interpreted as any *first* graduate school degree, is the preferred operationalization in this study because the data do not allow us to distinguish en route degrees and other combinations (almost a quarter of graduate school completers attained more than one degree). Although the consistency of effects on different advanced degrees is noteworthy, these results should thus be interpreted with some caution.

Limitations and Future Research

The limitations of the current study are the level of detail of the grant aid variable and the absence of variables that predict selection into receiving different forms of grant aid. Future research on the relationships between undergraduate financing, college attendance costs, and graduate school attainment could be a step closer to informing higher education policies if it could differentiate between need-based and merit-based grants, the type of student loan and repayment conditions, the institutional characteristics of the undergraduate institution (including the tuition costs), and the timing of educational decision-making in either longitudinal or administrative data. Estimating these more fine-grained treatment effects remain beyond the scope of this study. The use of students' undergraduate GPA and test scores in such data would also improve the researcher's ability to account for selection into forms of grant aid.

In addition, we find that the effects of both grant aid and loan-taking on advanced degree attainment do not operate differently across college graduates' parental education or race and ethnicity. It is plausible that effect heterogeneity along race, ethnicity, and parental education (or class background) are partially dependent on the types of grants, loans, and institution. The selection pathways into the different forms of undergraduate financing should be examined in greater detail in order to address the sociodemographic heterogeneous effects, yet this remains beyond the scope of the NSCG data. Furthermore, building on the presented "no student loan-taking" counterfactual exercises, future research would benefit from comparing the relationship between undergraduate financing (both policy and behavior) and postbaccalaureate educational attainment across countries.

Additionally, we should stress some potential problems with regard to endogenous selection (Elwert and Winship 2014). By addressing the question of how undergraduate grant aid and student loans affect advanced degree attainment in a sample consisting of college graduates only, the estimated "effects" of X on Y are likely conservative. This is because there is an indirect path between loan-taking (or receiving a grant) and bachelor's degree completion, which in turn (positively) affects advanced degree attainment. It is plausible that our reported estimates suffer from overcontrol bias as a result of selecting (our study sample) on a component of the mechanism by which undergraduate financing strategies affect advanced degree attainment (Heckman, Humphries, and Veramendi 2018). This is because the necessary first step toward advanced degree attainment is college graduation, which is known to be affected by undergraduate financing (Goldrick-Rab, Harris, and Trostel 2009).

Furthermore, conditioning on the mechanism between undergraduate financing and advanced degree attainment introduces collider variables due to the presence of factors that influence *both* college completion and advanced degree attainment. This mechanism cannot be fully captured by our set of independent variables (e.g., GPA remains unobserved). In other words, our study can only answer the extent to which college graduates' opportunities and decisions are affected by their undergraduate financing. An alternative identification

strategy—one that would provide the *total effect* of undergraduate financing on advanced degree attainment rather than among a subsample of college graduates—would include the observation of the pathways toward college completion. One would expect these total effect sizes to be greater: a stronger positive effect of grant aid among all observed 1986–2007 cohorts and a stronger negative effect of loan-taking among younger cohorts of college graduates (1997–2007).

Conclusion

Access to graduate school is paramount for both equality of educational opportunity and for fulfilling an assumed demand for skills in the US labor market. Given these societal goals and debates, this study addresses the roles of the two pillars of undergraduate financing—grant aid and loan-taking—in advanced degree attainment using data from individuals who graduated college before and after the 1992 reauthorization of the Higher Education Act. Although the purchasing power of grant aid (e.g., Pell grants) had already started to decline, and the prevalence of undergraduate loans had started to increase before 1992, the enactment of this Act marks an historic policy shift from promoting higher education attainment through need-based grants to loan provision regardless of family income. The educational attainment behavior of college graduation cohorts before and after 1992 therefore form the initial benchmark of our assessment of the effects of undergraduate financing on the long-term (spillover) effect to advanced degree attainment.

Our descriptive analysis shows that the proportion of students who relied, at least partially, on their own funds or those of their family remained relatively stable between 1986 and 2007. Over the same time span, reliance on traditional undergraduate grant aid increased by 10 percentage points. The major shift, however, was an increased usage of student loans, which were of higher amounts, and more frequently in combination with grant aid. This suggests that loans indeed became a necessary supplement during the undergraduate studies of a large number of students. Of critical concern regarding educational equality, and social equality more broadly, is whether undergraduate grant aid and student loans can indirectly boost advanced degree attainment or could even form a net financial hurdle. As both forms of undergraduate financing should enable students who can otherwise not afford the costs of college attendance, both the directions and effect sizes of grant aid and student loans are important.

The results for the main treatment effects of the two forms undergraduate financing are straightforward. Having received undergraduate grant aid increases the chance of attaining a master's degree or higher within ten years after college graduation by about 8.5 percentage points. This long-term boost remained remarkably stable across more than two decades, underscoring the power of reducing financial hurdles for higher education attainment—a mechanism that rests on robust empirical evidence about bachelor's degree completion (Goldrick-Rab et al. 2016). This study confirms a theorized “spillover effect” for the advanced degree level. In contrast, an undergraduate student loan reduces the

chance of attaining an advanced degree by 2.6 percentage points across the same time span. Student loans were initially *not* associated with the advanced degree attainment chance. However, we find a substantial negative effect (−3.9%) among those enrolled in college after 1992 Higher Education Act.

Moreover, undergraduate loans considered heavy (>\$10,000), or effectively “above the median,” are more detrimental to the advanced degree attainment chance compared with a small loan and no loan, and these effects are larger among college graduates who were enrolled after the 1992 Higher Education Act came into effect. A closer examination of the cohort trends in the relationship between undergraduate loan-taking and advanced degree attainment chances also confirms a progressively harsher penalty of any loan (among college graduates in the 2000s), and in particular for those accruing a student loan debt of more than \$10,000 (since the mid-1990s). In other words, larger student loan debts have become more common and are increasingly detrimental to the chances of educational attainment beyond the bachelor’s degree since the reauthorization of the Higher Education Act in 1992.

Both findings accord with price theory and hypothesized directions of the treatment effects. Following price theory, we argue that college graduates are more inclined to complete an advanced degree as a result of having more financial leverage after college graduation, in comparison to the counterfactual situation. The most plausible mechanism of the grant aid effect is rooted in the reduction of pressure on family resources, which in turn creates a less financially stressful situation when deciding whether to pursue a graduate degree and while attending graduate school. Taking out a student loan shifts this mechanism in the opposite direction. Consistent with research that suggests indebted graduates are less likely to make large investments (Baker, Andrews, and McDaniel 2017), undergraduate loans exhaust the financial means of students and their families early, which leads to insufficient funds available for pursuit of advanced degrees.

To summarize, grant aid and student loans are assumed to improve educational opportunity as students who could otherwise not afford enrollment in a bachelor’s degree program would be able to do attend. Such an equalizing mechanism evidently spills over in terms of access to ever more valuable higher education credentials. Undergraduate student loans, which have never functioned as booster of advanced degree attainment, currently increase educational inequality in the pathway toward the highest education tier in the United States. Sociological scholarship has frequently linked educational expansion to the reduction of social inequalities in educational and labor market outcomes (Treiman 1970) yet has also placed caveats on this mechanism, demonstrating how inequalities can remain unchanged as the educational system expands (e.g., Raftery and Hout 1993). If graduate school approaches the new universal higher education level, providing ever more educational credentials necessary for labor market entry, equality of opportunity is likely to be reduced through reliance on an undergraduate loan system and increased through provision of grant aid.

In addition to educational equality and opportunity—here studied using data from college graduates between 1986 and 2007—undergraduate financing indirectly affects the number of advanced degree holders in the labor market.

Counterfactual projection models were used to estimate to what extent undergraduate student loans, accumulated after the 1992 Higher Education Act and until 2007, affected the number of advanced degree holders entering the US labor market. Results suggest that a counterfactual scenario of no undergraduate loan-taking would have increased the number of advanced degree holders by 4 percentage points. Moreover, assuming the same influences on advanced degree attainment of predictors fitted on the 1997–2007 cohorts as for the left out 2008–2016 cohorts, and no loan debts after college graduation, the number of advanced degrees would be 4 percentage points greater. Thus, a higher education financing policy that relies heavily on loan-taking has far-reaching consequences for the types of degrees and human capital available in the US labor market.

Although the “no loan-taking” scenario is a hypothetical one for the United States, several European countries, such as Germany and Sweden, have entirely tuition-free higher education systems combined with generous student grants. Our project results should therefore be interpreted as mimicking a critical component of the higher education system, making it comparable to a number of other high-income countries that have similar “high-skill” labor markets, but different undergraduate financing systems. Insofar advanced degree attainment is deemed necessary for skill-upgrading in the United States (a topic currently debated among scholars and policy makers), the current amounts and distributions of college loan debt have a considerable negative impact.

Notes

1. [Kim and Otts \(2010\)](#) examined the Survey of Earned Doctorates 2005, similarly finding that undergraduate loan debt associates with smaller delays in obtaining doctoral degrees.
2. [Zhang \(2013\)](#) found null effects when accounting for omitted variable bias regarding marital status and homeownership, and salary and sector of occupation.
3. All reported results are consistent with those from logistic regressions.

About the Author

Dirk Witteveen obtained his PhD from the City University of New York in 2018. He is currently a Departmental Lecturer at the University of Oxford. His research examines stratification and inequality mechanisms within higher education and the labor market, focusing on college graduation pathways, post-college employment chances, education-occupational matching, and intragenerational mobility. His studies also focus on intergenerational transmission of (dis)advantages, as well as the ways in which macroeconomic conditions shape social inequalities in employment and educational attainment.

Supplementary Material

Supplementary material is available at *Social Forces* online, <http://sf.oxfordjournals.org/>.

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