Does the Bennett Hypothesis Hold in Professional Education? An Empirical Analysis

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Abstract: Policymakers have been debating the Bennett Hypothesis—whether colleges increase tuition after the federal government increases access to student loans—for decades. Yet most of the prior research has focused on studying small changes to loan limits or Pell Grants for undergraduate students. In this study, I examine whether business schools (the most popular master's program) and medical schools (one of the most-indebted programs) responded to a large increase in federal student loan limits in 2006 following the creation of the Grad PLUS program by raising tuition as well as examining whether student debt burdens also increased. Using two quasi-experimental estimation strategies and program-level data from 2001 to 2016, I find little consistent evidence to support the Bennett Hypothesis in either medical or business schools.

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To this point, affordability conversations in higher education have largely focused on undergraduate education. The rising inflation-adjusted price of tuition and fees for a bachelor's degree program (up by 110% at public colleges and 65% at private nonprofit colleges over the last two decades) are certainly a cause for concern (Ma, Baum, Pender, and Welch 2017). Yet a similar trend is occurring in graduate and professional education, where sticker prices have risen at similar or even faster rates compared to undergraduate programs (Association of American Medical Colleges 2017c; Baum and Steele 2017).

The listed price tag of a graduate degree is of relatively little importance to graduate students enrolled full-time in PhD programs, as tuition is generally paid for by a teaching or research assistantship. In the 2011-12 academic year, 58% of PhD students attending full-time had assistantships, with about three-fourths of full-time PhD students at public and private nonprofit colleges receiving some amount of financial assistance from their institution. But students enrolling in master's and professional doctoral programs rarely received assistantships, with just eight percent of master's and three percent of professional doctoral students having assistantships in the 2011-12 academic year (author's calculations using data from the National Postsecondary Student Aid Study).

The combination of high sticker prices and limited grant aid has resulted in many professional students taking on large amount of debt to finance their education. The median 2017 medical school graduate had $192,000 in debt (Association of American Medical Colleges 2017b), while law school graduates had over $140,000 in debt and master's graduates had about $50,000 in debt in the 2011-12 academic year (Delisle 2014). As a comparison, the median bachelor's degree recipient who borrowed for college had about $27,000 in debt (excluding Parent PLUS loans) in 2011-12 (author's calculation using data from the National Postsecondary

Student Aid Study). This has led to graduate and professional students accumulating about 38% of all outstanding federal student loan dollars in spite of only being 17% of all borrowers (Baum and Steele 2018).

The landscape of federal lending for graduate and professional students has changed significantly over the last fifteen years. Prior to 2006, students in professional doctorate programs in a number of health science fields (such as medicine and dentistry) could take out a maximum of $38,500 per year in federal student loans, subject to a lifetime maximum of $189,125; most other graduate and professional students were limited to $18,500 in annual loans and a lifetime maximum of $138,500 (Bhole 2017).[2] As of July 1, 2006, graduate students could take out federal loans up to the full cost of attendance (covering living expenses as well as tuition and fees) for the first time after the Grad PLUS loan program was created in the Higher Education Reconciliation Act of 2005. Given that tuition and fees (particularly at private nonprofit institutions) were often at or above federal loan limits in 2006, the creation of Grad PLUS had the potential to enhance students' ability to borrow for graduate and professional education.

The second major change to the lending landscape occurred with the passage of the College Cost Reduction and Access Act of 2007, which created a more generous income-driven repayment (IDR) plan for all students and a Public Service Loan Forgiveness (PSLF) program that allowed students who worked at qualifying nonprofit or government agencies to make loan balances forgiven after making ten years of income-driven payments. These options are particularly salient for those with large amounts of professional school debt, as even those with

[2] Professional students enrolled in fields such as public health, pharmacy, or clinical psychology were subject to annual loan limits of $31,000 prior to 2006 (Bhole 2017). For the sake of brevity (and because they are not the focus of my analyses), I do not discuss them in more detail in this paper.

annual incomes of over $100,000 per year can qualify for substantial forgiveness (Delisle 2016). Even among medical students, a recent survey indicated that 46% planned to either use PSLF or an income-driven plan to manage their loans (Association of American Medical Colleges 2017b).

The continued increase in tuition prices that occurred alongside a large increase in federal student lending limits and more generous repayment plans has raised questions of whether federal student loans are driving tuition increases. This idea was popularized by William Bennett, who was President Reagan's Education Secretary, in a 1987 *New York Times* opinion piece (Bennett 1987) and has been hotly debated in both research and policy circles ever since.[3] Several academic studies have examined the veracity of the so-called Bennett Hypothesis in undergraduate education, with a mix of null and modest positive relationships (e.g., Archibald and Feldman 2016; Cellini and Goldin 2014; Heller 2013; Lau 2014; Lucca, Nadauld, and Shen 2015; Rizzo and Ehrenberg 2004; Singell and Stone 2007; Stoll, Bradley, and Mahan 2014; Turner 2014). However, these studies have exclusively focused on undergraduate education and have relied on small changes to federal grant or loan limits to estimate whether federal student aid drives tuition increases. Only one prior study has looked at graduate and professional education, with Kelchen (2017) finding limited evidence to support the Bennett Hypothesis among law schools.

In this study, I extend the literature on the Bennett Hypothesis in post-baccalaureate education by examining the master's degree program with the most degrees awarded (business administration) and one of the highest-debt professional doctorates (medicine). In both cases,

[3] The origins of the idea date back to at least 1976 (Gladieux and Wolanin 1976), but it was popularized by Secretary Bennett. Thank you to Beth Popp Berman for bringing this piece to my attention.

students pay the vast majority of overall tuition and fees, making both the expansion of federal loan access through Grad PLUS and the growth of income-driven repayment programs particularly salient.

My research questions are the following:

(1) Did tuition and fees for medical and business school students increase at a faster rate following the creation of the Grad PLUS program in 2006 and the expansion of income-driven repayment beginning in 2007?

(2) Did the student debt burden of medical and business school graduates increase at a faster rate following the creation of the Grad PLUS program in 2006 and the expansion of income-driven repayment beginning in 2007?

About Graduate and Professional School Borrowing

Prior to the creation of the Grad PLUS program in 2006, most graduate and professional students could borrow up to $8,500 per year in subsidized federal loans and a maximum of $18,500 per year across both subsidized and unsubsidized loans. Lifetime federal loans limits, including both undergraduate and graduate loans, were set at a maximum of $65,500 in subsidized loans and $138,500 for all loans (FinAid.org 2017). Since 2006, there have been two other changes to federal student loan limits. In 2007, the unsubsidized loan limit increased by $2,000 per year and subsidized loans for graduate and professional students were eliminated in 2012. Today, students are subject to annual unsubsidized loan limits of $20,500 and lifetime subsidized and unsubsidized loan limits of $138,500, with medical students having higher limits as noted in the previous section.

The Grad PLUS program was created in part because borrowing limits for federal subsidized and unsubsidized loans were well below the average cost of attendance for most graduate and professional programs. In the 2003-04 academic year, 73% of law and medical students and 39% of MBA students with federal loans borrowed the maximum amount (Woo and Shaw 2015). Prior to 2006, the only option to finance the remainder of the cost of attendance was by using private loans; in 2003-04, 36% of law students, 18% of medical students, and 7% of MBA students who borrowed for graduate school had private loans.

Once Grad PLUS loans were made available to graduate and professional students, they quickly became a popular financing option for students who were not receiving assistantships of fellowships. Total Grad PLUS loan volume increased from $3.6 billion in the 2007-08 academic year to $10.3 billion in the 2017-18 academic year (Baum, Ma, Pender, and Libassi 2018). Grad PLUS loan usage varies considerably across programs, with five percent of business students, 34% of medical students, and 59% of law students using Grad PLUS loans in 2011-12 (Woo and Shaw 2015). One reason why students take out Grad PLUS loans is because they likely would not qualify for private loans (Bhole 2017). Grad PLUS loans differ from other federal loans in that a potential borrower must not have an 'adverse credit history,' but this standard is far lower than what private banks use to determine interest rates.[4]

The other major policy change regarding loans for graduate and professional students came in 2007, when the College Cost Reduction Act created two new programs that made it easier for students to manage larger debt burdens. First, the act created a new Income-Based Repayment program that allowed all students with federal loans to access income-driven

[4] An 'adverse credit history' is defined as having at least $2,085 in debt at least 90 days delinquent in the last two years or having a foreclosure, default, or wage garnishment in the last five years (Federal Student Aid 2015).

repayment and pay 15% of their discretionary income (above 150% of the federal poverty line) for up to 25 years before any remaining balance would be forgiven. These terms were more generous than the prior plan, which required students to pay 20% of their discretionary income for up to 25 years. After not being included in the initial bill, Grad PLUS loans were included when the program was fully implemented in 2008 in what some insiders have considered to be a drafting error at the Department of Education (Shireman 2017). Three other income-driven student loan programs have been created since then (a revised Income-Based Repayment Plan, Pay as You Earn, and Revised Pay as You Earn), which can reduce monthly payments to as low as 10% of discretionary income for 20 years (Federal Student Aid n.d.).

Second, the act also created a Public Service Loan Forgiveness (PSLF) program that allows borrowers working for government or other nonprofit agencies to pay 10% of their discretionary income for as little as ten years while having any remaining balances forgiven tax-free (which is not the case for other income-driven programs). As of March 2018, nearly 870,000 borrowers have submitted employment certification forms that indicate their interest in applying for PSLF after making 120 qualifying monthly payments (Federal Student Aid 2018). The Association of American Medical Colleges has been among the groups lobbying to keep PSLF for future borrowers after both the Trump Administration and House Republicans have proposed to end the program over cost concerns (Association of American Medical Colleges 2017a). Although it is unclear how many professional students are relying on income-driven repayment or PSLF, the fact that 53% of the federal Direct Loan dollars belonging to students with at least $100,000 in debt are enrolled in income-driven programs suggests that these programs are heavily utilized by graduate and professional students (author's calculation using data from the Federal Student Aid Data Center).

Literature Review and Theoretical Framework

The key premise of the Bennett Hypothesis is the assumption that colleges are revenue-maximizing agents that are attempting to take advantage of increases in federal aid availability to garner additional institutional resources. While the initial formulation of the Bennett Hypothesis implied that all colleges would raise their prices following increases in federal aid limits, existing research—nearly all at the undergraduate level—provides some support for this hypothesis but well below the expected relationship that a $1 increase in aid would cause a $1 increase in prices. In this section, I discuss the state of the literature on the Bennett Hypothesis, the theoretical framework underlying an updated version of the hypothesis by Gillen (2012), and why the Bennett Hypothesis may function differently in professional education than in undergraduate programs.

Only two rigorous empirical studies have examined the key premise of the Bennett Hypothesis at the undergraduate level as originally stated—whether increases in federal student loan availability are associated with increases in tuition and fee prices. At the undergraduate level, Lucca et al. (2015) concluded that increases in subsidized loans were associated with sizable increases in tuition at for-profit and expensive private nonprofit colleges (between $.45 and $.60 for each $1 increase in loan limits), while increases in unsubsidized loans were generally not associated with tuition increases. Lau (2014) found a relationship between increased loan limits and tuition prices, with the relationship varying between $.25 at community colleges and $.51 at for-profit colleges. Other high-quality studies at the undergraduate level have examined the relationship between maximum Pell Grant awards and tuition prices (e.g.,

Rizzo and Ehrenberg 2004; Singell and Stone 2007; Turner 2014), the relationship between veterans' benefit limits and tuition prices (Baird, Kofoed, Miller, and Wagner 2018), and the relationship between participation in federal financial aid programs and tuition prices (Cellini and Goldin 2014) and found a mix of null and modest positive relationships.

This weaker-than-expected relationship between federal aid availability and college pricing led Gillen (2012) to introduce the Bennett Hypothesis 2.0 in an effort to explain why colleges may not be able to capture additional revenue from federal student aid by raising prices. This revised theory introduced three changes to the original Bennett Hypothesis, all of which have different implications for graduate and professional education relative to undergraduate education. The first is that universal aid programs are more likely to result in tuition increases than aid programs targeted at students from lower-income families. Since graduate students mainly receive loans from the federal government, this universality condition is met.

The second part of Bennett Hypothesis 2.0 states that selective institutions and those not facing tuition caps are more able to respond than other institutions. Most graduate and professional programs differ considerably in their selectivity just like undergraduate institutions, but nearly all medical schools accept fewer than ten percent of applicants (author's calculations using *U.S. News* admissions data). This means that selective business schools and virtually all medical schools could raise tuition without reducing the number of quality students in their incoming class, particularly as graduate students tend to be more willing to leave their home state to receive an education than are undergraduate students (author's calculation using National Postsecondary Student Aid Study data). Tuition caps are relatively common for in-state undergraduates at public universities, while graduate and professional prices are generally not

regulated (Armstrong, Carlson, and Laderman 2017). This autonomy and flexibility to increase tuition means that the Bennett Hypothesis may apply particularly well to graduate education.

The final piece of the Bennett Hypothesis 2.0 focuses on Bowen's (1980) revenue theory of costs, which posits that colleges will seek to raise—and spend—as much money as possible in an effort to improve the quality of education and to enhance their prestige. The increased availability of federal aid provides incentives for programs and colleges to increase tuition to use resources to improve student experiences. At many institutions, this pressure is enhanced by private-sector rankings organizations such as *U.S. News & World Report* that direct reward many professional programs (such as medical schools) that have the resources to keep class sizes low regardless of student learning outcomes (Morse and Hines 2017). Colleges often counter Bowen's theory with Baumol's (1967) cost disease theory, which states that the rising price tag of higher education is largely due to the skilled labor-intensive nature of the industry. Although there is empirical support for Baumol's cost disease (e.g., Archibald and Feldman 2008), no literature to this point has attempted to separate Bowen or Baumol effects from Bennett effects.[5]

In spite of the Bennett Hypothesis 2.0 suggesting that graduate programs may be more willing to increase prices upon being able to access additional financial aid, only one study to this point has examined the veracity of the Bennett Hypothesis in graduate or professional education. Kelchen (2017) examined whether law schools increased tuition or living allowances following the implementation of Grad PLUS as well as whether student debt burdens increased and found no or modest evidence to support the Bennett Hypothesis across a range of

[5] Unfortunately, a lack of data availability on program-level operating costs at the graduate/professional level makes it impossible at this point to fully separate Bowen, Baumol, and Bennett effects.

specifications. This paper extends that previous research by looking at two popular professional programs that theory suggests may be susceptible to the Bennett Hypothesis.

Data, Samples, and Methods

I constructed a panel dataset ranging from the 2001-02 to the 2016-17 academic years from a number of sources to examine whether business and medical schools raised tuition prices following the creation of the Grad PLUS program in 2006 and if the debt burdens of graduates were also affected. The following section contains details on the data sources, analytic methods, and samples for the business and medical school analyses.

Data

My primary data source for both the business and medical school analyses is *U.S. News & World Report*'s annual "Best Graduate Schools" guidebooks that include data for a range of graduate and professional programs in addition to the popular rankings lists. My two research assistants and I hand-entered data that programs self-reported to *U.S. News* in the program directory portions of the 2003 through 2018 guidebooks (representing data from the 2001-02 through 2016- 17 academic years) to compile this dataset. Approximately 85% of business schools and 82% of medical schools invited to submit information to *U.S. News* did so in the typical year, with participation rates being highest in 2010-11 and lowest in earlier and later years of the panel.

The two outcomes of interest came from the *U.S. News* guidebooks. The first outcome was tuition and fees, which is the classic test of the Bennett Hypothesis. This also ties into the

theoretical underpinnings of the study (the Bennett Hypothesis 2.0 and Bowen's revenue theory of costs). Although neither program-level expenditures nor potentially relevant proxies such as student-to-faculty ratios are available in the *U.S. News* data or in other publicly-available datasets, capturing a measure of potential tuition revenue likely correlates strongly with expenditures for nonprofit institutions that seek to spend most of their available revenues on educational pursuits. Because of the prevalence of cross-subsidization in higher education (e.g., Capaldi and Abbey 2011), revenue-generating programs may not get to keep all of their tuition dollars; however, revenues and costs should be sufficiently correlated for the purposes of this study.

I examined both in-state and out-of-state tuition and fees for full-time students attending public institutions and the tuition and fees charge for full-time students at private nonprofit institutions. A small number of business schools reported tuition prices for the entire degree program (which was generally two years in length), so I divided the reported price by two to get an annual price. The second outcome was the mean debt burden of graduates who took on debt, which included over 80% of medical students and 40% of business students (Woo and Shaw 2015).[6] I also considered allowances for room and board as a potential outcome, but omitted it for the sake of brevity and because results were rarely statistically significant.

The *U.S. News* guidebooks also provided information on a number of program-level characteristics that I used as control variables in my regressions. For both business and medical schools, I used overall program enrollment, the percentage of female and racial/ethnic minority students, the percentage of students admitted, and the median standardized test scores

[6] The estimate for business students includes both full-time and part-time students. Since my analysis focuses on full-time students only, the borrowing rate is likely higher.

(GMAT/MCAT) and GPAs of newly-enrolled students. For business schools, I also used the percentage of part-time and international students, while I used the percentage of underrepresented (non-Asian) minority students for medical schools. All variables are for full-time students only, which represents all medical school students and between 35% and 40% of the business school students attending colleges in the *U.S. News* dataset.

When *U.S. News* tuition and fee data were unavailable for medical schools (about 15% of observations), I first substituted data from the U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS) and then from the Association of American Medical Colleges (AAMC). Although IPEDS generally does not include program-level data, the dataset does contain tuition and fee prices for in-state and out-of-state students in medicine as well as law and a number of other health-related fields. IPEDS data were missing for the 2009-10 academic year and incomplete for the 2008-09 academic year, while the AAMC data were available for all years. In-state tuition and private tuition values were very strongly correlated among the data sources (over 0.9 in nearly every year), while out-of-state tuition correlations across the sources ranged between 0.7 and 0.9. Unfortunately, no additional sources were available over time for business school tuition and fee prices. I used IPEDS data on three other covariates that could potentially affect graduate programs' prices: graduate and professional students as a percentage of overall enrollment, the share of overall revenue coming from tuition dollars, and per-student endowment resources. In the small number of cases where financial data were combined with other institutions in a system of higher education (e.g., Jaquette and Parra 2014), I assigned the same per-FTE values to each IPEDS UnitID nested within a Federal Student Aid OPEID.

Finally, I also used comparable data for undergraduate students in one set of analyses. Data on tuition and fees came from IPEDS, and median debt of bachelor's degree recipients came from the College Scorecard. Although data on selectivity and standardized test scores were not used due to a high rate of missing data, I did use the percentage of female and racial/ethnic minority students as covariates.

Samples

The business school sample consisted of 410 programs that were accredited by the Association to Advance Collegiate Schools of Business (AACSB), enrolled full-time master's students, and participated in the *U.S. News* guidebook at any point during the length of the panel. AACSB-accredited business schools are typically found at more-selective and research-oriented colleges, as AACSB accreditation standards require faculty members to meet peer-reviewed research standards (AACSB International 2017). AACSB-accredited programs in my dataset awarded approximately 59% of the over 160,000 master's degrees in business in the 2015-16 academic year (author's calculations using IPEDS data). Summary statistics of the 277 public and 133 private nonprofit business schools in the 2015-16 and 2016-17 academic years are presented in the left side of Table 1.

[Insert Table 1 here]

The medical school sample consisted of 150 MD-granting programs that were accredited by the Liaison Committee on Medical Education, the only organization that accredits such programs.[7] Because I was able to supplement tuition and fee data from other sources beyond *U.S. News*, all medical schools are included in the dataset for analyses without additional covariates.

[7] *U.S. News* also surveys osteopathic programs under the medicine section of the guidebook, but I omitted those programs (approximately 30) to ensure a more comparable sample.

Summary statistics for the 91 public and 51 private nonprofit medical schools that were in operation in the 2015-16 and 2016-17 academic years are presented in the right side of Table 2.

For certain analyses, I used a comparison sample of public and private nonprofit colleges that were did not have a business or medical program that was included in the *U.S. News* guidebook.[8] All of these institutions in the comparison samples were public or private nonprofit colleges that had data on at least one of the outcomes of interest, were classified as a Carnegie baccalaureate institution in 2010 (excluding master's and doctoral universities, and was not classified as a primarily religious institution. This resulted in comparison groups of 85 public and 395 private nonprofit institutions for the business school analyses and 89 public and 399 private nonprofit institutions for the medical school analyses.

Methods

I used two different analytic strategies to examine whether there is evidence to support the Bennett Hypothesis among business or medical schools. My preferred strategy was to use interrupted time series (ITS) models (run separately for public and private nonprofit business and medical schools) to examine whether tuition and fees or student debt burdens increased more quickly following the implementation of the Grad PLUS program in 2006. The regression equation for college *i* in year *t* is the following:

$$Y_{it} = \beta_{0t} + \beta_1 Time_{it} + \beta_2 Post_{it} + \beta_3 (Time * Post)_{it} + \beta_4 X_{i(t-k)} + \epsilon_{it} + \mu_i \quad (1)$$

[8] These colleges could have had a business school that was either not accredited by AACSB or did not respond to the survey in any year, but this represents very few full-time students who could have been affected by the increase in federal student loan limits.

Y represents the outcome of interest, which was logged to interpret as a percent change. *Time* reflects the number of years following the beginning of the panel dataset in the 2001-02 academic year, *Post* is a dummy variable equal to 0 before the 2006-07 academic year and 1 otherwise, and (*Time***Post*) represents the number of academic years since July 1, 2006. In interpreting the ITS results, *Post* reflects the immediate treatment effect (the change in level immediately following 2006) and (*Time***Post*) reflects the treatment effect over time (the change in slope following 2006, which would also capture any effects from the expansion of IDR programs in 2007).

The *X* vector includes three sets of control variables that were previously described in the data section and presented in Table 1: program-level demographics from *U.S. News* data, program-level selectivity measures from *U.S. News* data, and institution-level control variables from IPEDS. For the tuition analyses, covariates were used from the prior year to reflect the college's characteristics when it set prices for the following academic year. The debt analyses were matched with covariates from two years prior in order to allow students to experience one full year of the new pricing strategy before graduation. This means that tuition prices for the 2006-07 academic year and debt burdens for the graduating class of 2007 were all matched with 2005-06 covariates.

One addition to the *X* vector in the ITS was in response to concerns regarding the spatial correlation of tuition prices among colleges in the same area (González Canche 2018). Tests for spatial correlation using Moran's I statistic showed high levels of spatial correlation throughout the panel that slightly increased over time among business schools and stayed fairly constant among medical schools. To account for this in my model, I added a control variable for the average inverse distance-weighted tuition price faced by each program. Because professional

students are often highly mobile and many states have only one or two in-state public options (particularly for medical schools), I used a combined measure of out-of-state tuition for public programs along with private tuition. Finally, ϵ represents an idiosyncratic error term and μ is an institution-specific error term. All financial variables were logged and adjusted for inflation into 2016 dollars using the Consumer Price Index.

One factor that could have influenced whether programs were able to increase their prices following the creation of Grad PLUS and the expansion of IDR is the selectivity of the program, with more-selective programs potentially having the ability to raise their prices and still meet enrollment targets. All medical schools in the dataset were already highly selective prior to 2006, with the median program admitting just eight percent of applicants. However, there was much more variation in business schools, with some programs admitting all students and others with admit rates more similar to the typical medical school.

I divided business schools into three groups based on GMAT scores in the 2004-05 and 2005-06 academic years to obtain a pre-treatment measure of selectivity. I used GMAT scores because they were a more stable measure of selectivity over time than were admit rates, which were highly variable across years for all but the most elite programs. Programs with median GMAT scores over 600 in either year were placed in the highly selective category, programs with scores between 540 and 600 were placed in the moderately selective category, and programs with lower GMAT scores and those that did not report GMAT scores were classified as less selective. I then conducted two ITS analyses based on selectivity, comparing highly to moderately selective programs and then moderately to less selective programs.

The second analytic strategy in this study was to use dynamic difference-in-differences (DD) models to examine whether tuition prices or student debt burdens increased at a faster rate for business and medical schools than for undergraduate students at four-year colleges that were not in the analytic sample. A dynamic DD approach is appropriate because it accounts for potential differences in how professional programs responded over time—a key underpinning of the Bennett Hypothesis 2.0. This compares professional programs which received Grad PLUS eligibility to undergraduate programs which did not. For college *i* in year *t*, the regression equation is the following:

$$Y_i = \theta_{0i} + \theta_{1i}Prof_i + \theta_{2i}Year_t + \theta_{3i}(Prof * Year)_{it} + \theta_{4i}X_{it} + \epsilon_{it} + \mu_i, \quad (2)$$

where *Y* represents the same outcome variables as in the ITS regression, *Prof* is a dummy variable equal to 1 for business or medical schools and 0 for undergraduate institutions, and *Year* is a dummy variable for each year). The key variable in this model is (*Prof***Year*), which represents the difference in slope (if any) between professional programs and undergraduate institutions in that given year. A positive value for this coefficient would provide support for the Bennett Hypothesis in professional education. The *X* vector of control variables contained two demographic measures (percent female and percent minority) that were present in both the business and medical school data and the three institutional financial characteristics that were also included in the ITS regression. Since debt burdens were only in the College Scorecard through 2014-15 at the time of this analysis, the debt analyses contains one fewer year of data than do the tuition analyses.

One potential threat to validity in both the ITS and DD models is that professional programs could have already been increasing tuition at higher rates prior to the 2006

implementation of Grad PLUS loans, either because programs expected changes to federal student lending limits or due to some other factors that could possibly confound the relationship between Grad PLUS and prices charged. I explored this threat in three different ways. To check the ITS models, I ran falsification tests that used 2005 as the beginning of the Grad PLUS program instead of 2006 (Appendix 1). For the ITS models, the post-2005 dummy (the key variable in the falsification test) was positive and significant at $p<.10$ for in-state tuition at medical schools and positive and significant at $p<.01$ for debt burdens of public medical school graduates. This potentially suggests a positive pre-treatment trend in the data. The years*post-2005 dummy variable (examining the change in slope over time) was negative and significant at $p<.01$ for tuition prices at public business and medical schools. To check the DD models, I used the didq command in Stata (Mora and Reggio 2015) to test for parallel trends under a fully flexible model. None of the p-values for business or medical schools approached statistical significance (results are available upon request from the author), suggesting no major concerns with using undergraduate students as a comparison group.

I then graphically examined trends in tuition prices and debt burdens across business and medical schools as well as for undergraduate institutions. In general, the pre-treatment trends looked similar between undergraduate and graduate students for business school tuition while debt burdens of business school graduates increased somewhat faster than for undergraduates (Figure 1). The same story is generally true for medical students, although in-state tuition for undergraduates appeared to increase somewhat slower than medical students (Figure 2).

[Insert Figures 1 and 2 here]

Limitations

There are three main limitations of this study. The first limitation is that it is possible that other outcomes, such as student demographics or enrollment levels, could potentially also have been affected by the increased availability of loans. This is a particularly salient concern at business schools, which can more easily expand capacity at a lower cost than can medical schools. I addressed this potential concern in two ways in my ITS models, first controlling for demographic characteristics from the prior year in the regressions and then running separate models with enrollment as the outcome of interest. For business schools, the interaction between the number of years since the beginning of the panel and the post-2006 indicator was statistically significant at $p<.10$ for private nonprofit programs and was not significant for public programs.[9] However, the post-2006 dummy variable was significant at $p<.05$ for both public and private nonprofit programs as enrollment increased during the beginning of the Great Recession. This could allow total program revenue to increase even if per-student revenue did not, potentially biasing my results toward zero.

The second limitation is that because of the increased generosity of income-driven repayment programs beginning in 2007, the results from my analyses should be interpreted as the effect of both Grad PLUS and income-driven repayment instead of a pure test of the Bennett Hypothesis. If colleges took advantage of income-driven repayment plans to increase their tuition, the true effect of the Grad PLUS program would be smaller than the observed coefficients. But since undergraduate students generally saw the same changes to income-driven repayment plans as professional students, the DD analyses do help to potentially isolate the effect of the Grad PLUS program from the effect of income-driven repayment plans.

[9] The full set of coefficients is available upon request from the author.

Finally, the difference-in-differences models are potentially understating the actual effect of the creation of the Grad PLUS program for professional students because undergraduate students also saw a small increase in their federal student loan limits (Wei and Skomsvold 2012). Alternative estimation strategies such as fuzzy difference-in-differences models (de Chaisemartin and D'Haultfoeuille 2018) account for some comparison group cases receiving the same treatment as the treatment group, but cannot improve estimates in a case where all colleges in the treatment group received Grad PLUS and all colleges in the comparison group did not receive that same treatment.

Interrupted Time Series Results

I first tested for whether business and medical schools increased their tuition at faster rates following the creation of the Grad PLUS program. The results of this most direct test of the Bennett Hypothesis using ITS regressions can be found in Table 2. Across both public and private nonprofit programs at business and medical schools, I found no evidence to support the Bennett Hypothesis through either changes in level (the immediate treatment effect) or changes in slope (the treatment effect over time). The change in level coefficient was insignificant or weakly negative across all models, while the change in slope coefficient ranged from negative two to negative four percent and was significant at $p<.05$ for public business and medical schools (with the exception of out-of-state tuition at public business schools). The change in slope was not significant for private business or medical schools. However, the negative coefficients are somewhat smaller (closer to zero) for in-state and out-of-state tuition at business schools than in the falsification tests from Appendix 1 that used 2005 as the placebo treatment date.

[Insert Table 2 here]

Turning to debt burdens (Table 3), there were no statistically significant coefficients for either the changes in levels or changes in slopes among business schools in models with control variables. However, the level of debt burdens increased by about seven percent at public medical schools and six percent at private medical schools immediately following 2006 (both $p<.01$). The change in level was comparable for public medical schools in the falsification test, while not significant for private medical schools. This provides evidence that the increase in debt burdens for private medical school graduates may be attributable to the Grad PLUS program.

[Insert Table 3 here]

Because business schools varied so much in their selectivity (and thus potentially affecting their ability to respond to increased federal student loan limits), I ran two different analyses to examine the implications of selectivity. Table 4 presents ITS results with interaction terms to account for selectivity, with the key coefficient of interest being on the interaction between post-2006 and selectivity. Highly selective public business schools raised their out-of-state tuition at higher rates than moderately selective programs following 2006, while debt burdens fell at highly selective private business schools relative to moderately selective programs. The only statistically significant difference between moderately and less selective business schools was that debt burdens of graduates fell at moderately selective relative to less selective programs, although the estimate is quite noisy.

[Insert Table 4 here]

Difference-in-Differences Results

The next set of analyses compared outcomes for business and medical schools with undergraduate students using a DD framework. The results from regressions with tuition and fees as the outcome of interest can be found in Table 5, with the key coefficient of interest being the business school*year interaction variable. First turning to business schools (panel A), there were no differences in the changes in tuition and fees between business schools and undergraduate institutions immediately before or after the creation of Grad PLUS in 2006 (the omitted year in the regression). Beginning in the early 2010s, tuition increases at public business schools outpaced undergraduate institutions, while there was no similar pattern for private business schools. This suggests some possible delayed effects of Grad PLUS, but a more likely explanation is the relatively limited and weak market power of public baccalaureate institutions in the early 2010s. Among medical schools (panel B), there were no changes immediately following 2006. In-state tuition increased slightly faster at public medical schools, while private tuition did not increase as quickly for medical schools as undergraduate institutions.

[Insert Table 5 here]

Finally, I examined debt burdens for business and medical students in the DD framework (Table 6). For private business schools and both public and private medical schools, professional students saw relatively smaller increases in debt than undergraduates prior to 2006 before coefficients generally approached zero at business schools through 2009. In the 2010s, private business school graduates saw smaller increases in debt than undergraduate students, while there was no change for public institutions. The story at medical schools was somewhat different, with

a small increase in debt at private medical schools following 2006 before both public and private medical schools saw negative coefficients in the 2010s.

[Insert Table 6 here]

Discussion

Whether the availability of federal student aid increases tuition prices and student debt has been the subject of numerous policy debates ever since the Bennett Hypothesis was first stated more than three decades ago. Rigorous empirical studies have found a mix of null and modest positive relationships between increases in federal grant and loan limits and tuition prices at the undergraduate level, yet these studies have generally estimated effects based on small increases in federal financial aid awards. There has been little attention paid to graduate and professional schools' potential responses to changes in financial aid availability, even as the creation of the Grad PLUS program in 2006 sharply increased federal loan limits and subsequent income-driven repayment policies reduced the amount that some students would be expected to repay on their loans. Additionally, Gillen's (2012) Bennett Hypothesis 2.0 theorized that the Bennett Hypothesis would have larger effects in graduate and professional programs than for undergraduate institutions.

In this study, I provide quasi-experimental examinations of the Bennett Hypothesis for the most popular master's degree program in the United States (business) and for one of the most expensive professional programs (medicine). I did not find consistent evidence that either business or medical schools systemically increased tuition and fees following 2006, and this

generally resulted in student debt burdens remaining on their prior trajectory. There were some differences between the two estimation strategies (ITS and DD), but even the largest coefficients in either of the two models were still relatively modest in size.

Why did both business and medical schools generally fail to increase tuition prices at higher rates following a large increase in federal student loan limits? I offer two potential explanations. The first explanation is that programs were either unwilling or unable to increase tuition following the creation of Grad PLUS. The optics of sharply increasing tuition after more federal financial aid would not be favorable for higher education, and as such colleges may have been hesitant to do so. Less selective programs may have been particularly unwilling to raise tuition given the lack of a waitlist, which may help to explain the estimated larger tuition increases at selective public business schools (although the opposite was true among private nonprofit programs). This difference by selectivity fits the Bennett Hypothesis 2.0, which posits that selective institutions will be more able to increase tuition than less-selective institutions.

The second possibility is that a relatively small percentage of enrolled students faced credit constraints that would have been eliminated by Grad PLUS. The Grad PLUS program still could have had the effect of increasing access to credit, but that effect may have operated through changing the applicant pool for professional programs. Medical schools have the highest borrowing rates, but nearly every medical school rejects more than three-fourths of its applicants. It is possible that Grad PLUS made medical school possible for a more diverse group of students, with the applicant pool including students who would have been unable to access private loans; this is a question that deserves further study. Meanwhile, other students switched from private loans to Grad PLUS, especially following the creation of income-driven repayment programs (Bhole 2017).

Although the Grad PLUS program is profitable for the federal government under official accounting standards (Congressional Budget Office 2017), there are growing concerns among policymakers (particularly conservatives) about the implications of unlimited lending to graduate students combined with income-driven repayment plans (e.g., Delisle 2016).[10] House Republicans' 2017 legislation to reauthorize the Higher Education Act would cap graduate loans at below the full cost of attendance for most programs and end or curtail income-driven repayment programs (Douglas-Gabriel 2017). It is important to emphasize that my study cannot speak to the implications of reverting back to pre-2006 student loan policies for graduate and professional students, as the same trends for pricing and debt may not hold in reverse.

As the topic of federal student loans for graduate and professional students gets an increasing amount of attention, further research is needed in two main areas. First, as mentioned above, an examination of whether additional access to federal financial aid changed the types of students enrolling in graduate and professional education is much needed. Second, the outcomes and career pathways of students following Grad PLUS and PSLF should be examined, with a particular focus on whether these policies induced students to enroll in socially valuable but low-paid fields. Unfortunately, this question is difficult to examine at this point for most professional programs due to a lack of available program-level data on student outcomes and PSLF takeup. Federal Student Aid could spur important research by working to make these data elements available to the public.

[10] Under an alternative set fair-value accounting estimates (which base projections on market risk instead of Treasury yields), Grad PLUS loans are already viewed as being unprofitable for the federal government.

References

AACSB International (2017). *Eligibility procedures and accreditation standards for business accreditation.* Tampa, FL: Author.

Archibald, R. B., & Feldman, D. H. (2008). Explaining increases in higher education costs. *The Journal of Higher Education, 79*(3), 268–295.

Archibald, R. B., & Feldman, D. H. (2016). *Federal financial aid policy and college behavior.* Washington, DC: American Council on Education.

Armstrong, J., Carlson, A., & Laderman, S. (2017). *The state imperative: Aligning tuition policies with strategies for affordability.* Boulder, CO: State Higher Education Executive Officers Association.

Association of American Medical Colleges (2017a, November 17). *Coalition letter urges Congress to preserve Public Service Loan Forgiveness.* Accessed 16 January 2018 from https://www.aamc.org/advocacy/washhigh/highlights2017/484880/111717coalitionletterurgescongresstopreservepublicserviceloanfor.html.

Association of American Medical Colleges (2017b). *Medical student education: Debt, costs and loan repayment fact card 2017.* Accessed 11 December 2017 from http://www.members.aamc.org/iweb/upload/2017%20Debt%20Fact%20Card.pdf.

Association of American Medical Colleges (2017c). *Tuition and student fees.* Accessed 11 December 2017 from https://www.aamc.org/data/tuitionandstudentfees/.

Barid, M., Kofoed, M. S., Miller, T., & Wenger, J. (2018). *For-profit higher education responsiveness to price shocks: An investigation of changes to post 9-11 GI Bill allowed maximum tuitions.* Working paper.

Baum, S., Ma, J., Pender, M., & Libassi, C. (2018). *Trends in student aid.* New York, NY: The College Board.

Baum, S., & Steele, P. (2017). *The price of graduate and professional school: How much students pay.* West Chester, PA: AccessLex Institute.

Baum, S., & Steele, P. (2018). *Graduate and professional school debt: How much students borrow.* West Chester, PA: AccessLex Institute.

Baumol, W. J. (1967). Macroeconomics of unbalanced growth: The anatomy of urban crisis. *American Economic Review, 57*(3), 415-426.

Bennett, W. J. (1987, February 18). Our greedy colleges. *The New York Times.* Accessed 11 December 2017 from http://www.nytimes.com/1987/02/18/opinion/our-greedy-colleges.html.

Bhole, M. (2017). *Why do federal loans crowd out the private market? Evidence from graduate PLUS loans.* Working paper, Stanford University.

Bowen, H. R. (1980). *The costs of higher education: How much do colleges and universities spend per student and how much should they spend?* San Francisco, CA: Jossey-Bass.

Capaldi, E. D., & Abbey, C. W. (2011). Performance and costs in higher education: A proposal for better data. *Change: The Magazine of Higher Learning, 43*(2), 8-15.

Cellini, S. R., & Goldin, C. (2014). Does federal student aid raise tuition? New evidence on for-profit colleges. *American Economic Journal: Economic Policy, 6*(4), 174-206.

Congressional Budget Office (2017). *Baseline projections for selected programs.* Accessed 26 January 2018 from https://www.cbo.gov/about/products/baseline-projections-selected-programs#18.

de Chaisemartin, C., & D'Haultfoeuille, X. (2018). Fuzzy differences-in-differences. *The Review of Economic Studies, 85*(2), 999-1028.

Delisle, J. (2014). *The graduate student debt review.* Washington, DC: New America.

Delisle, J. (2016). *The coming Public Service Loan Forgiveness bonanza.* Washington, DC: Brookings Institution Evidence Speaks Reports.

Douglas-Gabriel, D. (2017, December 1). GOP higher ed plan would limit student loan forgiveness in repayment program, overhaul federal financial aid. *The Washington Post.* Accessed 26 January 2018 from https://www.washingtonpost.com/news/grade-point/wp/2017/12/01/gop-higher-ed-plan-would-end-student-loan-forgiveness-in-repayment-program-overhaul-federal-financial-aid.

Federal Student Aid (2015). *Direct PLUS loans and adverse credit.* Accessed 16 January 2018 from https://studentaid.ed.gov/sites/default/files/plus-adverse-credit.pdf.

Federal Student Aid (2018). *Federal student loan portfolio.* Accessed 26 June 2018 from https://studentaid.ed.gov/sa/about/data-center/student/portfolio.

Federal Student Aid (n.d.). *Income-driven plans.* Accessed 16 January 2018 from https://studentaid.ed.gov/sa/repay-loans/understand/plans/income-driven.

FinAid.org (2017). *Historical loan limits.* Accessed 12 December 2017 from http://www.finaid.org/loans/historicallimits.phtml.

Gillen, A. (2012). *Introducing Bennett Hypothesis 2.0.* Washington, DC: Center for College Affordability and Productivity.

Gladieux, L. E., & Wolanin, T. R. (1976). *Congress and the colleges: The national politics of higher education.* Lexington, MA: Lexington Books.

González Canché, M. S. (2018). Geographical network analysis and spatial econometrics as tools to enhance our understanding of student migration patterns and benefits in the U.S. higher education network. *The Review of Higher Education, 41*(2), 169-216.

Heller, D. E. (2013). *Does federal financial aid drive up college prices?* Washington, DC: American Council on Education.

Jaquette, O., & Parra, E. E. (2014). Using IPEDS data for panel analyses: Core concepts, data challenges, and empirical applications. P. 467-533 in M. B. Paulsen (Ed.), *Higher education: Handbook of theory and research (Vol. 29)*. Dordrecht, the Netherlands: Springer.

Kelchen, R. (2017). *An empirical examination of the Bennett Hypothesis in law school prices*. West Chester, PA: AccessLex Institute Research Paper No. 17-09.

Lau, C. V. (2014). *The incidence of federal subsidies in for-profit higher education.* Job market paper, Northwestern University.

Lucca, D. O., Nadauld, T., & Shen, K. (2015). *Credit supply and the rise in college tuition: Evidence from the expansion in federal student aid programs.* New York, NY: Federal Reserve Bank of New York Staff Report No. 733.

Ma, J., Baum, S., Pender, M., & Welch, M. (2017). *Trends in college pricing 2017.* New York, NY: The College Board.

Mora, R., & Reggio, I. (2015). didq: A command for treatment-effect estimation under alternative assumptions. *The Stata Journal, 15*(3), 796-808.

Morse, R., & Hines, K. (2017, March 13). Methodology: 2018 best medical school rankings. *U.S. News & World Report.* Accessed 17 January 2018 from https://www.usnews.com/education/best-graduate-schools/articles/medical-schools-methodology.

Rizzo, M., & Ehrenberg, R. G. (2004). Resident and nonresident tuition and enrollment at flagship state universities. P. 303-349 in C. M. Hoxby (Ed.), *College choices: The economics of where to go, when to go, and how to pay for it.* Chicago, IL: University of Chicago Press.

Shireman, R. (2017). Learn now, pay later: A history of income-contingent student loans in the United States. *The ANNALS of the American Academy of Political and Social Science, 671*, 184-201.

Singell, Jr., L. D., & Stone, J. A. (2007). For whom the Pell tolls: The response of university tuition to federal grants-in-aid. *Economics of Education Review, 26*(3), 285-295.

Stoll, A., Bradley, D. H., & Mahan, S. M. (2014). *Overview of the relationship between federal student aid and increases in college price.* Washington, DC: Congressional Research Service.

Turner, L. J. (2014). *The road to Pell is paved with good intentions: The economic incidence of federal student grant aid.* Working paper.

Wei, C. C., & Skomsvold, P. (2012). *Borrowing at the maximum: Undergraduate Stafford loan borrowers in 2007-08.* Washington, DC: National Center for Education Statistics.

Woo, J. H., & Shaw, S. (2015). *Trends in graduate student financing: Selected years, 1995-96 to 2011-12.* Washington, DC: National Center for Education Statistics.

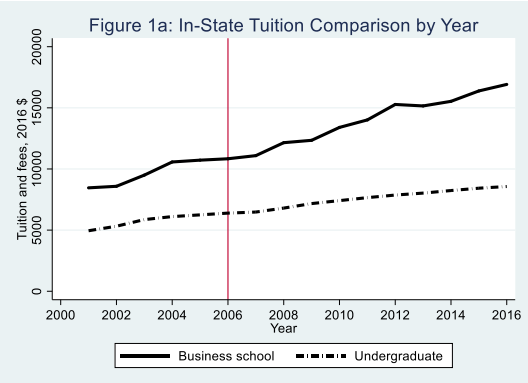
Figure 1a: In-State Tuition Comparison by Year
Tuition and fees, 2016 $
0
5000
10000
15000
20000
2000
2002
2004
2006
2008
2010
2012
2014
2016
Year
Business school
Undergraduate

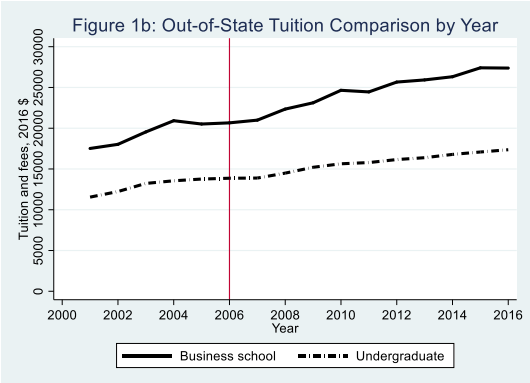
Figure 1b: Out-of-State Tuition Comparison by Year
Tuition and fees, 2016 $
0
5000
10000
15000
20000
25000
30000
2000
2002
2004
2006
2008
2010
2012
2014
2016
Year
Business school
Undergraduate

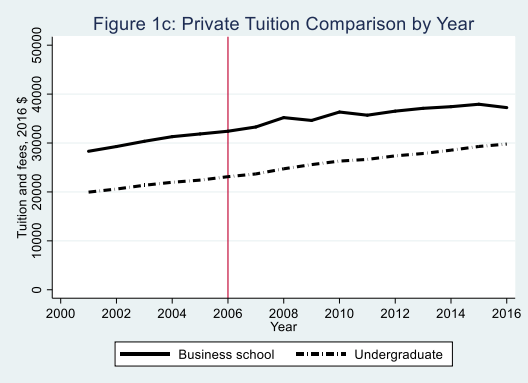
Figure 1c: Private Tuition Comparison by Year
Tuition and fees, 2016 $
0
10000
20000
30000
40000
50000
2000
2002
2004
2006
2008
2010
2012
2014
2016
Year
Business school
Undergraduate

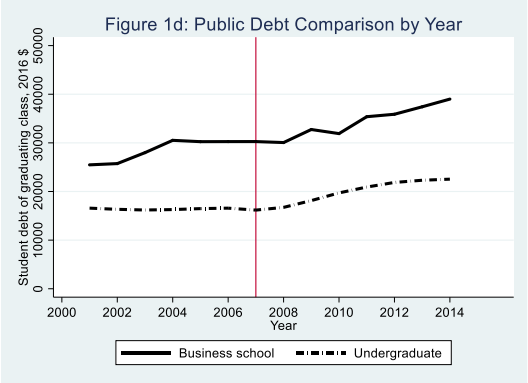
Figure 1d: Public Debt Comparison by Year
Student debt of graduating class, 2016 $
0
10000
20000
30000
40000
50000
2000
2002
2004
2006
2008
2010
2012
2014
Year
Business school
Undergraduate

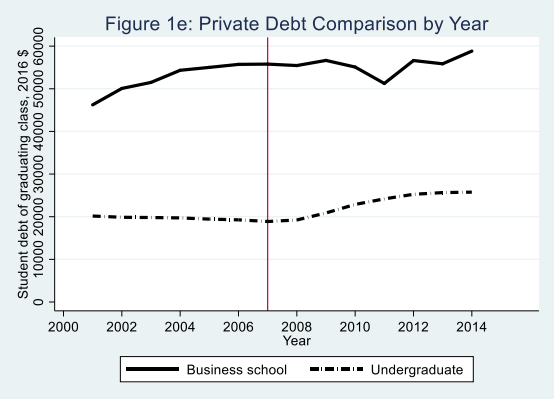
Figure 1e: Private Debt Comparison by Year
Student debt of graduating class, 2016 $
0
10000
20000
30000
40000
50000
60000
2000
2002
2004
2006
2008
2010
2012
2014
Year
Business school
Undergraduate

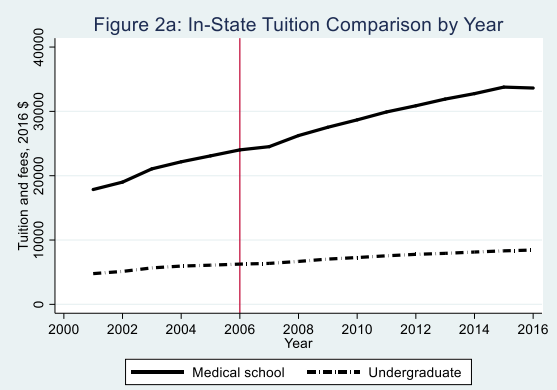
Figure 2a: In-State Tuition Comparison by Year
Tuition and fees, 2016 $
0
10000
20000
30000
40000
2000
2002
2004
2006
2008
2010
2012
2014
2016
Year
Medical school
Undergraduate

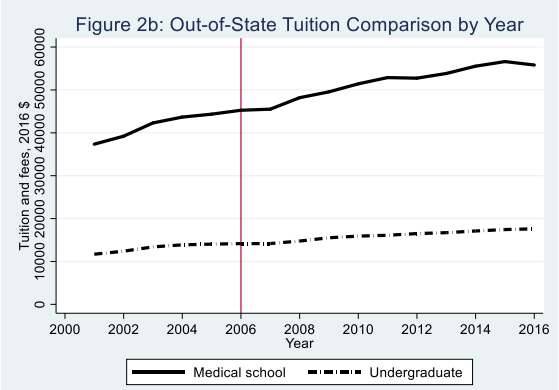
Figure 2b: Out-of-State Tuition Comparison by Year
Tuition and fees, 2016 $
0
10000
20000
30000
40000
50000
60000
2000
2002
2004
2006
2008
2010
2012
2014
2016
Year
Medical school
Undergraduate

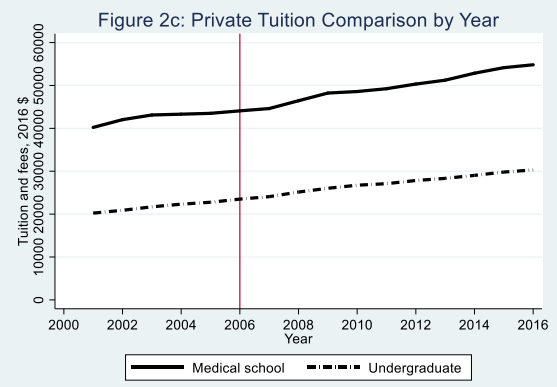
Figure 2c: Private Tuition Comparison by Year
Tuition and fees, 2016 $
0
10000
20000
30000
40000
50000
60000
2000
2002
2004
2006
2008
2010
2012
2014
2016
Year
Medical school
Undergraduate

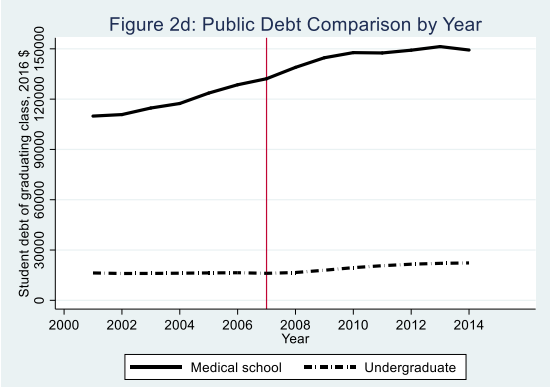
Figure 2d: Public Debt Comparison by Year
Student debt of graduating class, 2016 $
0
30000
60000
90000
120000
150000
2000
2002
2004
2006
2008
2010
2012
2014
Year
Medical school
Undergraduate

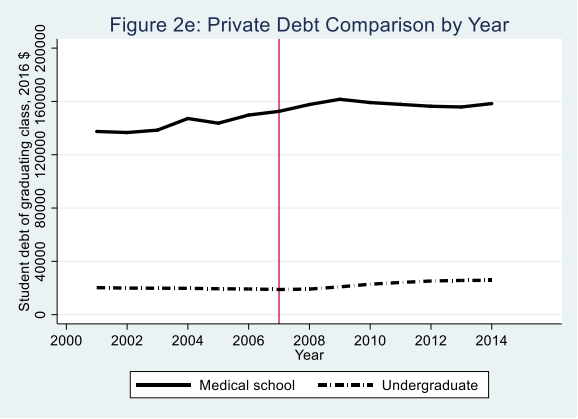
Figure 2e: Private Debt Comparison by Year
Student debt of graduating class, 2016 $
0
40000
80000
120000
160000
200000
2000
2002
2004
2006
2008
2010
2012
2014
Year
Medical school
Undergraduate

Table 1: Summary statistics of the datasets.

	Business schools				Medical schools			
	Public		Private nonprofit		Public		Private nonprofit	
Characteristic	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)
Outcomes of interest (2016-17 academic year, 2016$)								
In-state tuition and fees	16,916	(11,386)	37,238	(16,807)	33,632	(8,292)	54,826	(6,957)
Out-of-state tuition and fees	27,377	(12,552)	--	--	55,814	(13,946)	--	--
Debt of 2016 graduates	36,663	(20,544)	56,694	(27,754)	158,994	(30,003)	158,018	(42,986)
Demographic controls (2015-16 academic year)								
Total enrollment	306	(303)	429	(476)	652	(240)	620	(202)
Pct part-time students	63.3	(22.7)	56.5	(22.1)	--	--	--	--
Pct female students	39.5	(11.2)	41.1	(9.6)	46.7	(4.6)	49.2	(3.1)
Pct minority students	20.2	(16.2)	21.2	(14.3)	34.2	(13.9)	42.3	(9.4)
Pct underrep minority students	--	--	--	--	17.5	(13.2)	16.5	(4.5)
Pct international students	27.9	(18.7)	31.0	(17.9)	--	--	--	--
Selectivity controls (2015-16 academic year)								
Pct of students admitted	60.3	(24.3)	53.2	(23.2)	7.6	(3.8)	5.1	(1.9)
Median GMAT/MCAT	568	(77)	589	(94)	31.2	(2.0)	34.1	(2.3)
Median GPA of student body	3.34	(0.14)	3.34	(0.15)	3.72	(0.07)	3.77	(0.10)
Institutional control variables (2015-16 academic year)								
Pct of revenue from tuition	30.8	(9.6)	57.7	(21.4)	20.5	(12.8)	31.7	(22.8)
Pct of enrollment as grad students	18.8	(10.7)	34.6	(18.1)	38.8	(27.0)	62.2	(25.7)
Per-student endowment (2016$)	15,026	(27,073)	141,146	(284,811)	49,642	(74,128)	313,759	(411,876)
Maximum number of schools	277		133		92		51	

Sources: *U.S. News* (outcomes and demographic/selectivity control variables), Integrated Postsecondary Education Data System (tuition/fees and institutional control variables), Association of American Medical Colleges (tuition/fees).

Notes:

(1) For business schools, demographic and selectivity control variables are only for full-time students.

(2) Underrepresented minority students exclude Asian students, but include all other racial/ethnic minority students.

Table 2: Interrupted time series results for professional schools' tuition and fee prices.

Business schools	Public				Private nonprofit	
	In-state		Out-of-state		Tuition/fees	
Variable	(1)	(2)	(1)	(2)	(1)	(2)
Years since start of panel	0.080***	0.078***	0.043***	0.041***	0.028***	0.023***
(pre-treatment trajectory)	(0.010)	(0.014)	(0.008)	(0.012)	(0.007)	(0.009)
Post-2006 dummy	-0.010	-0.042	0.001	-0.023	0.019	0.010
(change in level--immediate treatment effect)	(0.019)	(0.027)	(0.016)	(0.022)	(0.014)	(0.017)
Years*post-2006 dummy	-0.037***	-0.042***	-0.016**	-0.017	-0.006	0.002
(change in slope--treatment effect over time)	(0.009)	(0.013)	(0.008)	(0.011)	(0.006)	(0.008)
Includes control variables?		X		X		X
Number of programs	267	204	266	203	131	93
Adjusted R-squared (overall)	0.091	0.072	0.066	0.014	0.025	0.009
Medical schools	Public				Private nonprofit	
	In-state		Out-of-state		Tuition/fees	
Variable	(1)	(2)	(1)	(2)	(1)	(2)
Years since start of panel	0.053***	0.063***	0.030***	0.034***	0.031***	0.028***
(pre-treatment trajectory)	(0.007)	(0.009)	(0.009)	(0.009)	(0.006)	(0.005)
Post-2006 dummy	0.011	0.008	-0.003	-0.015	-0.011	-0.003
(change in level--immediate treatment effect)	(0.014)	(0.016)	(0.018)	(0.016)	(0.012)	(0.009)
Years*post-2006 dummy	-0.025***	-0.035***	-0.014*	-0.017**	-0.001	-0.002
(change in slope--treatment effect over time)	(0.006)	(0.008)	(0.008)	(0.008)	(0.005)	(0.004)
Includes control variables?		X		X		X
Number of programs	96	71	96	71	52	44
Adjusted R-squared (overall)	0.299	0.152	0.183	0.237	0.062	0.033

Sources: See Table 1.

Notes:

(1) * represents p<.10, ** represents p<.05, and *** represents p<.01.

(2) All financial variables are logged and inflation-adjusted into 2016 dollars using the Consumer Price Index.

(3) Regressions have a one-year lag between control variables and outcomes metrics and also include institutional fixed effects and an inverse distance-weighted tuition measure.

Table 3: Interrupted time series results for professional schools' debt burdens.

Business schools	Debt burdens			
	Public		Private nonprofit	
Variable	(1)	(2)	(1)	(2)
Years since start of panel	0.025	0.059	0.042**	0.067*
(pre-treatment trajectory)	(0.021)	(0.042)	(0.019)	(0.040)
Post-2006 dummy	0.004	0.020	-0.040	-0.036
(change in level--immediate treatment effect)	(0.048)	(0.058)	(0.044)	(0.054)
Years*post-2006 dummy	0.013	-0.032	-0.021	-0.033
(change in slope--treatment effect over time)	(0.024)	(0.041)	(0.021)	(0.039)
Includes control variables?		X		X
Number of programs	187	132	99	66
Adjusted R-squared (overall)	0.035	0.012	0.001	0.004

Medical schools	Debt burdens			
	Public		Private nonprofit	
Variable	(1)	(2)	(1)	(2)
Years since start of panel	0.028***	0.030**	0.010	0.005
(pre-treatment trajectory)	(0.007)	(0.012)	(0.006)	(0.011)
Post-2006 dummy	0.078***	0.070***	0.058***	0.055***
(change in level--immediate treatment effect)	(0.017)	(0.016)	(0.015)	(0.017)
Years*post-2006 dummy	-0.011	-0.017	-0.005	0.000
(change in slope--treatment effect over time)	(0.008)	(0.012)	(0.007)	(0.011)
Includes control variables?		X		X
Number of programs	75	69	44	42
Adjusted R-squared (overall)	0.222	0.151	0.031	0.044

Sources: See Table 1.

Notes:

(1) * represents p<.10, ** represents p<.05, and *** represents p<.01.

(2) All financial variables are logged and inflation-adjusted into 2016 dollars using the Consumer Price Index.

(3) Regressions have a one-year lag between control variables and outcomes metrics and also include institutional fixed effects and an inverse distance-weighted tuition measure.

(4) Because of how data are reported to *U.S. News*, there is one more pre-treatment year for debt (the same year of data includes debt for 2006 graduates [pre] and tuition prices in 2006-07 [post]).

Table 4: Interrupted time series results by program selectivity.

	Public business schools			Private business schools	
Variable	In-state Tuition	Out-of-state Tuition	Debt of graduates	Tuition	Debt of graduates
Highly vs. moderately selective					
Years since start of panel	0.094***	0.064***	0.057	0.024***	0.037
	(0.016)	(0.013)	(0.043)	(0.009)	(0.043)
Post-2006 dummy	-0.067	-0.087***	-0.222*	0.024	0.197**
	(0.043)	(0.033)	(0.130)	(0.026)	(0.096)
Years*post-2006 dummy	-0.050***	-0.032**	-0.024	0.000	-0.011
	(0.017)	(0.013)	(0.043)	(0.009)	(0.043)
Highly selective business school	0.295***	0.172**	-0.146	0.195***	0.185
	(0.092)	(0.073)	(0.174)	(0.065)	(0.135)
Post-2006 dummy*highly selective	0.021	0.081**	0.184	-0.016	-0.258***
	(0.043)	(0.033)	(0.131)	(0.024)	(0.092)
Number of business schools	97	97	69	50	41
Adjusted R-squared	0.355	0.316	0.418	0.358	0.437
Moderately vs. less selective					
Years since start of panel	0.082***	0.054***	0.350*	0.025**	0.045
	(0.015)	(0.014)	(0.196)	(0.011)	(0.062)
Post-2006 dummy	-0.083**	-0.065*	0.344	0.032	-0.048
	(0.042)	(0.038)	(0.337)	(0.033)	(0.108)
Years*post-2006 dummy	-0.043***	-0.023	-0.298	0.000	-0.015
	(0.016)	(0.014)	(0.196)	(0.012)	(0.063)
Moderately selective business school	0.168**	0.229***	0.948***	0.414***	-0.037
	(0.076)	(0.062)	(0.338)	(0.071)	(0.177)
Post-2006 dummy*moderately selective	0.045	0.016	-0.843**	-0.035	0.168
	(0.044)	(0.039)	(0.347)	(0.033)	(0.124)
Number of business schools	162	161	95	69	45
Adjusted R-squared	0.186	0.165	0.129	0.331	0.238

Sources: See Table 1.

Notes:

(1) * represents p<.10, ** represents p<.05, and *** represents p<.01.

(2) All financial variables are logged and inflation-adjusted into 2016 dollars using the Consumer Price

(3) Highly selective programs had a median GMAT above 600 in 2004-05 or 2005-06, while moderately selective programs had a GMAT between 540 and 600. Schools that were not open in 2005 or did not report data that year are classified as less selective.

(4) All models include all three sets of lagged control variables (enrollment/demographics, admissions/selectivity, and institutional financial controls) and institutional fixed effects. Results with fewer sets of controls are available upon request.

(5) Controls are lagged one year for the tuition outcomes and two years for the debt outcomes.

Table 5: Difference-in-differences results for tuition prices at professional schools versus undergraduate institutions.

Panel A: Business schools.	Public				Private nonprofit	
Variable	In-state		Out-of-state		Tuition/fees	
Business school vs. undergraduate institution	0.097	(0.068)	0.138**	(0.056)	0.144***	(0.042)
Year by business school interactions (2006 omitted)						
Year: 2002	-0.079*	(0.042)	-0.016	(0.038)	0.019	(0.022)
Year: 2003	-0.071*	(0.041)	-0.022	(0.037)	0.019	(0.020)
Year: 2004	-0.022	(0.039)	-0.008	(0.036)	0.008	(0.022)
Year: 2005	-0.003	(0.039)	-0.014	(0.035)	0.009	(0.021)
Year: 2007	0.002	(0.038)	0.017	(0.035)	0.005	(0.021)
Year: 2008	0.027	(0.038)	0.005	(0.035)	0.007	(0.021)
Year: 2009	0.029	(0.038)	0.008	(0.035)	0.002	(0.021)
Year: 2010	0.087**	(0.039)	0.057	(0.035)	0.027	(0.021)
Year: 2011	0.088**	(0.039)	0.066*	(0.035)	-0.005	(0.021)
Year: 2012	0.128***	(0.039)	0.090**	(0.036)	-0.018	(0.021)
Year: 2013	0.113***	(0.039)	0.095***	(0.035)	-0.012	(0.021)
Year: 2014	0.113***	(0.039)	0.104***	(0.035)	-0.014	(0.021)
Year: 2015	0.144***	(0.039)	0.135***	(0.035)	-0.022	(0.021)
Year: 2016	0.181***	(0.039)	0.134***	(0.035)	-0.017	(0.021)
Number of institutions	321		320		514	
Adjusted R-squared (overall)	0.216		0.214		0.159	

Panel B: Medical schools.	Public				Private nonprofit	
Variable	In-state		Out-of-state		Tuition/fees	
Medical school vs. undergraduate institution	1.245***	(0.065)	1.153***	(0.062)	0.692***	(0.064)
Year by medical school interactions (2006 omitted)						
Year: 2002	-0.064**	(0.027)	-0.024	(0.031)	0.093***	(0.027)
Year: 2003	-0.031	(0.026)	-0.002	(0.030)	0.068**	(0.029)
Year: 2004	-0.036	(0.025)	-0.020	(0.029)	0.051*	(0.027)
Year: 2005	-0.005	(0.025)	-0.009	(0.029)	0.033	(0.026)
Year: 2007	0.013	(0.025)	-0.001	(0.029)	0.012	(0.026)
Year: 2008	0.008	(0.025)	-0.021	(0.029)	0.007	(0.026)
Year: 2009	0.023	(0.025)	-0.031	(0.029)	-0.011	(0.027)
Year: 2010	0.032	(0.025)	-0.024	(0.029)	-0.031	(0.027)
Year: 2011	0.040	(0.025)	-0.004	(0.030)	-0.044	(0.027)
Year: 2012	0.045*	(0.026)	-0.016	(0.030)	-0.060**	(0.027)
Year: 2013	0.037	(0.026)	-0.021	(0.030)	-0.059**	(0.027)
Year: 2014	0.032	(0.026)	-0.017	(0.030)	-0.052*	(0.028)
Year: 2015	0.055**	(0.026)	-0.006	(0.030)	-0.053*	(0.027)
Year: 2016	0.060**	(0.026)	-0.010	(0.030)	-0.059**	(0.028)
Number of institutions	158		158		441	
Adjusted R-squared (overall)	0.769		0.786		0.285	

Sources: See Table 1.

Notes:

(1) * represents p<.10, ** represents p<.05, and *** represents p<.01.

(2) All financial variables are logged and inflation-adjusted into 2016 dollars using the Consumer Price Index.

(3) Regressions have a one-year lag between control variables and outcomes metrics and also include year fixed effects.

(4) Models also include the demographic and institutional financial control variables mentioned in Table 1.

Table 6: Difference-in-differences results for debt burdens at professional schools versus undergraduate institutions.

Panel A: Business schools.	Public		Private nonprofit	
Business school vs. undergraduate institution	0.219***	(0.079)	0.793***	(0.043)
Year by business school interactions (2006 omitted)				
Year: 2003	-0.088	(0.063)	-0.156***	(0.032)
Year: 2004	-0.073	(0.062)	-0.125***	(0.032)
Year: 2005	-0.058	(0.060)	-0.051	(0.032)
Year: 2007	-0.033	(0.058)	0.000	(0.032)
Year: 2008	0.017	(0.057)	-0.036	(0.031)
Year: 2009	0.025	(0.057)	-0.014	(0.032)
Year: 2010	-0.030	(0.057)	-0.166***	(0.032)
Year: 2011	-0.040	(0.057)	-0.265***	(0.031)
Year: 2012	-0.059	(0.057)	-0.185***	(0.031)
Year: 2013	-0.036	(0.058)	-0.231***	(0.031)
Year: 2014	0.014	(0.058)	-0.113***	(0.031)
Number of institutions	238		476	
Adjusted R-squared (overall)	0.218		0.549	

Panel B: Medical schools.	Public		Private nonprofit	
Medical school vs. undergraduate institution	2.050***	(0.044)	2.066***	(0.040)
Year by medical school interactions (2006 omitted)				
Year: 2003	-0.102***	(0.029)	-0.079***	(0.028)
Year: 2004	-0.100***	(0.029)	-0.032	(0.028)
Year: 2005	-0.048*	(0.027)	-0.031	(0.028)
Year: 2007	0.010	(0.027)	0.056**	(0.027)
Year: 2008	0.046*	(0.027)	0.076***	(0.028)
Year: 2009	0.021	(0.027)	0.020	(0.028)
Year: 2010	-0.057**	(0.027)	-0.083***	(0.028)
Year: 2011	-0.135***	(0.028)	-0.143***	(0.028)
Year: 2012	-0.162***	(0.028)	-0.189***	(0.029)
Year: 2013	-0.170***	(0.028)	-0.201***	(0.029)
Year: 2014	-0.171***	(0.028)	-0.200***	(0.029)
Number of institutions	154		438	
Adjusted R-squared (overall)	0.941		0.869	

Sources: See Table 1.

Notes:

(1) * represents p<.10, ** represents p<.05, and *** represents p<.01.

(2) All financial variables are logged and inflation-adjusted into 2016 dollars using the Consumer Price Index.

(3) Regressions have a one-year lag between control variables and outcomes metrics and also include year fixed effects.

(4) Models also include the demographic and institutional financial control variables mentioned in Table 1.

Appendix 1: Interrupted time series falsification tests using 2005 as adoption of Grad PLUS (instead of 2006).

Business schools	Public			Private nonprofit	
Variable	In-state tuition	Out-of-state tuition	Debt of graduates	Tuition and fees	Debt of graduates
Years since start of panel	0.109**	0.079***	-0.012	0.030***	-0.023
(pre-treatment trajectory)	(0.020)	(0.016)	(0.078)	(0.012)	(0.069)
Post-2005 dummy	-0.023	-0.037	0.109	-0.001	0.056
(change in level--immediate treatment effect)	(0.029)	(0.024)	(0.066)	(0.017)	(0.060)
Years*post-2005 dummy	-0.070***	-0.048***	0.043	-0.003	0.047
(change in slope--treatment effect over time)	(0.020)	(0.016)	(0.078)	(0.012)	(0.069)
Number of programs	204	203	132	93	66
Adjusted R-squared (overall)	0.067	0.011	0.011	0.010	0.012
Medical schools	Public			Private nonprofit	
Variable	In-state tuition	Out-of-state tuition	Debt of graduates	Tuition and fees	Debt of graduates
Years since start of panel	0.079***	0.054***	0.018	0.025***	0.022
(pre-treatment trajectory)	(0.011)	(0.012)	(0.022)	(0.006)	(0.020)
Post-2005 dummy	0.030*	-0.011	0.067***	-0.011	0.017
(change in level--immediate treatment effect)	(0.016)	(0.017)	(0.019)	(0.010)	(0.018)
Years*post-2005 dummy	-0.046***	-0.034***	-0.003	-0.004	-0.016
(change in slope--treatment effect over time)	(0.011)	(0.012)	(0.022)	(0.006)	(0.020)
Number of programs	71	71	69	44	42
Adjusted R-squared (overall)	0.116	0.190	0.160	0.101	0.052

Sources: See Table 1.

Notes:

(1) * represents p<.10, ** represents p<.05, and *** represents p<.01.

(2) All financial variables are logged and inflation-adjusted into 2016 dollars using the Consumer Price Index.

(3) Because of how data are reported to *U.S. News*, there is one more pre-treatment year for debt (the same year of data includes debt for 2005 graduates [pre] and tuition prices in 2005-06 [post in the falsification test]).

(4) All models include all three sets of control variables (enrollment/demographics, admissions/selectivity, and institutional fixed effects. Results with fewer sets of controls are available upon request.