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Risk-sharing and student loan policy: Consequences for students and institutions

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ABSTRACT

This paper examines the potential costs and benefits associated with a risk-sharing policy imposed on all higher education institutions. Under such a program, institutions would be required to pay for a portion of the student loans among which their students defaulted. I examine the predicted institutional responses under a variety of possible penalties and institutional characteristics using a straightforward model of institutional behavior based on monopolistic competition. I also examine the impact of a risk-sharing program on overall economic efficiency by estimating the returns to scale for undergraduate enrollment (as well as other outputs) among each of ten educational sectors. My estimates suggest that a risk-sharing program would induce only a modest tuition increase, with considerable heterogeneity across sectors. Two different penalty structures are analyzed in the context of the model, and alternative institutional responses such as tuition discounting and credit rating students are discussed.

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, Caldwell, & Sutherland, 2014), occupation choice (Rothstein & 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 & 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, Cekic, Hossler, & Hillman, 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

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[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.

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 among university outputs in order to look at a possible loss of allocative efficiency under a 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, Rhine, and Santos (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 (Archibald & Feldman, 2016; Cellini & Goldin, 2014; Heller, 2013; Lucca, Nadauld, & Shen, 2015; Turner, 2014) examine the link between these policies and institutional budgeting. I believe a fair summary of the literature relating student aid and tuition is that there is a nearly dollar for dollar link at for-profit institutions, but much weaker evidence of any significant pass-through at non-profits (although there is somewhat stronger evidence of reductions in institutional grant aid).

Although I am aware of no published academic work relating to risk-sharing in higher education, there is a literature on other types of accountability metrics. The most common way that states attempt to incentivize institutions is through Performance Based Funding (PBF), which often ties financial incentives to graduation rates of particular student groups (e.g. Pell Grant recipients). For an overview of PBF programs and evaluations of various programs, see recent work by Shin (2010), Sanford and Hunter (2011), Hillman, Tandberg, and Gross (2014), and Kelchen and Stedrak (2016).

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.

3.1. Cost function stimation

I estimate a panel data variant of the model originally estimated in Cohn et al. (1989), the seminal paper in the higher

[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.

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).

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

C represents the total cost expended by institution i at time t. X is a vector of control variables (the average instructor's salary, interactions between instructor salary and each output variable, and year fixed effects),[3] 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.[4] 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, 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 for each of the ten institutional types studied. These quantities are defined as follows:

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

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

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 Eq. (1).

3.2. 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 & 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 & 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 1000 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 1050 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 Eq. (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.[5] 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.

[3] Results are robust to including other control variables which impact the marginal cost of a student such as the fraction of faculty which are full-time/tenure track.

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

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

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:

$$MC_{new} = \hat{MC} + riskpenalty \times (1 - \%repayment) \times \%loan \times averageloan \quad (4)$$

where $\hat{MC}$ is the estimated marginal cost curve derived from Eq. (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 1000 in excess of the original profit maximizing enrollment, and original enrollment is 1050 in excess of the new profit maximizing enrollment, 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.[6] 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. The results are generally robust to the use of default rather than repayment rates, however the associated penalties must be higher under default rates to attain the same response.

4. Results and discussion

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 Eq. (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 & Lentz, 2003; Sav, 2011).

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

Several interesting results stand out from the scale 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 & 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 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 (currently 62%) with a 5% buffer[7] (if an institution's repayment rate is 8 percentage points worse than the national average, then their penalty is 8% − 5% = 3%).[8] While the first penalty structure incentivizes every institution, the second has the virtue of effectively controlling for the national labor market and not punishing institutions for students who graduate in a recession. 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 worst-case scenario in terms of the outcomes examined. While such a model is likely close to reality for some in-

[6] 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/.

[7] These types of penalties were proposed in the Senate hearing on risk-sharing mentioned earlier and in policy proposals such as Kelchen (2015).

[8] 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.

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.	55,961	70,554	58,082	51,802	52,742	49,840	57,878	48,957	32,607	27,800
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	22,863	3590	15,750	3138	15,612	2013	9075	12,397	9600
% Repayment within 3 years	.825	.878	.750	.818	.7312	.789	.581	.685	.463	.506
% Repayment (low-income)	.766	.826	.691	.754	.664	.721	.506	.614	.398	.445
% Repayment (medium-income)	.840	.878	.774	.833	.767	.809	.665	.735	.535	.585
% Repayment (high income)	.882	.922	.827	.890	.822	.875	.734	.826	.660	.693
# Institutions	155	103	236	331	100	509	867	102	514	884
Total observations	3461	2259	5232	6796	2033	10,890	18,153	1528	4746	4852

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	17,463***	10,744	10,067***	9711***	−1819	7454***	7487***	4013**	9906***	8465***
	(2970)	(8219)	(666.0)	(1732)	(6600)	(1095)	(592.7)	(1871)	(1401)	(938.2)
Under2	0.0147	−0.384	0.0982***	0.115	1.031	−0.114***	0.0866***	−0.569	−0.0287***	−0.615***
	(0.238)	(1.083)	(0.0202)	(0.370)	(0.627)	(0.0423)	(0.0257)	(0.870)	(0.00756)	(0.162)
Grad	3157	−3369	5130**	437.8						
	(5547)	(11,146)	(2153)	(2003)						
Grad2	4.408*	−0.465	0.00351	0.218						
	(2.462)	(1.941)	(0.584)	(0.543)						
Research	1.527***	2.666***								
	(0.248)	(0.620)								
Research2	−1.70e-09**	−1.55e-09***								
	(7.80e-10)	(5.26e-10)								
Under*Grad	−2.556*	−0.629	−0.157	−0.535						
	(1.487)	(2.996)	(0.213)	(0.877)						
Under*Research	3.66e-05**	2.03e-06								
	(1.49e-05)	(9.63e-05)								
Grad*Research	7.37e-05*	0.000129								
	(3.97e-05)	(8.87e-05)								
Faculty Salary	115.2	−422.7***	−19.15	3.796	7.509	−2.451	32.80	−19.22***	1.771	−0.259
	(71.87)	(160.8)	(15.09)	(8.098)	(24.71)	(5.203)	(26.90)	(4.057)	(6.947)	(2.677)
Salary*under	−0.0181*	0.0370	−0.0124	0.00586	−0.00181	0.00797	9.77e-05	0.0851***	0.00133	0.00282
	(0.00985)	(0.0286)	(0.00836)	(0.00723)	(0.00614)	(0.00522)	(0.00295)	(0.0149)	(0.00167)	(0.00332)
Salary*grad	0.0343**	0.160***	0.0760*	0.00173						
	(0.0171)	(0.0568)	(0.0438)	(0.0110)						
Salary*research	1.16e-06	−1.77e-06***								
	(8.29e-07)	(6.07e-07)								
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	0.916	0.874	0.881	0.675	0.369	0.529	0.690	0.834	0.722	0.366

Table 3
Economies of scale.

	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	1.251	1.273	1.191	1.806						
	(.058)	(.127)	(.047)	(.096)						
Economies of Scale										
(Undergrad)	1.178	2.058	.216	.927	3.431	2.551	1.476	1.800	1.798	1.651
	(.328)	(1.045)	(.176)	(.184)	(1.233)	(.121)	(.067)	(.310)	(.736)	(.130)
(Graduate)	4.108	4.327	36.749	45.414						
	(2.773)	(1.076)	(10.753)	(41.092)						
(Research)	1.461	1.640								
	(.231)	(.371)								

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	66	37	97	55	53	47	57	75	230	111
	(4)	(7)	(16)	(13)	(15)	(2)	(2)	(44)	(61)	(15)
Penalty=% above average										
Change in tuition	7	1	30	2	17	19	15	26	203	100
	(2)	(1)	(8)	(1)	(9)	(4)	(2)	(14)	(57)	(14)
Elasticity	−2.50	−1.19	−1.14	−2.16	−1.19	−1.69	−1.00*	−4.79	−2.91	−2.51

Standard errors are obtained by bootstrapping Eqs. (1) and (5), and the process described in the Empirical Methodology section together. The first two rows represent the median predicted increase in tuition (and associated bootstrapped standard errors) from a risk-sharing structure with a flat 20% penalty. The next two rows simulate the tuition response to a risk-sharing system in which the penalty is calculated based on an institution's repayment rate relative to the average repayment rate among all institutions. The last row presents the implied elasticity (obtained from the ratio between marginal cost and observed tuition) which is used for each of the simulations. *The implied elasticity for public community colleges in the data was unreasonable to use in the simulation because the marginal cost was above the price paid by students. While this fact is not unreasonable by itself given large public subsidies and the low price of most community colleges, it would not be appropriate to assume that the elasticity of demand for these institutions is positive. I therefore force the assumed elasticity to be -1.0 for the purposes of the simulation. The results are not sensitive to the choice of different (negative) elasticities.

stitutions (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 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 two rows of Table 4 show the median predicted increase in annual in-state tuition (and its associated standard error) under a flat 20% penalty, and the next two rows display the projected tuition impact and standard error assuming the normalized penalty structure described above. 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 $111 at 2-year for-profits and $230 per year for 4-year for-profits under a 20% risk-sharing plan (~2%), or a slightly more modest $100 and $203 respectively 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 institutional 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 balance at these schools is low relative to the for-profit sector, meaning much smaller penalties. The presumed elasticities used in each simulation are shown at the bottom of the table.[9] It should be noted that the elasticities implied by the ratio of price to marginal cost across institutional type follows a fairly intuitive pattern. The private for-profit institutions operate at a higher (in absolute value) elasticity of demand, reflecting the focus on pure profit maximization, while non-profits tend to operate closer to unit-elasticity.

It is important to point out that the there are essentially two conditions which must both be met for an institution to exhibit a large tuition response to risk sharing: (1) low repayment rates and (2) large loan balances. Most students at nonprofit four year institutions may have large student loans, but they also have very high rates of repaying their loans. Conversely, community colleges tend to have low repayment rates, but their loan burdens prevent sizable penalties (and subsequent tuition responses). It is only the for-profit institutions which satisfy both conditions, and are forced by a profit-maximizing model to respond with large price increases.

[9] The results are robust to the choice of other elasticities, simulations using any other elasticity are available upon request.

The above tuition simulations make the (hopefully unreasonable) assumption that institutions will respond to a risk-sharing system in a purely financial manner, and will take no steps whatsoever to improve outcomes for students, in other words it is an upper bound on the tuition response. They can thus be seen as upper bounds on the extent of tuition increases. To the extent that there are reforms which universities would find less costly than their risk-sharing penalties, the actual tuition increases would likely be smaller than those presented in Table 4.

As described above, the assumptions I make in order to generate the tuition simulations are fairly unrestrictive in that I do not assume institutions solely seek to maximize their profits in a global sense. However, particularly for non-profit institutions, even assuming an across-the-board tuition increase may be too restrictive of an assumption. A progressive tuition discounting pattern, in which the actual tuition paid is considerably below the "sticker price" (particularly for low-income students), is commonplace in the non-profit sector Hillman (2012). Table 5 presents the results of how a tuition discounting policy could be used to offset increased risk-sharing costs. I assume that, rather than all students seeing an across the board tuition increase, an institution's students who come from families with greater than $110,000 in family income will be asked to pay 2/3 of the costs of risk-sharing, and those whose families make between $75,000 and $110,000 will make up the remaining 1/3 of the costs. These represent the top two (out of five) family income categories in which there is information on tuition discounting available from the College Scorecard. Unsurprisingly, if all institutions followed a tuition discounting strategy to address risk-sharing penalties students from advantaged backgrounds would shoulder a larger burden at public schools because they make up a smaller share of the total student body.

While colleges shifting the risk-sharing burden to students without investing in improving their labor market outcomes is one potential negative consequence, such behavior would be fairly easy to identify ex-post. A potentially more difficult to detect (and socially damaging) problem would be if institutions tied characteristics which correlate with future repayment probabilities to admissions decisions. To get a sense of exactly how big the financial incentives would be for institutions to credit rate students, I use College Scorecard data on repayment rates broken down by family income. While there is certainly a difference in repayment rates across the three income categories I have data on (family income <$30k, $30k <family income <$75k, and $75k <family income), much of the difference tends to be across rather than within institutions. Nationally, the repayment rates for these groups are 54%, 67% and 76% respectively. However, the differences are much

Table 5
Response to risk-sharing (Tuition discounting).

	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
Fam inc>$110k	64	25	93	66	51	47	58	82	308	162
$110k>Fam inc>$70k	32	13	46	33	25	24	29	41	154	81

The figures in this table represent the increase tuition for the top 2 (of 5) family income categories if institutions chose to pass the entire cost of a risk-sharing program onto these two groups. I generated these figures assuming that the top income category would pay 2/3 of the total burden and the next highest income category would pay the remaining 1/3.

smaller when looking within rather than across institutions (i.e. a high income student who attends Harvard is not in the applicant pool of a non-selective institution). Table 1 presents repayment rates broken down by the three income levels mentioned above and institutional type. A simple variance decomposition of a variable equal to the difference in repayment rates between students from high and low income backgrounds indicates that nearly half (42%) of the variation can be explained solely by the ten institutional-type categories.[10]

Furthermore, this sort of credit rating would only be likely to take place among schools with binding capacity constraints and considerable excess demand, typically the more prestigious institutions. The fact that net tuition per student is greater than the expected (taking into account risk-sharing penalties) marginal cost effectively ensures that any institution which is not capacity constrained will not wish to turn away even high risk students. So while the effect of risk-sharing on college access might be expected to be small, there are two other potential channels it could impact low-income students: academic mismatch at elite institutions (schools with capacity constraints credit rating their students) and lower quality education (due to fewer resources as a result of the penalties) at non-selective institutions. Furthermore, it is difficult to say what the magnitude of the impact of risk-sharing on academic mismatch and educational quality would be. For this reason, a well-designed risk-sharing policy would seek to remove these perverse incentives by paying a bonus (or reducing the risk-sharing penalty) for high risk-students who graduate/repay their loans, as proposed for instance in Kelchen (2015). I view some sort of bonus system, such as paying a reward for each Pell student who graduates/repays their loan, as absolutely necessary to protect the interests of the students Title IV funding was created to serve.

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 magnitude of unintended consequences. The above results imply that the risk or large tuition increases is likely minimal, and concerns regarding the credit rating of students can be incentivized against. As is always the case, the details of how the program is structured will be very important. A risk-sharing penalty which is normalized either to a national or group-specific (e.g. Carnegie Classification) average has both benefits and drawbacks. On the one hand, normalizing the penalty to any measure will control for business cycle fluctuations in student outcomes that should not be attributed to institutions. Furthermore, the fact that the best-performing institutions will be unaffected by the penalty gives a strong incentive to improve outcomes and considerably reduces the risk of unintended consequences. Anchoring the penalty to some group-specific measure also has the virtue of comparing institutions to similar peers, but policymakers should be careful not to choose group definitions which can be easily manipulated (for instance by using spending per student).

[10] Given that there is substantial heterogeneity within each of the ten institution types, this fraction would likely be much larger if panel data on repayment rates were available.

A flat penalty, such as the 20% example modeled above, may not have these advantages, but I do see two sizable benefits from this approach. First, is the simplicity of the structure and inability to "game" any part of the penalty. In my interactions with policymakers, it has been consistently emphasized how important simplicity is, both when it comes to the political process of enacting a new policy and the enforcement of that policy. Second, the normalized penalty structure modeled above effectively only provides incentives to a fraction of institutions (those who are below the average repayment rate). Whether this is a feature or a bug depends on what you believe the purpose of accountability regulations to be. If they are meant to punish/incentivize against worst-case offenders, then a normalized penalty structure seems ideal. If instead you view the purpose of such regulations as an incentive for everyone, and that even a near perfect institution should be pushed to improve, then the flat penalty structure is likely more appealing. My personal preference is for a normalized penalty structure, but reasonable people can certainly disagree on this preference.

While there is no way to know for sure that institutions would invest resources in student outcomes rather than pursuing a strategy aimed solely at mitigating financial losses, 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.

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, or could be forced to close due to the penalties. 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 & Szabo-Kubitz, 2014; Wiederspan, 2016).

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 involv-

ing 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.[11] 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 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.

There are many ways that policymakers could design an accountability system which improves on the current arrangement. As of this writing, there is effectively one major penalty threshold which carries potentially crippling consequences (a loss of Title IV funding eligibility). This is far too stiff a penalty and affects far too few institutions. The model presented above describes two different continuous penalty structures which greatly reduce the potential for schools to game the system and provides incentives to a much broader range of schools to invest in their students' future labor market success. The specifics of how the penalty is structured are just as important as the overall decision to implement a risk-sharing system, the text above gives some guidance about how to think about the tradeoffs between different penalty types. Finally, I think it is crucial that a risk-sharing system implement some sort of positive financial incentive to guard against the potential unintended consequence of institutions credit rating students in the application process. While there is reason to believe this sort of behavior will not be widespread, it should be guarded against. Fortunately, since a risk-sharing policy would generate revenue for the federal government, it would be easy to redistribute that money to institutions which are doing an effective job of graduating (or any other metric of labor market success) the most at risk students.

[11] 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, Reidy, Droll, & LeMon, 2012).

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References

Archibald, R., & Feldman, D. (2016). Does federal aid drive college tuition? *Regulation Magazine, 39(2)*, 12–18.
Avery, C., & Turner, S. (2012). Student loans: Do college students borrow too much–or not enough? *Journal of Economic Perspectives, 26(1)*, 165–192.
Brown, M., Caldwell, S., & Sutherland, S. (2014). Just released: Young student loan borrowers remained on the sidelines of the housing market in 2013. *Technical report*. Federal Reserve Bank of New York Economics Blog.
Cellini, S. (2010). Financial aid and for-profit colleges: Does aid encourage entry. *Journal of Policy Analysis and Management, 29(3)*, 526–552.
Cellini, S., & Goldin, C. (2014). Does federal student aid raise tuition? New evidence on for-profit colleges. *American Economic Journal: Economic Policy, 6(4)*, 174–206.
Cochrane, D., & Szabo-Kubitz, L. (2014). At what cost? How community colleges that do not offer federal loans put students at risk. Issue brief. *Technical report*. Institute for College Access & Success.
Cohn, E., Rhine, S., & Santos, M. (1989). Institutions of higher education as multi--product firms: Economies of scale and scope. *Review of Economics and Statistics, 71(2)*, 284–290.
Darolia, R. (2013). Integrity versus access? The effect of federal financial aid availability on postsecondary enrollment. *Journal of Public Economics, 106*, 101–114.
Dynarski, M. (1994). Who defaults on student loans? Findings from the national postsecondary student aid study. *Economics of Education Review, 13(1)*, 55–68.
Ehrenberg, R. (2012). American higher education in transition. *Journal of Economic Perspectives, 26(1)*, 193–216.
Ehrenberg, R. (2014). What's the future of public higher education? A review essay on gary c. fethke and andrew j. policano's public no more: A new path to excellence for america's public universities. *Journal of Economic Literature, 52(4)*, 1142–1150.
Gicheva, D. (2016). Student loans or marriage? A look at the highly educated. *Economics of Education Review*. Forthcoming.
Gross, J., Cekic, O., Hossler, D., & Hillman, N. (2009). What matters in student loan default: A review of the research literature. *Journal of Student Financial Aid, 39(1)*, 19–29.
Heller, D. (2013). Does federal financial aid drive up college prices? *Technical report*. American Council on Education.
Hillman, N. (2012). Tuition discounting for revenue management. *Research in Higher Education, 53(3)*, 263–281.
Hillman, N. (2014). College on credit: A multilevel analysis of student loan default. *The Review of Higher Education, 37(2)*, 169–195.
Hillman, N. (2015). Borrowing and repaying student loans. *Journal of Student Financial Aid, 45(3)*, 5.
Hillman, N., Tandberg, D., & Gross, J. (2014). Performance funding in higher education: Do financial incentives impact college completions. *Journal of Higher Education, 85(6)*, 826–857.
Jaquette, O., & Hillman, N. (2015). Paying for default: Change over time in the share of federal financial aid sent to institutions with high student loan default rates. *Journal of Student Financial Aid, 45(1)*, 2.
Johnson, N., Reidy, L., Droll, M., & LeMon, R. (2012). Program requirements for associates and bachelors degrees: A national survey. *Technical report*. HCM Strategists.
Kelchen, R. (2015). Proposing a federal risk-sharing policy. *Technical report*. Lumina Foundation.
Kelchen, R., & Stedrak, L. (2016). Does performance-based funding affect colleges' financial priorities? *Journal of Education Finance, 41(3)*, 302–321.
Laband, D., & Lentz, B. (2003). New estimates of economies of scale and scope in higher education. *Southern Economic Journal, 70(1)*, 172–183.

Long, B. (2004). How do financial aid policies affect colleges? The institutional impact of the georgia hope scholarship. *Journal of Human Resources, 39(4)*, 1045–1066.
Lucca, D., Nadauld, T., & Shen, K. (2015). Credit supply and the rise in college tuition: Evidence from the expansion in federal student aid programs. *Technical report*. Federal Reserve Bank of New York.
Rothstein, J., & Rouse, C. (2011). Constrained after college: Student loans and early–career occupational choices. *Journal of Public Economics, 95(1–2)*, 149–163.
Sanford, T., & Hunter, J. (2011). Impact of performance-funding on retention and graduation rates. *Education Policy Analysis Archives, 19*, 1–30.
Sav, G. (2011). Panel data estimates of public higher education scale and scope economies. *Atlantic Economic Journal, 39(1)*, 143–153.
Shin, J. (2010). Impacts of performance-based accountability on institutional performance in the u.s. *Higher Education, 60(1)*, 47–68.
Stingell, L., & Stone, J. (2007). For whom the pell tolls: The response of university tuition to federal grants-in-aid. *Economics of Education Review, 26(3)*, 285–295.
Turner, L. (2014). The road to pell is paved with good intentions: The economic incidence of federal student grant aid. *Technical report*. University of Maryland.
Webber, D. (2016). Are college costs worth it? How individual ability, major choice, and debt affect the return to schooling. *Economics of Education Review, .53*, 296–310.
Wiederspan, M. (2016). Denying loan access: The student-level consequences when community colleges opt out of the stafford loan program. *Economics of Education Review, 51*, 79–96.