1 Introduction

With total student loan debt at an all-time high (and rising rapidly), it is more important than ever to understand the impact that the high debt burden (and policies aimed at reducing this burden) will have on individuals and on the higher education landscape. From the individual's perspective, a high level of debt may delay or reduce financial self-sufficiency, which has implications for countless other markets such as housing (Brown et al., 2014), occupation choice (Rothstein and Rouse, 2011), or marriage (Gicheva, 2016). Further, those with particularly high levels of debt may never realize a positive financial return on their investment in schooling (Webber, 2016). From a macroeconomic perspective, the approximately $1.3 trillion in outstanding debt from student loans will impact the federal budget for decades to come.

At the core of the problem is an increasing number of student loan defaults and delinquencies driven by rising tuition and poor initial job placements among recent graduates (the rate of defaults within 2 years of leaving school roughly doubled from 2004 to 2011). There is, of course, substantial heterogeneity in default rates across institutional characteristics, ranging from a low of 7.2% among private non-profits to a high of almost 20% among private for-profit institutions. Moreover, the amount of federal funding going to schools with moderate and high default rates increased considerably over the same period (Jaquette and Hillman, 2015).The prior figures have spurred a number of policy proposals aimed at incentivizing schools to reduce their student loan default rates. One such policy mandates that institutions to be ineligible for federal financial aid (such as Pell Grants) if their three-year cohort default rates are above 30% for three consecutive years, or above 40% for one year. While this is certainly a substantial penalty, the thresholds are set such that only a small number of schools are subject to penalties in a given year (Gross et al., 2009). An obvious drawback to the current policy is the discontinuous nature of the punishment; institutions which fall just over the required default rate may face a funding crisis, as federal aid is crucial to the operation of many institutions.[1] Similarly, students at these institutions will now be without a needed source of funding, even those for whom the education would have benefited. A second drawback is that this type of policy provides no incentives to improve student outcomes for those institutions which have default rates far from the cutoff.

Another recently proposed policy to reduce defaults and overall student loan debt is to force schools to pay for a portion of the debt accrued by students who default on (or alternatively fail to repay any of the principal) their student loans,[2] also known as risk-sharing. The most basic risk-sharing system would impose a penalty equal to some proportion (e.g. 20%) of the student loan debt accrued by an institution's students which is later defaulted upon. While a policy of risk-sharing has received much less attention than federal aid eligibility cutoffs, it may be a theoretically more appealing option since it does not suffer from the drawbacks listed above. First, students are not deprived of the opportunity to receive federal funds or forced to attend a less conveniently located school (if one even exists). Second, replacing the sharp discontinuity with a smooth punishment function incentivizes all schools to lower their default rates, not just the worst offenders. There are, however, potential downsides which are shared by both policies. Institutions could pass additional costs onto students in the form of higher tuition and/or reduce the number of students admitted. Furthermore, schools could effectively "credit-rate" potential students in an effort to avoid admitting students who are likely to have trouble repaying any accrued student loan debt.

This paper evaluates the response of postsecondary institutions to various risk-sharing policies both in terms of tuition and enrollment. This is accomplished by incorporating the parameters from cost function estimates into a simple model of university behavior based on monopolistic competition. I also present updated estimates of the returns to scale and scope among university outputs in order to look at a possible loss of allocative efficiency under a

[1]Darolia (2013) provides evidence from a regression discontinuity design of enrollment declines, particularly among for profits and community colleges, following a loss of federal loan eligibility.

[2]See the white paper by Senator Lamar Alexander (http://www.help.senate.gov/imo/media/Risk_Sharing.pdf) for a detailed description of the many risk-sharing proposals being considered by Congress.

risk-sharing program.

I find that even under pessimistic assumptions about the degree of reform schools are able to achieve, a risk-sharing program could bring about a sizable reduction in total student loan debt. However, such savings would likely come at a cost of modestly higher tuition rates among institutions with low rates of loan repayment and large student loan balances (predominantly the for-profit sector), a tradeoff which policymakers should consider when designing the program. Furthermore, I find no evidence that there would be a significant loss of economic efficiency if students are induced to enter a different educational sector as a result of a risk-sharing program.

The paper is constructed as follows: Section 2 discusses the previous literature. Section 3 describes the data and empirical methodology used to estimate institutional cost functions and responses. Section 4 provides a discussion of the findings and their implications, and Section 5 concludes.

2 Previous Literature

This section presents a brief summary of the literatures which are touched on by this paper. For a broader overview of the higher education fiscal landscape, see Ehrenberg (2012) or Ehrenberg (2014).

A central focus of this paper is the estimation of cost functions among higher education institutions. The seminal paper in this literature is Cohn et al. (1989), the first study to estimate cost function parameters for institutions of higher education and translate these parameters into the economically meaningful measures of economies of scale and scope. A number of studies have utilized the framework from Cohn et al. (1989) to provide similar measures for institutions in different countries or at different points in time (see Laband and Lentz (2003) or Sav (2011) to name just a few).

Since defaults on student loans are disproportionately concentrated among for-profit institutions, much of the political discussion surrounding defaults has focused on schools in that sector. While the literature which focuses specifically on for-profit institutions is still relatively small, primarily due to a lack of high-quality data, there are several recent excellent studies which examine multiple aspects of the for-profit sector.

Cellini (2010) and Cellini and Goldin (2014) both illustrate the large role that federal student aid plays in the strategic decisions of for-profit institutions. Cellini (2010) finds that entry of new for-profit programs is directly tied to the availability and generosity of federal aid such as Pell Grants. A number of recent studies (Cellini and Goldin, 2014; Lucca et al., 2015; Turner, 2014) show that increases in the generosity of these programs leads to an increase in tuition (although the rate of pass-through varies by institution-type and methodology used), particularly at for-profit institutions. This represents compelling evidence in support of the so-called "Bennett Hypothesis", and important evidence which supports the model of institution behavior which is used in this paper.

Recent work also tends to find that the costs (Cellini, 2012) and benefits (Cellini and Chaudhary, 2014; Lang and Weinstein, 2013) of attending a for-profit college tend to be less favorable to students relative to other sectors. However, it is important to note there is selection along several dimensions into attending a for-profit university, and that not all groups have equal access to all educational sectors (Chung, 2012).

The current paper also has substantial overlap with the growing body of research on student loans. For an excellent survey of both the practical and academic sides of student loans, see Avery and Turner (2012). The strand of this literature which deals with default rates is the most relevant to the current study. Dynarski (1994) and Hillman (2014) examine the characteristics which correlate with eventual default on their loans, finding unsurprisingly that borrowers from low-income households, college dropouts, and those with the lowest post-college earnings were the most likely to default on their student loans. See also Hillman (2015) for an excellent overview of the recent research on the characteristics of students who take on student loan debt, the magnitude of debt borrowed, and the future consequences of such debt.

3 Data and Empirical Methodology

The data for this study are drawn from two primary sources, the Integrated Postsecondary Education Data System (IPEDS) and the College Scorecard. IPEDS is an administrative dataset of postsecondary institutions which contains information on the demographic and academic characteristics of each institution's student body as well as detailed data on costs and revenues. The College Scorecard is a recent initiative from the Obama administration which publishes institution-level data on students' debt and labor market outcomes.

The goal of this study is to predict how postsecondary institutions would respond to various student loan risk-sharing policies. This is accomplished in two steps: 1) estimate cost function parameters to obtain a marginal cost curve for each institution, and 2) use the cost curve estimates in a simple model of monopolistic competition to predict what the institutional response would be to a risk-sharing policy (modeled as a change in costs). Each step is described in turn below.

Cost Function Estimation

I estimate a panel data variant of the model originally estimated in Cohn et al. (1989), the seminal paper in the higher education cost function literature. Specifically, I estimate the following equation for each of ten institution types (Public Research, Private Research, Public Masters, Private Masters, Public 4-year, Private 4-year, Public 2-year, Private 2-year, For-profit 4-year, and For-profit 2-year).

$$C_{it} = \alpha_0 + X_{it}\beta + \sum_j \gamma_j Y_{ijt} + (1/2)\sum_k \sum_j \delta_{jk} Y_{ijt} Y_{ikt} + \mu_i + \varepsilon_{it} \tag{1}$$

C represents the total cost expended by institution i at time t. X is a vector of control variables (the average instructor's salary and year fixed effects), Y represents the total value of outputs j and k (where j and k both index undergraduate enrollment, graduate enrollment, and a measure of external research output), μ_i denotes institution fixed effects, and ε_{it} is the usual error term. The above formulation effectively forms a quadratic in each output, as well as interactions between each output pair[3]. Output categories were excluded from samples where all, or nearly all, institutions had no positive values of the output (e.g. research or graduate enrollment for community colleges).

The analysis utilizes an unbalanced panel of institutions which cover the 1986-87 to 2012-13 academic years. Undergraduate and graduate enrollment are measured in full-time equivalent (FTE) students. Following Cohn et al. (1989), research output is measured as spending on external research administration.

While the main focus of this paper is not to generate estimates of institutional economies of scale and scope, these quantities are nonetheless useful when considering the optimal response to a change in costs. Following Cohn et al. (1989), I present updated estimates of ray economies of scale, product specific economies of scale, and economies of scope for each of the ten institutional types studied. These quantities are defined as follows:

$$Ray\, Economies\, of\, Scale\, (at\, time\, t): \frac{C_{it}}{\sum_j MC_i^j \times Output_{it}^j} \tag{2}$$

$$Product\, Specific\, Economies\, of\, Scale\, (for\, product\, j\, at\, time\, t): \frac{C_{it} - C_{it}^{-j}}{MC_i^j \times Output_{it}^j} \tag{3}$$

[3]Other parameterizations were tested, including a quartic in each output category and a translog cost function. Results are available upon request.

$$Economies\, of\, Scope\, (for\, product\, j\, at\, time\, t): \frac{C_{it}^{j} + C_{it}^{-j} - C_{it}}{C_{it}} \tag{4}$$

Ray economies of scale represent the impact on cost of a proportional increase of all products (i.e. undergraduate teaching, graduate teaching, and research), and are equivalent to product specific economies in the case of single-product firms. In the notation above, quantities with a superscript j refer to the item specific to product j (e.g. the marginal cost of undergraduate teaching), and quantities with a superscript -j refer to the item specific to all products *except* j (e.g. the total cost of all products *except* undergraduate teaching). The quantities above are calculated based on the estimates from Equation (1).

Estimating Institutional Responses

To predict how institutions will respond to a program such as risk sharing, we must first posit a model for their optimal choice of output. In this paper, I assume that firms make decisions based on a simple model of monopolistic competition, where they choose output (e.g. undergraduate teaching) and price (tuition) based on marginal cost, marginal revenue, and demand.

At first glance, a model based on profit maximization may seem inappropriate for schools in the nonprofit sector. However, I assume that each institution's current output and price combination represents an optimal allocation, and only assume that institutions will respond to small changes in costs in a profit-maximizing manner. In this way, my strategy makes no assumptions about what objective function institutions are attempting to maximize in a global sense (e.g. profit, prestige, research, school rank), but only assumes that they will respond to a small increase in costs in a way which minimizes the negative impact on their budgets. While the validity of this assumption still likely varies across institutional type, it is relatively unrestrictive in that many institutions are currently under substantial budgetary pressure and likely do take costs into account when making strategic decisions.

In a sense, assuming a model of monopolistic competition is akin to assuming that the "Bennett Hypothesis" holds. As noted above, the recent evidence is strongly in favor of this point among for-profit institutions (Cellini and Goldin, 2014). The evidence on other sectors of higher education still seems to support some degree of "Bennett Hypothesis" response, although the evidence is more mixed when examining in-state tuition at public universities (Long, 2004; Stingell and Stone, 2007; Turner, 2014). Despite this mixed evidence for institutions in the nonprofit sector, I would still argue that a model of monopolistic competition is an appropriate tool for the purpose of this policy simulation because it will produce estimates which can be interpreted as upper bounds on the unintended consequences of risk-sharing.

The first step in my simulation is to assume that the observed undergraduate enrollment and tuition levels are the result of the institution maximizing their objective function, which may or may not be entirely based on profit maximization. Since the goal of this paper is to predict how institutions would respond to a risk-sharing system, the methodology I propose does not need to impose an assumption that institutions are profit maximizing, only that the *change* in their behavior is based solely on financial concerns. For example, imagine the standard monopolistic competition graph where an institution is enrolling 1,000 more students past the intersection of MC and MR. This is how we might expect many, if not all, non-profit institutions to behave (higher enrollment and lower tuition than would be predicted by the intersection of MC and MR). A risk sharing program is implemented, shifting MC upward, making the current enrollment 1,050 students past the intersection of the new MC and MR curves. The procedure I describe below would estimate that the institutional response to risk sharing would be a decline in enrollment of 50 students. In this way, my model is considerably less restrictive than assuming profit maximization in that I only assume the local response, as opposed to the global position, is based on purely budgetary motives.

Based on the estimates from Equation (1), I can construct an approximation to the slope of each institution's marginal cost curve by taking the second derivative of the cost function with respect to undergraduate enrollment (the output which this paper will focus on). In order to produce an estimate of the elasticity of the demand curve, I use a standard profit maximization result which relates price (tuition) to marginal cost to infer this elasticity.[4] In order to increase the precision of the simulation, I use the median implied elasticity at the institutional type (each of 10 categories) rather than use a separate elasticity for each institution. As a robustness check (and in earlier versions of this paper), I have also simulated the effects of a risk-sharing program using a variety of elasticities which have been estimated in the college choice literature. The results presented in this paper closely match those which use the median elasticity from the prior literature.

In order to assess the response of the institution to a risk-sharing program, I then shift the marginal cost curve up according to the following equation:

$$MC_{new} = \hat{MC} + riskpenalty \times (1 - \%repayment) \times \%loan \times averageloan \tag{5}$$

where $\hat{MC}$ is the estimated marginal cost curve derived from Equation (1), riskpenalty is the fraction of unpaid loan balances costs the institution is asked to pay for, %repayment is the fraction of students who have made some progress in paying down their principal loan balance over the past 6 months, %loan is the share of each institution's students who receive student loans, and averageloan is the average dollar value of the loans held by students with a loan. Data on student loan repayment rates at the institutional level is obtained from the most recent wave of the College Scorecard. Finally, the predicted enrollment following risk sharing implementation is obtained by calculating the intersection of the new marginal cost curve and the original marginal revenue curve, and then adjusting based on how far the original enrollment diverged from the original MC and MR intersection. To restate the example above, if original enrollment is 1,000 in excess of the original profit maximizing enrollment, and original enrollment is 1,050 in excess of the new profit maximizing enrollment,

[4] $\frac{P}{MC} = \frac{\eta}{1+\eta}$ where η is the elasticity of demand.

then my model would anticipate an enrollment decline of 50 students. The new tuition level is calculated in a similar manner.

While the cost function estimation utilizes data from the entire IPEDS panel in order to obtain the most precise cost parameters possible, the simulations use only the last year of IPEDS/College Scorecard data (2013-2014). Since the purpose of this step is to produce a prediction of how universities would respond to the implementation of a risk-sharing system, the most policy-relevant responses are certainly those which correspond to contemporaneous institutional characteristics.

One final important note is that the analyses below assume that the risk-sharing penalty is based on repayment rates as opposed to default rates, which have traditionally been used in accountability metrics. While both measures conceptually capture students' post-school financial success, there are important differences. A cohort default rate measures the proportion of students who default (fail to make any payment over a nine month period) with a given number of years after leaving school. Although default is an important signal of financial distress, it only captures worst-case scenario events, and ignores students who are struggling to repay their loan but remain outside of technical default. Repayment rates, on the contrary, measure the proportion of students who have paid down at least part of the principal loan balance. This metric is thus both a better overall indicator of students' financial status and also less susceptible to gaming by colleges.[5] The simulations below specifically use the 3-year repayment rate, in other words the proportion of students who have made progress paying down their principal balance within 3 years of leaving school.

[5]Institutions may place financially distressed students in deferment or forbearance programs to avoid a technical default. See the following piece in the Chronicle of Higher Education for a description this practice. http://chronicle.com/article/Group-Questions-Tactics/133990/

4 Results

Table 1 presents summary statistics for each of the ten institution types. All of the data come from IPEDS with the exception of the 3-year default rate, which is obtained from the Department of Education at the institution-type level. The substantial differences among the observable characteristics of institutions underscores the need to estimate all models separately by institution type. Of particular interest to this study are the differences in the student loan variables. The average loan amount at for-profit institutions is roughly double that of public institutions. The disparity grows even larger when taking into account that about four out of 5 students attending for-profit institutions receive student loans, while less than half of the student body at the typical public institution takes on debt (and only 11% of students at public 2-year schools). These figures are important for interpreting the results below.

Coefficient estimates and standard errors (clustered at the institution level) from Equation (1) run separately on each institution type are shown in Table 2. The model fit is fairly strong for most institution types, and does not change much when other more flexible functional forms are utilized (e.g. quartic). Given that the focus of this paper is on predictions at individual institutions, a simpler functional form is actually preferable, since a quartic specification can lead to implausible responses for outlier institutions. While the estimates in Table 2 are not the focus of the paper (they are used to construct the marginal cost estimates), the results are in line with similar estimates from the prior literature (Cohn et al., 1989; Laband and Lentz, 2003; Sav, 2011).

Table 3 presents estimates of ray/product specific economies of scale and economies of scope for each institutional category. Each estimate represents the median institution's degree of scale or scope economies; standard errors are generated by bootstrapping the cost function regressions and scale/scope calculations together.

A value of greater than one for either ray or product specific economies of scale implies increasing returns to scale, while a value of less than one implies diseconomies of scale. Economies (diseconomies) of scope exist when the estimate is positive (negative).

Several interesting results stand out from the scale and scope calculations. First, private (both for-profit and non-profit) tend to have larger scale economies than their public counterparts. This is not at all surprising given the profit motives of for-profit institutions and the focus on small class sizes of private non-profits. Second, while not a perfect comparison, these estimates appear somewhat larger (greater economies of scale) than similar estimates using older data (Cohn et al., 1989; Laband and Lentz, 2003) despite considerable growth in enrollments. Anecdotally, this may be attributed to technological advances such as online learning. I am not aware of any work which rigorously examines the causes of such changes in cost structure over time, but it appears to be a potentially interesting question for future research.

Table 4 shows the predicted results of a risk-sharing program where the institution must pay for 20% of the value of the principal loan balances for students who have yet to pay down any principal, or a system in which the penalty is normalized by the average repayment rate with a 5% buffer (if an institution's repayment rate is 8 percentage points worse than the national average, then their penalty is 8%-5%=3%).[6] The predictions are generated using data only from the most recent survey year (Academic Year 2013-2014). The standard errors for each prediction are obtained by bootstrapping the regressions and response models together. As mentioned earlier, the model used to generate these predictions (monopolistic competition) effectively assumes a wost-case scenario in terms of the outcomes examined. While such a model is likely close to reality for some institutions (e.g. the for-profit sector), many non-profits would likely resist a purely financial response to risk-sharing. However, I believe the estimates presented below for these institutions still hold great value in that they can be interpreted as an upper bound on the policy response, or alternatively as a way to

[6]In unreported analyses, I estimate the response to penalties as large as 50%. Based on the political discussion surrounding risk-sharing, I view a penalty as large as 50% to be highly unlikely because of the burden this would place upon colleges. These results are available upon request.

gauge the magnitude of the loss in efficiency since equivalent cuts would need to be made in order to balance budgets following implementation.

The first row of each panel shows the median predicted increase in annual in-state tuition (in constant 2014 dollars). The largest increases, as would be expected, are seen in the institutions with the highest default rates, loan amounts, and prevalence of loans. Tuition at for-profit institutions would be expected to rise by $150-$250 per year for the typical institution under a 20% risk-sharing plan (~2%), or a slightly more modest $100-$200 under a normalized risk-sharing system. For all other institution types, the tuition hikes would be considerably smaller, mostly below 2% under a 20% risk-sharing penalty and negligible under a normalized penalty structure. The disparity between the institutinoal types, particularly under the normalized system, is due to the fact that most of the schools who fall significantly below the national average are for profit institutions. While this is true of a number of community colleges as well, the average loan balence at these schools is low relative to the for-profit sector, meaning much smaller penalties.

So is a risk-sharing program a good idea? The answer depends on how much institutions will focus on reducing student defaults due to the new incentives and the type of student who is likely to be pushed out of higher education as a result. The above results imply that even a relatively modest improvement in default rates would make the program a sensible one. While there is no way to know for sure that this type of behavior would occur, we can look at the implementation of stricter default standards in 1991 as a guide. Only the worst institutional offenders were punished with a loss of federal financial aid (default rates greater than 30%) as a result of the 1991 law change, but this also means that only a subset of schools faced any change in incentives whatsoever (a school with a 20% default rate had no incentive to change their behavior because they were not close to the threshold). Average 2-year cohort default rates dropped from 22.4% in 1990 to 15% in 1992 (a 33% drop!) and continued to decline over the next several years.

The downside to such a program is apparent from the above results, a potential reduction in college graduates and an increase in tuition. While there would almost certainly be some reduction in college graduates from a risk-sharing program, there are many reasons to believe the overall impact would be small. Non-profit institutions, particularly public 2-year institutions, would likely absorb many students displaced from their for-profit counterparts since their goal is definitionally not profit-maximization.

However, tuition increases are a much greater concern if some sort of risk-sharing program is implemented. Given the substantial increase in tuition over the past several decades, policymakers must be mindful of any additional cost pressure which is put on postsecondary institutions. Fortunately, since a risk-sharing program will save money, these funds could be reinvested in institutions which achieve low default rates, putting downward pressure on ballooning tuition.

One final limitation of this study is that it ignores any general equilibrium impact on institutional decisions, in other words some institutions may decide to opt out of the Title IV system due to the new regulatory structure imposed by a risk-sharing policy. This is already an issue at a number of community colleges, and has the potential to limit college access for some students who are unable or unwilling to take out private student loans, which often carry less generous terms than those offered by the federal government (Cochrane and Szabo-Kubitz, 2014).

5 Conclusion

As student loan debt continues to rise, a wide variety of policies aimed at reducing student debt and default rates have been proposed. This paper seeks to evaluate the costs and benefits of one such proposal, often referred to as risk-sharing. Under a risk-sharing program, postsecondary institutions would be obligated to pay for a portion of the debt which is defaulted on by their students. In contrast to current regulations involving default rates which are only binding for schools with very high default rates, a risk-sharing program would incentivize all institutions to reduce their default rates.

This paper examines the potential response of institutions to the introduction of risk-sharing under a variety of scenarios involving the magnitude of institutional penalties and the tuition elasticity of demand. I find that even a small degree of improvement in default rates (10%) would lead to considerable savings in national student loan debt, with the bulk of the gains coming from 4-year for-profit institutions. Tuition increases are likely to be modest at most schools based on the results of this analysis, but policymakers should be aware that risk-sharing would put positive pressure on tuition rates. Furthermore, I find no evidence that there would be a sharp decline in overall cost efficiency in the event that a risk-sharing program induced students to enroll in a different educational sector.

When evaluating the tradeoffs inherent in a risk-sharing system, it is important to remember that rationale for such a program is not primarily to reduce the aggregate student loan debt burden (this would only be a pleasant by-product). The real goal is to tie the incentives of institutions to the financial futures of the students they serve. Moreover, the generic penalty structure which does not emphasize any particular reform is a feature rather than a flaw. Institutions will be incentivized to improve their students' outcomes through whatever means possible, with the optimal policies almost certainly differing across schools.

In general, any policy which improves graduation, reduces time to degree, or improves post-school earnings is incentivized under a risk-sharing system. At institutions with strong graduation rates, risk-sharing might lead to an increased focused on academic advising, internship, and career placement services. At schools where students take an exceptionally long time to graduate (accruing more debt and spending additional time outside of the labor force), administrators could look at whether credit requirements have become overly burdensome.[7] Most importantly, I find that the burden of risk-sharing would, in practice, fall primarily on those institutions whose students take out substantial debt and who fare

[7] For instance, a recent study found that more than half of Associate'•s Degrees nationally require 67 or more credits for what is traditionally a 60 credit degree (Johnson et al., 2012).

poorly in the labor market. This group of schools is disproportionately, but not exclusively, made up of for-profit institutions. Although beyond the scope of the analysis in this paper, extending a risk-sharing system to all Title IV institutions (as opposed to just the for-profit sector or those with high rates of default) is likely far more politically feasible. The fact that I find most schools would be largely unaffected under a risk-sharing system is evidence that even if one believes such a policy to be distortionary for traditional nonprofits, the distortion is likely small.

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Table 1: Summary Statistics

	Public PhD	Private PhD	Public Masters	Private Masters	Public 4-yr	Private 4-yr	Public 2-yr	Private 2-yr	For-Profit 4-yr	For-profit 2-yr
Undergraduate Enrollment	17787	6974	5822	2005	2323	1073	2235	224	465	170
Graduate Enrollment	3993	2660	949	500						
Research Exp. ($Millions)	57.3	11.7								
Average Faculty Exp.	55961	70554	58082	51802	52742	49840	57878	48957	32607	27800
Graduation Rate	.553	.724	.424	.542	.369	.551	.224	.516	.38	.628
% Students with loan	.44	.54	.49	.69	.50	.67	.11	.59	.82	.76
Average loan amount	3939	5270	3432	4779	3517	4347	2713	3979	6885	5109
Annual In-state Tuition	4284	22863	3590	15750	3138	15612	2013	9075	12397	9600
% Repayment within 3 years	.825	.878	.750	.818	.7312	.789	.581	.685	.463	.506
# Institutions	155	103	236	331	100	509	867	102	514	884
Total observations	3,461	2,259	5,232	6,796	2,033	10,890	18,153	1,528	4,746	4,852

Each cell represents the median value of the variable for each institution type.

Table 2: Cost Regressions

	Public PhD	Private PhD	Public Masters	Private Masters	Public 4-yr	Private 4-yr	Public 2-yr	Private 2-yr	For-Profit 4-yr	For-profit 2-yr
Under	13,631***	16,958**	8,840***	8,107***	-6,342	7,248***	6,377***	8,044***	5,476***	9,186***
	(2,470)	(7,831)	(926.4)	(1,386)	(5,642)	(1,006)	(420.3)	(2,064)	(1,147)	(1,085)
Under2	-0.0509	-0.847	0.0811*	0.578***	1.186**	-0.0996*	0.0915***	1.132***	0.00436	-0.744***
	(0.181)	(1.018)	(0.0426)	(0.222)	(0.474)	(0.0534)	(0.0308)	(0.356)	(0.00626)	(0.206)
Grad	12,039**	3,668	2,598	2,556						
	(5,214)	(12,844)	(1,710)	(1,573)						
Grad2	1.670	2.693	-0.0333	0.909***						
	(1.738)	(2.626)	(1.040)	(0.303)						
Research	1.520***	1.561***								
	(0.211)	(0.567)								
Research2	-2.33e-09***	-1.17e-09**								
	(7.98e-10)	(5.72e-10)								
Under*Grad	-2.199**	-1.365	0.0221	-1.962***						
	(0.940)	(3.184)	(0.416)	(0.503)						
Under*Research	3.64e-05**	0.000178**								
	(1.48e-05)	(8.87e-05)								
Grad*Research	0.000161***	-2.39e-05								
	(3.03e-05)	(0.000102)								
Faculty Salary	12.55	32.61	12.86	12.01	-5.255*	4.995**	11.03***	0.102	7.584	2.557**
	(8.862)	(155.6)	(9.163)	(9.708)	(3.164)	(2.225)	(2.758)	(0.127)	(6.792)	(1.082)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Institution FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,461	2,259	5,232	6,796	2,033	10,890	18,153	1,528	4,746	4,852
R-squared	0.899	0.841	0.782	0.605	0.295	0.438	0.640	0.666	0.894	0.379

Table 3: Economies of Scale and Scope

	Public PhD	Private PhD	Public Masters	Private Masters	Public 4-yr	Private 4-yr	Public 2-yr	Private 2-yr	For-Profit 4-yr	For-profit 2-yr
Ray Economies of Scale	1.309	1.121	1.339	1.855						
	(.0869)	(.1361)	(.0521)	(.0815)						
Economies of Scale										
(Undergrad)	1.258	.8580	.4907	.9659	.2296	2.667	1.518	1.621	2.614	1.238
	(.4839)	(.4925)	(.0695)	(.0958)	(2.813)	(.114)	(.0549)	(.4256)	(.3691)	(.0839)
(Graduate)	2.367	4.145	30.83	-18.56						
	(2.559)	(1.753)	(14.67)	(7.936)						
(Research)	1.24	1.6005								
	(.1508)	(.4946)								
Economies of Scope										
(Undergrad)	.1346	.0083	-.0009	.050						
	(.0977)	(.1170)	(.0183)	(.0083)						
(Graduate)	.1229	.0823	-.0009	.0500						
	(.0748)	(.1085)	(.0183)	(.0083)						
(Research)	-.1240	-.0536								
	(.0254)	(.019)								

Table 4: Response to Risk-Sharing

	Public PhD	Private PhD	Public Masters	Private Masters	Public 4-yr	Private 4-yr	Public 2-yr	Private 2-yr	For-Profit 4-yr	For-profit 2-yr
Penalty=.2										
Change in tuition	63	31	99	57	54	72	57	9	240	139
	(5)	(11)	(10)	(13)	(12)	(4)	(1)	(36)	(58)	(12)
Penalty=% above average										
Change in tuition	6	1	30	2	17	19	15	3	213	124
	(3)	(1)	(7)	(1)	(9)	(3)	(1)	(17)	(54)	(14)

Standard errors are obtained by bootstrapping Equation (1), Equation (5), and the process described in the Empirical Methodology section together. The first row in each panel represents the median predicted increase in tuition.