Effects of Tuition Discounting on University's Financial Performance

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Abstract

We study how tuition discounting affects the financial decisions of universities, their student recruitment, and reputation. Using a large panel data of U.S. private and public four-year institutions, we find that tuition discounting helps institutions enhance their short-term operating surplus, increase admission yield, and reduce drop-out rate. However, it does not improve the graduation rate or the quality of the incoming students. Institutions relying more on tuition discounting have more financial leverage, less equity, and experience lower liquidity and asset turnover – indicating greater financial risk. These results are stronger for private universities. Finally, out-of-sample tests show that tuition discounting may not help enhance the reputation of private universities.

Keywords: Tuition Discounting, University Reputation, Financial Performance, Higher Education Financial Management

I. Introduction

Higher educational institutions in the U.S. are experiencing an upheaval in their business models. Due to a substantial and ongoing decrease in subsidy share of costs (i.e. the proportion of educational costs subsidized by state funds or institutional resources), the colleges and universities – both public and private – increasingly depend on direct revenues, such as tuitions and fees. As a result of the budgetary pressures associated with the recent financial crisis and a slow subsequent economic recovery, state governments have significantly reduced assistance to state colleges and universities (Zumeta, 2010). Federal budget cuts have decreased grant funds to both public and private universities. The average amount of student loan has increased steadily. Even private institutions and individuals have lowered their contributions. These forces have changed the way financial aids are viewed.

Colleges and universities historically reflected the desires of the constituents at large by discounting the costs of the attending the universities (Kane, 1999). For example, state colleges and universities practice a two-tiered tuition system where the in-state tuition is much lower than out-of-state tuition (Shin and Milton, 2004). Although this practice remains today, decreasing state aids have forced many state schools to actively cater to the out-of-state population and make it more burdensome for in-state students to attend by increasing their tuition, introducing large fees, or limiting the number of seats for in-state applicants. Private schools have also suffered from these decreases in subsidies. They have become more and more dependent on tuition revenues that tend to be volatile and to some degree, dependent on business cycles. As a result, student financial aids are increasingly being viewed by colleges and universities as "business" decisions where the survival of the institution is at stake, rather than "social welfare" decisions where the institutions provide a valuable service to the society by preparing students from all financial backgrounds to

be productive members (Dynarski, 2000; McPherson and Schapiro, 1999; Winston and Zimmerman, 2000).

In this backdrop, tuition discounting (defined as institutional grant dollars as a share of gross tuition and fee revenue) has become a challenging reality for these higher education institutions. While the headline tuition and fees per student announced by universities tend to go up each year, the total revenues for the universities are barely budging due in large part to the significant discounts the universities offer to recruit and retain students. According to the 2013 NACUBO Tuition Discounting Study, the tuition discount rate rose consistently over the last decade and reached a level of 46.4% in 2013. Currently, 76.6% students receive some form of grants. In addition, 49.1% of the surveyed institutions reported a drop in undergraduate student enrollment. Due to these issues, the average increase in net tuition revenue per student is expected to be only 1.1% in 2013, a rate lower than expected inflation. More importantly, the NACUBO study finds that when adjusted for inflation, average net tuition revenue dollars have seen, on average, no growth over the last 13 years. In our study, we want to closely explore tuition discounting and examine its impact on both student achievement and institutional financial health.

The Economics and Finance literatures have extensively studied the role of discounting in the context of price discrimination or differential pricing (Stigler, 1987). It refers to a pricing strategy where identical or largely similar goods are transacted at different prices. The economic rationale for this is that prices are set according to each customer's willingness or ability to pay. This is a process through which producers can increase their surplus. If this drives tuition discounting at colleges and universities, we can expect to observe two things. First, tuition discounting will be positively related to student quality. If universities can successfully identify students who will respond to lower pricing, they would be able to attract a better group of students

over time by providing tuition discounting. Second, tuition discounting will positively affect a university's financial performance. Since universities are efficiently allocating their grants and aids, they will be able to maximize producer surplus (Bruinicks, Keeney, and Thorp, 2010).

On the other hand, we can envision a totally different set of outcomes using the idea of destructive competition. It occurs when there are more producers than what the market can bear – leading to a situation where prices are lowered so much that very few make a profit and the institutions linger in poor financial health – in the form of lower operating profit, more financial risk, higher debt burdens, and lower liquidity. If destructive competition is behind tuition discounting, we can expect to observe that tuition discounting is negatively related to student success.

In this study, we attempt to understand which of these two realities described above is more prevalent among the higher educational institutions. To this end, we collect historical data on four-year degree granting higher educational institutes in the U.S. between 2006 and 2015. Our sample includes both private and public institutions. Certainly, there are significant differences in the nature and operation of private and public universities. Hence, we first estimate the regression equations for all universities. Then we re-estimate the equations for public universities only and private universities only to compare and contrast their differences. We utilize fixed effects regression models where we include a dummy variable for each institution so that the time-invariant characteristics of universities are empirically controlled. The effects of business cycles are controlled by including time fixed effects.

We begin by examining the relationship between operating surplus (defined as core revenues minus core expenses, scaled by total assets)[1] and tuition discounting using summary statistics. An analysis of the historical patterns shows that in addition to providing greater tuition discounting, private institutions experience much higher volatility in operating surplus. The risk-adjusted operating surplus is significantly higher for public universities than the private ones. Our formal regression analyses support the idea that tuition discounting is not always beneficial for universities in improving their financial health. We find that there is a positive relationship between tuition discounting and operating surplus at first. However, as tuition discounting goes up and the institutions provide significantly more discount than their peers, there is a negative relationship between tuition discounting and operating surplus. Simply stated, universities cannot improve their profitability forever by providing more discount than their peers. This relationship is robust to other measures of profitability, such as profit margin and annual revenue growth. Therefore, it can be argued that tuition discounting can be a positive differentiating factor, but it does not appear to be an effective competitive strategy, especially for private universities.

In addition to the effects of tuition discounting on short-term profitability, we explore the relationship between tuition discounting and a number of measures of financial stability and risk. We find a significant and negative relationship. Institutions relying more on tuition discounting utilized more financial leverage, experienced lower liquidity, and are characterized by lower asset turnover. Therefore, institutions with higher tuition discounting tend to be more exposed to financial risk and do not utilize their assets efficiently. Again, these results are stronger for private universities as compared to their public counterparts.

[1] We use other measures of university profitability, such as revenue growth and profit margin, but the findings are similar.

As an enrollment management tool, the efficacy of tuition discounting is mixed. We find that tuition discounting helps institutions increase their admission yield and reduce drop-outs after the students are admitted. However, it does not improve the on-time graduation rate (e.g., within six years for undergraduate students) or the quality of the incoming students. The impact of tuition discounting in increasing retention rate and lowering graduation rate indicate that it takes students on average longer time periods to graduate from these institutions. Additionally, the better quality students in private universities appear to use these institutions as a bridge to transfer up to better institutions as implied by a higher transfer out rate.

Finally, using out-of-sample tests, we explore the long term effects of tuition discounting on the reputation of the universities as measured by U.S. News and World Report rakings. There are significant differences between private and public institutions in this respect. Public university reputations are not associated with tuition discounting. However, it does not enhance the reputation of private universities. This finding is consistent with the idea that the primary reason students choose a private college is for reputation and a public school for affordability. Thus, heavy tuition discounting in private universities does not appear to be warranted.

This paper contributes to the literate by providing detailed analyses of how tuition discounting is related to the performance of the universities. Numerous news articles and studies have anecdotally described the negative effects of tuition discounting. We show that these reports have some systematic basis. Furthermore, we provide an understanding of tuition discounting through the viewpoint of universities and their financial management decisions. It is a natural to argue that if the universities cannot maintain their financial solvency, the whole higher education system in the U.S. will be at risk. While tuition discounting has some positive attributes, our results caution universities not to engage in destructive competition to provide even higher amounts of

discount regardless of the long-term consequences and strongly encourage them to concentrate more on student outcomes and success.

This study contributes to the Finance literature by exploring the effects of price discounting on the financial management of a considerably large group of non-profit institutions in the economy. According to IBIS Capital, the global education market was worth $4.4 trillion in the world in 2013, with the U.S. accounting for over $1 trillion of the value. In this country, education is the second largest sector, after only the healthcare industry. Yet, the financial management of the educational institutions and the implications of their financial policies are not well studied. There are a number of Finance articles that explore the management of endowments (e.g. Bajeux-Besnainou and Ogunc, 2006; Barber and Wang, 2013; Blume, 2010). However, other aspects of the financial decisions of colleges and universities require rigorous exploration.

Clearly there are significant differences between the profit-motivated corporations and non-profit universities in terms of their goals, actions, visions, and missions. However, there are commonalities. Even non-profit institutions require efficient financial management. While tuition discounting can have a positive aspect for students in reducing their cost of education, its overall impact on the long-term financial management of the universities has a number of negative elements. It is widely shown that for-profit *corporations* that engage in significant discounting of their product prices can easily become exposed to significant long-term financial risks. Similarly, we show that not-for-profit colleges and universities utilizing too much tuition discounting sometimes subject themselves to negative financial consequences. Therefore, colleges and universities can benefit from the experiences and disciplines utilized by the for-profit business organizations in their financial management. Moreover, there are major differences in the impact of tuition discounting on the reputation of private vs. public educational institutions. An

exploration of these intricacies, as we do in this study, can greatly enhance our understanding of the financial management of non-profit institutions.

The rest of the paper is organized as follows. In section II, we provide a brief literature review. Section III provides details on the sample selection and empirical methodology. Section IV discusses the results. We conclude in section V.

II. Literature Review

The effects of tuition discounting on a university's financial success is not heavily studied in the Finance or Economics literature. A few papers concentrate on the effects of tuition discounting on student recruitment. For example, Redd (2000) shows that tuition discounting did not significantly improve the academic profiles of recruited students, but increased the costs of universities in the 1990s. A quarter of the institutions that implemented a tuition discounting strategy to meet revenue goals, failed to do so. One positive outcome was that institutions were able to increase the number of low-income students through tuition discounting. However, tuition discounting reached students from all financial backgrounds, even the ones who may not have needed it. A similar finding is reported in Davis (2003). He observes that during the 1990s tuition discounting did not help students as intended. It hurt lower-income students' access to grant aid and thus, the ability to attend four-year institutions. In fact, when that practice is extensively used by institutions, tuition discounting had an adverse impact on students from all income levels.

Browning (2013) examines the relationship between the financial performance of educational institutions and their strategies of price discrimination. She constructed a measure of

financial health of the universities based on debt, revenue concentration, surplus margin, administrative cost and size called the Financial Vulnerability Index (FVI). For stable institutions (FVI<0.10), financial performance had a negative relationship with tuition discount rates. As the FVI decreased, tuition discount rates increased, indicating that financially strong institutions used those methods to enhance their future reputation and consolidate their position. They also attracted talented students and gave access to lower-income students. However, for unstable institutions (FVI > 0.20), their financial position had a positive relationship with tuition discount rates. As the FVI increased for unstable institutions, tuition discount rates increased, indicating that institutions used their current resources to attract more students and help them maintain their operation. However, continuing use of discounting will further hinder and threaten their position.

Hillman (2010) examines the effectiveness of tuition discounting in generating additional revenue for public institutions during the period of 2002 to 2008. He finds that tuition discounting can generate additional revenue up to a certain point. When tuition discount rates exceed 13%, institutions experience lower returns.

In summary, previous studies show that tuition discounting has had some benefits in increasing total enrollment in general and low-income undergraduate students in particular. However, financially strong institutions hold a clear advantage in using tuition discounting to maintain and enhance their reputation and other enrollment goals such as diversity. Moreover, tuition discounting as a revenue enhancement tool has worsened the financial position of many institutions. Aggressive tuition discounting can bring about unintended consequences, such as reducing access to higher education. In our study, we build on these findings and provide a more comprehensive understanding of how tuition discounting affects the financial performance of universities.

III. Data and Methodology

The data for our study come from two sources. The information on the student characteristics and the financial performances of the universities are collected from the Integrated Postsecondary Education Data System (IPEDS) of the National Center for Education Statistics. Due to relevant and comparable data availability, we limit our sample to federal financial aid program participating institutions between 2006 and 2015. We exclude private for-profit universities and universities that do not provide at least a two-year associate degree. The final sample consists of approximately 26,770 institution-year observations from 2,980 universities and colleges across the United States.

The second source of our data is the U.S. News and World Report. We mainly hand collect annual ranking information from the publications titled "America's Best Colleges." We obtain both national and regional rankings of the colleges and universities each year.

Our main variable of interest *Discount* captures the amount of tuition discounting and is computed as the ratio of total institutional aid to gross tuition. Gross tuition is calculated by multiplying the nominal amount of tuition and fees by the size of the cohort (i.e. number of students), while total institutional aid is calculated by multiplying average institutional aid by the number of students receiving the aid. We also calculate a measure to identify how much an institution's *Discount* deviates from the median discount offered by similar institutions in the same State during the same year. We denote it as *DevMED*.

The dependent variables to study the financial health of the institutions include *Operating Surplus* (annual core revenue minus core expenses, divided by total assets), *Profit Margin* (annual core revenue minus core expenses, divided by core revenue), *Revenue Growth* (percentage change in annual core revenue), *TotalDebt* (calculated as the ratio of the total liabilities to total assets), *EquityRatio* (calculated as the ratio of total assets minus total liabilities to total assets), *Liquidity* (calculated as the ratio of current assets to total assets), and *AssetTurnover* (calculated as the ratio of total amount of tuition and fees, after excluding discounts and allowances to total assets).

In this study we utilize three different measures of annual financial performance of the universities – *Operating Surplus*, *Profit Margin*, and *Revenue Growth*. This is mainly due to the unique nature of the universities as non-profit institutions. *Operating Surplus* takes the core revenues minus core expenses and divides the difference by total assets. Core revenues and core expenses are defined as revenues and expenses associated with the essential education activities of the institutions, such as tuition and fees, government grants, investment income, etc. Since total assets include the value of the physical assets and endowment assets, it may understate the financial performance for universities with large endowments. As an alternative, we compute *Profit Margin* where the denominator is core revenue. Since it may be argued that universities have more control over their expenses than their revenues, we also create the variable *Revenue Growth*. To save space, we do not always mention the results with all three variables in the body of the paper. However, we find similar results no matter the variable of choice.

We also use a number of student performance and quality measures as dependent variables to capture the performance of the institutions. They include *Yield* (number of students enrolled divided by the number admitted), *Retention* (the percent of previous year's full time students re-enrolling in the current year), *GraduationRate* (the graduation rate of the total cohort), *TransferOut*

(the percent of student who has enrolled in another institution, rather than simply dropping out of college education), and *SAT75* (the 75th percentile of the incoming freshman cohort total SAT scores).

To control for the characteristics of the institutions, we include *FemaleRatio* (the ratio of female students to all students), *ForeignRatio* (the ratio of foreign students to all students), *LnAssets* (the natural logarithm of the institution's total assets), *GDPgrowth* (growth rate of real GDP in the State),*Endowment* (natural logarithm of the end-of-year endowment assets per full time enrollment), *EndowmentGrowth* (annual percentage change in endowment assets), *Enrollment* (natural logarithm of the total students enrolled for credit in the fall of the academic year), *Tuition* (natural logarithm of the published tuition and fees), *LoanAid* (natural logarithms of the average amount of student loan aid received by full-time first-time undergraduates), and *RateElasticity* (percentage change in student loans in response to a percentage change in real interest rate). *FemaleRatio* controls for the gender balance of the students and identifies all-female universities. *ForeignRatio* captures the ability of the universities to compete globally and attract students from all over the world. *LnAssets* takes into account the different asset sizes of the universities. *GDPgrowth* proxies for the economic environment of the schools' vicinity since universities, on average, tend to attract a large share of students from their own States. The data are from the Bureau of Economic Analysis. *Endowment* indicates whether a university has the cushion to comfortably absorb adverse financial shocks. *EndowmentGrowth* captures the growth in endowment assets of a university. A positive growth is obviously more desirable for an institution. *Enrollment* captures the size of the university in terms of the number of students served. *Tuition* proxies for the baseline cost of attendance of the university. *LoanAid* captures the loan burden of students. *RateElasticity* attempts to capture the impact of interest rate changes on student

borrowing cost. The data for the real interest rate are obtained from Federal Reserve Bank of Cleveland. Finally, we incorporate institutions fixed effects in all our regressions, except for the out-of-sample tests. This is equivalent to including a dummy variable for each institution. Therefore, it accounts for the unobserved heterogeneity of the institutions and omitted variables. We similarly include year dummy variable in all our regressions, except for the out-of-sample tests, to account for changes in the economic or regulatory environment in a particular year. Table 1 Panel A provides the summary statistics of our sample, while Table 1 Panel B describes the correlations among the financial variables. Among the interesting variables, the average level of tuition discounting is 24%, with a standard deviation of 20%. On the other hand, the *Operating Surplus* is approximately 4%, with a standard deviation of 8%. The correlation between tuition discounting and *Operating Surplus* is a statistically significant (at the 10% significance level) -0.1041.

Table 1: Summary Statistics

Discount is computed as the ratio of total institutional aid to gross tuition. Gross tuition is calculated by multiplying the nominal amount of tuition and fees by the size of the cohort, while total institutional aid is calculated by multiplying average institutional aid by the number of students receiving the aid. *DevMED* identifies how much an institution's *Discount* deviates from the median discount offered by similar institutions in the same State during the same year. *Operating Surplus* is annual core revenue minus core expenses, divided by total assets. *Profit Margin* is annual core revenue minus core expenses, divided by core revenue. *Revenue Growth* is the percentage change in annual core revenue. *FemaleRatio* is the ratio of female students to all students. *ForeignRatio* is the ratio of foreign students to all students. *LnAssets* is the natural logarithm of the institution's total assets. *GDPgrowth* is the growth rate of real GDP of the State. *Endowment* is the natural logarithm of the end-of-year endowment assets per full time enrollment. *EndowmentGrowth* is the annual percentage change in endowment assets. *Enrollment* is the natural logarithm of the number of total students enrolled for credit in the fall of the academic year. *Tuition* is the natural logarithm of the published tuition and fees. *LoanAid* is the natural logarithms of the average amount of student loan aid received by full-time first-time undergraduates. *RateElasticity* is the percentage change in student loans in response to a percentage change in the real interest rate. *Yield* is annual change in the number of students enrolled divided by the number admitted. *Retention* is the percent of previous year's full time students re-enrolling in the current year. *GraduationRate* is the graduation rate of the total cohort. *TransferOut* is the percent of student who has enrolled in another institution, rather than simply dropping out of college education. S*AT75* is the 75th percentile of the incoming freshman cohort total SAT scores. *TotalDebt* (calculated as the ratio of the total liabilities to total assets), *EquityRatio* (calculated as

the ratio of total assets minus total liabilities to total assets), *Liquidity* (calculated as the ratio of the current assets to the total assets), and *AssetTurnover* (calculated as the ratio of total amount of tuition and fees, after excluding discounts and allowances to total assets).

Panel A: Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Discount	26,769	0.24	0.20	0.00	0.86
DevMED	26,769	0.02	0.16	-0.38	0.58
Yield	14,566	41.95	21.48	13	100
Retention	26,373	68.30	14.67	23	100
GraduationRate	26,532	42.26	22.51	3	100
TransferOut	6,186	24.25	15.47	1	86
SAT75	5,996	1757	231	914	2400
Operating Surplus	22,402	0.04	0.08	-0.29	0.40
Profit Margin	26,625	0.05	0.23	-1.89	0.63
Revenue Growth	23,916	0.05	0.27	-0.87	1.48
TotalDebt	22,402	0.34	0.21	0.01	1.11
EquityRatio	26,530	0.65	0.22	-0.15	0.99
Liquidity	22,321	0.31	0.23	0	1
AssetTurnover	22,402	0.22	0.22	0	2.03
FemaleRatio	26,763	56.73	14.04	0	95
ForeignRatio	26,763	2.90	4.63	0	29
LnAssets	22,402	18.28	1.58	13.10	22.32
GDPgrowth	26,444	0.00	0.02	-0.09	0.19
Endowment	22,201	8.44	2.05	3.00	13.41
Enrollment	26,763	8.00	1.33	3.40	10.53
Tuition	26,769	8.99	1.04	6.49	10.71
EndowmentGrowth	19,714	0.01	0.03	-0.10	0.21
LoanAid	24,936	8.54	0.41	7.23	9.36
RateElasticity	22,184	-0.14	1.48	-6.10	6.19

Panel B: Correlation Matrix

The following table provides correlation between tuition discounting and some of the financial variables. Statistical significance at the 10% level is indicated with a *.

	Discount	*DevMED*	*Operating Surplus*	*TotalDebt*	*Equityratio*	*Liquidity*	*AssetTurnover*
Discount	1						
DevMED	0.6815*	1					
Operating Surplus	-0.1041*	-0.0260*	1				
TotalDebt	-0.0530*	0.0104	-0.2352*	1			

Equityratio	0.0718*	-0.0215*	0.2359*	-0.9998*	1		
Liquidity	-0.0697*	-0.1469*	-0.0021	0.0959*	-0.0963*	1	
AssetTurnover	-0.0492*	-0.2475*	-0.0302*	0.1334*	-0.1342*	0.3137*	1
lnAssets	0.1764*	0.2808*	-0.0055	0.0695*	-0.0685*	-0.2916*	-0.3878*

Since there are significant differences between public and private universities, we estimate and present each of our regression equations for three groups – all universities, public universities only, and private universities only. This way we are able to understand the overall trends as well as how public and private universities differ in their operations and financial decisions. The estimation models we utilize in this study take the following form:

$$y_{i,t} = \alpha + \alpha_i + \alpha_t + \beta * Discount_{i,t-1} + \gamma * DevMED_{i,t-1} + \delta X_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

The dependent variable $y_{i,t}$ represents the characteristics of institution i in year t. The $Discount_{i,t-1}$ represents the tuition discount offered by the institution in year -1 . $DevMED_{i,t-1}$ is the difference between tuition discount and the median tuition discount for the group in year $t-1$. The set of control variables $X_{i,t-1}$ are computed for institution i in year $t-1$. In our regressions, α_i represents institution fixed effects and α_t year fixed effects. We include these fixed effects in all regressions, except for out-of-sample tests. Finally, the standard errors are corrected for heteroscedasticity using the Huber-White methodology. In our regression estimate presentations, we only display regressions with the non-linear term $DevMED$ if its coefficient is statistically significant.

It is important to note that our choice of fixed effects regression methodology is in large part driven by the necessity to control for the effects of endogeneity. One of the major assumptions of the OLS regression methodology is that the independent variables are uncorrelated with the error term. However, if there is another omitted variable that is correlated with both the dependent

and the independent variables, then we cannot easily exclude spurious relationship as an explanation. For example, it could be the case that instead of tuition discounting driving the financial health of the university, the financial health of the university is forcing the university to discount more. The fixed effects methodology attempts to mitigate the effects of such unobserved heterogeneity. To further aid in this process, we also lag the independent variables by one year so that the effects of these biases are significantly reduced. As further robustness test, we conduct instrumental variable regressions and out-of-sample tests to assess the impact of tuition discounting on the performance of the institutions. While we utilize empirical methodology to control for unobserved heterogeneity, it may not fully disappear from the relationships we find. As a result, it is important to take utmost care in interpreting the results. Instead of providing incontrovertible evidence of causality, the empirical estimates are more likely to emphasize the relationship between the dependent and the independent variables.

IV. Results

4.1 Relationship between Profitability and Tuition Discounting

Before we jump into formal regressions, we explore the relationship between tuition discounting and the *Operating Surplus* of the universities. Since public and private universities have significant differences in their operations and sources of funding, they are likely to have different levels of operating surpluses and different types of risk exposures. This is especially true due to the "put" option available to public universities that ensures the State governments will provide them the resources as a last resort. We calculate the average values of the *Operating Surplus* for public and private universities; and present them in Table 2. We also compute standard

deviations of the *Operating Surpluses* of each of the university and present the average values. The *Operating Surplus* is much higher for the public universities. However, the *Operating Surplus* volatility is higher among the private universities. Finally, the risk-adjusted *Operating Surplus*, i.e. *Operating Surplus* divided by the *Operating Surplus* volatility, for public universities is almost two and a half times the risk-adjusted *Operating Surplus* of the private universities. This is a clear indication that the private institutions are in much more precarious position than the public universities in terms of lower returns and higher risk.

Table 2: Relationship between Operating Surplus and Tuition Discounting

Panel A: Operating Surplus Risk-Return Relationship

The following table presents the *Operating Surplus* and its volatility by the types of universities during our sample period. *Operating Surplus* is annual core revenue minus core expenses, divided by total assets. *Operating Surplus* Volatility is the standard deviation of the *Operating Surplus*. Risk-Adjusted *Operating Surplus* is *Operating Surplus* divided by *Operating Surplus* Volatility. Column (1) presents the statistics for all universities, while Columns (2) and (3) present the information for public and private universities respectively.

	(1) All Universities	(2) Public Universities	(3) Private Universities
Operating Surplus	3.55%	4.71%	2.26%
Operating Surplus Volatility	5.89%	5.34%	6.51%
Risk-Adjusted *Operating Surplus*	0.60	0.88	0.35

Panel B: Optimal Operating Surplus and Tuition Discount

The following table reports the average *Discount* and *Operating Surplus*; then compares them to optimal *Discount* and optimal *Operating Surplus*. *Discount* is computed as the ratio of total institutional aid to gross tuition. Gross tuition is calculated by multiplying the nominal amount of tuition and fees by the size of the cohort, while total institutional aid is calculated by multiplying average institutional aid by the number of students receiving the aid. Average *Discount* is the average of the whole sample period. *Operating Surplus* is annual core revenue minus core expenses, divided by total assets. Optimal *Discount* is obtained by splitting the whole sample into 25 *Discount* groups and considering the group with the largest *Operating Surplus*. Average Tuition ($) in 2015 is the actual average tuition

and fees for the universities in 2015. Optimal *Discount* ($) in 2015 is Average Tuition ($) in 2015 multiplied by Optimal *Discount*. Optimal *Operating Surplus* is the *Operating Surplus* for the Optimal *Discount* group. Column (1) presents the statistics for all universities, while Columns (2) and (3) present the information for public and private universities respectively.

	(1) All Universities	(2) Public Universities	(3) Private Universities
Average *Discount*	24.43%	15.42%	35.09%
Optimal *Discount*	2.55%	2.66%	6.69%
Average Tuition ($) in 2015	$15,448	$5,571	$27,357
Optimal *Discount* ($) in 2015	$394	$148	$1,830
Operating Surplus	3.55%	4.71%	2.26%
Optimal *Operating Surplus*	4.88%	5.20%	3.44%

Next, we turn our attention to finding what level of tuition discount maximizes the *Operating Surplus* of the institutions. To find such optimal tuition discount, we split our sample into 25 tuition discounting groups, from smallest tuition discounts to the largest tuition discounts. To exclude the effects of extreme observations, we ignore the first and the last groups. Then we look at the average *Operating Surplus* of each of the groups. By identifying the group with the largest average *Operating Surplus*, we arrive at the conclusions presented in Table 2 Panel B. For all universities, the *Operating Surplus* is maximized for the group that has an average tuition discount of only 2.55%. This level is slightly higher for public institutions at 2.66% discount and much higher for private institution at 6.69%. However, these are significantly lower than the current discount levels of 15.42% and 35.09% respectively. Similarly, the optimal *Operating Surplus* for the public universities is 5.20% versus the average *Operating Surplus* of 4.71%. On the other hand, the optimal *Operating Surplus* for the private universities is 3.44% versus the

average *Operating Surplus* of 2.26%. These results strongly indicate that the current level of tuition discounting is having a detrimental effect on the financial health of the universities. In fact, the optimal level of tuition discount is significantly lower than what is practiced by average universities. While it may not be possible to reduce the tuition discount levels immediately, the universities must consider reversing the trend of providing increasing amounts of tuition discounts.

We next begin our formal regression analyses with an exploration of the relationship between tuition discounting and an institution's immediate short-term profitability. In Table 3, we present the results with the three annual profitability measures *Operating Surplus*, *Profit Margin*, and *Revenue Growth* as dependent variables. We estimate the regression equation for all universities, public universities only, and then private universities only. In columns (1), (4), and (7), the coefficient estimates for the variable *Discount* are positive and statistically significant for all universities, which implies a positive relationship between tuition discounting and university profitability. On the other hand, the coefficients for *DevMED* are negative and statistically significant for all universities. This indicates that the positive relationship between tuition discounting and the profitability of the institutions decreases as an institution provides more discount than its competitors. However, these relationships are not always statistically significant among the public universities. We notice in columns (2) and (8), the coefficients of *Discount* and *DevMED* have the correct sign but are not statistically significant. The results have the correct sign and are statistically significant in column (5) involving the dependent variable *Profit Margin*. On the other hand, for private universities, as shown in columns (3), (6), and (9), these relationships are consistently statistically significant. Taken together, it appears that private universities benefit more from tuition discounting, albeit there is a limit to this positive relationship.

Table 3: Relationship between Tuition Discounting and Profitability

Operating Surplus is annual core revenue minus core expenses, divided by total assets. *Profit Margin* is annual core revenue minus core expenses, divided by core revenue. *Revenue Growth* is the percentage change in annual core revenue. The independent variable of interest *Discount* is computed as the ratio of total institutional aid to gross tuition. Gross tuition is calculated by multiplying the nominal amount of tuition and fees by the size of the cohort, while total institutional aid is calculated by multiplying average institutional aid by the number of students receiving the aid. *DevMED* identifies how much an institution's *Discount* deviates from the median discount offered by similar institutions in the same State during the same year. *FemaleRatio* is the ratio of female students to all students. *ForeignRatio* is the ratio of foreign students to all students. *LnAssets* is the natural logarithm of the institution's total assets. *GDPgrowth* is the growth rate of real GDP of the State. *Endowment* is the natural logarithm of the end-of-year endowment assets per full time enrollment. *EndowmentGrowth* is the annual percentage change in endowment assets. *Enrollment* is the natural logarithm of the number of total students enrolled for credit in the fall of the academic year. *Tuition* is the natural logarithm of the published tuition and fees. *LoanAid* is the natural logarithms of the average amount of student loan aid received by full-time first-time undergraduates. *RateElasticity* is the percentage change in student loans in response to a percentage change in the real interest rate. OLS with fixed effects for institutions and year. Robust standard errors. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

	(1)	(2)	(3)	(4)	(5)	(6)
Universities:	All	Public	Private	All	Public	Private
Dependent Variable:	*Operating Surplus*	*Operating Surplus*	*Operating Surplus*	*Profit Margin*	*Profit Margin*	*Profit Margin*
Discount	0.571	0.006	0.022	0.189	0.076	0.050
	(0.059)***	(0.036)	(0.011)**	(0.017)***	(0.009)***	(0.024)**
DevMED	-0.598	0.008	-0.116	-0.185	-0.058	-0.066
	(0.059)***	(0.038)	(0.035)***	(0.017)***	(0.011)***	(0.023)***
FemaleRatio	0.003	0.001	0.002	0.001	0.000	0.000
	(0.001)***	(0.001)**	(0.002)	(0.000)**	(0.000)	(0.000)
ForeignRatio	0.006	0.009	0.004	0.003	0.001	0.002
	(0.001)***	(0.001)***	(0.002)*	(0.000)***	(0.000)***	(0.000)***
LnAssets	-0.244	-0.075	-0.331	-0.099	-0.011	-0.112
	(0.012)***	(0.006)***	(0.024)***	(0.003)***	(0.001)***	(0.005)***
GDPgrowth	0.100	0.012	0.047	0.016	0.110	-0.016
	(0.103)	(0.057)	(0.194)	(0.028)	(0.037)***	(0.040)
Endowment	-0.032	0.000	-0.042	-0.006	0.001	-0.013
	(0.005)***	(0.003)	(0.011)***	(0.002)***	(0.001)	(0.003)***
Enrollment	0.029	0.015	0.073	0.032	0.006	0.040
	(0.018)	(0.013)	(0.030)**	(0.005)***	(0.002)***	(0.007)***
Tuition	-0.058	-0.027	0.120	-0.021	-0.006	0.024
	(0.024)**	(0.013)**	(0.063)*	(0.007)***	(0.002)***	(0.010)**
EndowmentGrowth	0.051	-0.056	0.065	-0.006	-0.059	0.071
	(0.059)	(0.028)**	(0.144)	(0.016)	(0.019)***	(0.031)**
LoanAid	0.003	-0.011	0.028	-0.004	-0.002	0.006

	(0.010)	(0.006)*	(0.016)*	(0.003)	(0.003)	(0.003)*
RateElasticity	0.002	-0.001	0.002	-0.000	-0.001	-0.000
	(0.001)*	(0.001)	(0.002)	(0.000)	(0.001)*	(0.000)
Institution FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Constant	4.806	1.561	4.392	1.813	0.237	1.609
	(0.344)***	(0.212)***	(0.786)***	(0.100)***	(0.024)***	(0.148)***
R^2	0.37	0.44	0.42	0.52	0.07	0.59
N	16,020	7,864	8,156	13,949	6,821	7,128

(Table 3 continued……)

	(7)	(8)	(9)
Universities:	All	Public	Private
Dependent Variable:	*Revenue Growth*	*Revenue Growth*	*Revenue Growth*
Discount	0.025	0.068	0.063
	(0.009)***	(0.056)	(0.013)***
DevMED	-0.073	-0.054	-0.152
	(0.030)**	(0.060)	(0.048)***
FemaleRatio	0.001	-0.002	0.000
	(0.001)	(0.001)*	(0.002)
ForeignRatio	0.006	0.007	0.005
	(0.002)***	(0.002)***	(0.003)*
LnAssets	-0.405	-0.201	-0.595
	(0.015)***	(0.010)***	(0.032)***
GDPgrowth	-1.157	-0.438	-1.654
	(0.112)***	(0.074)***	(0.209)***
Endowment	-0.051	0.000	-0.077
	(0.007)***	(0.005)	(0.015)***
Enrollment	0.136	0.018	0.232
	(0.025)***	(0.020)	(0.042)***
Tuition	0.308	0.051	0.630
	(0.025)***	(0.016)***	(0.050)***
EndowmentGrowth	-0.660	-0.149	-2.188
	(0.079)***	(0.045)***	(0.192)***
LoanAid	0.134	0.013	0.186
	(0.012)***	(0.009)	(0.021)***
RateElasticity	-0.003	-0.004	-0.001
	(0.002)**	(0.001)***	(0.003)

Institution FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Constant	2.835	3.217	2.059
	(0.292)***	(0.223)***	(0.560)***
R^2	0.14	0.16	0.19
N	16,020	7,864	8,156

4.2 Robustness: Instrumental Variable and Simultaneous Equation Methodologies

As we note before, there is some likelihood that the independent variables could be correlated with the error term. If such a statistically significant correlation exists, then the regression estimates would not give an indication of the directionality of the relationship. That is, we would not be able to conclude whether *Discount* affects *Operating Surplus* or vice versa. There is another possibility that the decision regarding *Discount* and *Operating Surplus* could be simultaneously determined. In this section, we explore whether our basic results hold even after controlling for these alternatively possibilities. We present one Instrumental Variables (IV) regression, one Arellano-Bond (AB) estimation, and one set of Simultaneous Equations (SE) methodology. The estimates are presented in Table 4. For the sake of brevity, we only present the results for all universities using the dependent variable *Operating Surplus* in this manuscript. In unreported tables, we replicate these exercises using other dependent variables and find similar results.

In an IV regression model, the independent variable of interest, *Discount*, is instrumented with a variable that is correlated with *Discount*, but uncorrelated with the dependent variable *Operating Surplus*. This is referred to as the exclusion restriction. For our purpose, we take the

number of graduating high school students in a State to be the instrument. The number of high school graduates can be seen as a supply of potential students to a university and thus, would affect the discount offered by the university. However, the supply of high school graduated does not directly affect the *Operating Surplus* of the university. In our sample, we notice that the correlation between the number of high school graduates and *Discount* is a statistically significant -0.07. On the other hand, the correlation between the number of high school graduates and *Operating Surplus* is statistically insignificant 0.001. The IV estimation presented in column (1) of Table 4 shows that the coefficient of *Discount* is positive and statistically significant, as we previously report. We conduct a Durbin-Wu-Hausman test to see if our regressor *Discount* is exogenous. The low χ^2 value and high p-value indicates that we are unable to reject the null that the independent variable *Discount* is exogenous. That is, our results do not appear to be endogenously determined.

Table 4: Robustness using Alternative Estimation Models

Operating Surplus is annual core revenue minus core expenses, divided by total assets. *Discount* is computed as the ratio of total institutional aid to gross tuition. Gross tuition is calculated by multiplying the nominal amount of tuition and fees by the size of the cohort, while total institutional aid is calculated by multiplying average institutional aid by the number of students receiving the aid. *DevMED* identifies how much an institution's *Discount* deviates from the median discount offered by similar institutions in the same State during the same year. *FemaleRatio* is the ratio of female students to all students. *ForeignRatio* is the ratio of foreign students to all students. *LnAssets* is the natural logarithm of the institution's total assets. *GDPgrowth* is the growth rate of real GDP of the State. *Endowment* is the natural logarithm of the end-of-year endowment assets per full time enrollment. *EndowmentGrowth* is the annual percentage change in endowment assets. *Enrollment* is the natural logarithm of the number of total students enrolled for credit in the fall of the academic year. *Tuition* is the natural logarithm of the published tuition and fees. *LoanAid* is the natural logarithms of the average amount of student loan aid received by full-time first-time undergraduates. *RateElasticity* is the percentage change in student loans in response to a percentage change in the real interest rate. Column (1) represents Instrumental Variables (IV) method where *Discount* is instrumented with the number of graduating seniors in the state. Column (2) represents Arellano-Bond (AB) method where *Discount* is instrumented with the one-year lagged values of *Operating Surplus*. Columns (3) and (4) display the outcome of a Simultaneous Equations (SE) model. Column (3) shows the results with *Operating Surplus* as the dependent variable and column (4) with *Discount* as the dependent variable. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

	(1)	(2)	(3)	(4)
Methodology:	IV	AB	SE	SE
Universities:	All	All	All	All
Dependent Variable:	*Operating Surplus*	*Operating Surplus*	*Operating Surplus*	*Discount*
Discount	0.167 (0.073)**	0.135 (0.047)***	0.085 (0.020)***	
Operating Surplus				-0.003 (0.004)
DevMED	-0.260 (0.072)***	-0.228 (0.047)***	-0.159 (0.021)***	0.592 (0.007)***
FemaleRatio	0.001 (0.000)***	0.001 (0.000)***	0.001 (0.000)***	0.001 (0.000)***
ForeignRatio	0.002 (0.000)***	0.002 (0.000)***	0.002 (0.000)***	-0.000 (0.000)
LnAssets	0.012 (0.003)***	0.012 (0.003)***	0.014 (0.003)***	-0.009 (0.002)***
GDPgrowth	0.203 (0.099)**	0.215 (0.098)**	0.257 (0.097)***	0.125 (0.055)**
Endowment	0.001 (0.002)	0.001 (0.002)	0.001 (0.002)	0.019 (0.001)***
Enrollment	0.005 (0.004)	0.005 (0.004)	0.008 (0.004)**	-0.019 (0.002)***
Tuition	-0.015 (0.005)***	-0.016 (0.005)***	-0.036 (0.004)***	0.082 (0.002)***
EndowmentGrowth	0.054 (0.056)	0.054 (0.057)	0.072 (0.057)	-0.131 (0.032)***
LoanAid	-0.025 (0.007)***	-0.025 (0.007)***	-0.025 (0.007)***	-0.008 (0.004)**
RateElasticity	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	-0.001 (0.001)
Institution FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Constant	0.046 (0.057)	0.156 (0.058)***	0.153 (0.053)***	-0.322 (0.030)***
R^2	0.14	0.14	0.14	0.58
N	16,020	15,892	15,903	15,903
Tests for Exogeneity:				
Durbin-Wu-Hausman χ^2 (p-value)	0.016 (0.899)	0.372 (0.541)		

Our second set of tests involves the Arellano-Bond (AB) dynamic panel data estimation methodology. The AB methodology is applied to samples where there are large number of entities and fewer time periods. Additionally, it corrects for situations where the independent variables are not strictly endogenous – meaning that the regressors could be correlated with the current or past realizations of the error terms. We use two year lagged values of *Operating Surplus* to instrument *Discount*. The estimates are presented in column (2) of Table 4. The coefficient estimate of *Discount* remains positive and statistically significant.

Finally, to account for the fact that universities could reasonably set their tuition discounting and operating surplus targets at the same time, we estimate a simultaneous equations model. Essentially, we estimate two equations – in one, *Discount* is the dependent variable of interest and in another, it is *Operating Surplus*. Both equations are estimated at the same time under the assumption that their error terms are correlated. Columns (3) and (4) of Table 4 display the two regression estimates. In column (3), the variable *Discount* remains positive and statistically significant. However, the coefficient of *Operating Surplus* in column (4) is not statistically significant.

Overall, the robustness results show that our basic conclusions regarding the relationship between the short-term financial returns of universities and tuition discounting hold despite using various statistical methodologies. Therefore, although tuition discounting can help colleges and universities improve their financial returns in the short-run, it has its limits. An educational institution cannot rely on tuition discounting forever to improve its bottom line.

4.3 Tuition Discounting and College Achievements

In this section, we present our regression estimates where we explore the relationship between tuition discounting and various measures of student attraction, retention, and student quality. Specifically, we look at five different variables – *Yield*, *Retention*, *GraduationRate*, *TransferOut*, and *SAT75*. The results are presented in Table 5. The regression estimates show that tuition discounting is positively and statistically significantly related to *Yield* and *Retention* in the sample of all universities. On the other hand, tuition discounting is statistically significantly and negatively related to *GraduationRate* and *SAT75*. The coefficient of *TransferOut* is statistically insignificant. These results suggest that while universities can increase their yield and retention rate by providing increased tuition discounts, they are not able to increase the quality of their students or their graduation rate.

We notice significant divergences between public and private universities. The results are stronger for private universities. The coefficient estimates of *Discount* are not always statistically significant for public universities. In fact, we notice a divergence in the effects of tuition discounting on *TransferOut*. For public universities, the coefficient of *Discount* is negative and statistically significant. This indicates that public universities can reduce their transfer out ratio by offering more tuition discount. However, this effect is exactly opposite for private universities. For private university sub-sample, the coefficient of *TransferOut* is positive and statistically significant. This is in contrast to the results involving the retention rate. The difference between the two is that retention rate captures students who transfer out to another college and students who drop out of school altogether, while transfer out only takes into account students to transfer out to another college. Thus, for private universities, these two results involving *Retention* and *TransferOut* indicate that while higher tuition discounts prevent some of the students from

dropping out of college altogether, it does not lower the rate of students transferring to a different institution.

Table 5: Tuition Discounting and College Achievements

The dependent variables are *Yield* (annual change in the number of students enrolled divided by the number admitted), *Retention* (the percent of previous year's full time students re-enrolling in the current year), *GraduationRate* (the graduation rate of the total cohort), *TransferOut* (the percent of student who has enrolled in another institution, rather than simply dropping out of college education) and *SAT75* (75th percentile of the incoming freshman cohort total SAT scores). The independent variable of interest *Discount* is computed as the ratio of total institutional aid to gross tuition. Gross tuition is calculated by multiplying the nominal amount of tuition and fees by the size of the cohort, while total institutional aid is calculated by multiplying average institutional aid by the number of students receiving the aid. *FemaleRatio* is the ratio of female students to all students. *ForeignRatio* is the ratio of foreign students to all students. *LnAssets* is the natural logarithm of the institution's total assets. *GDPgrowth* is the growth rate of real GDP of the State. *Endowment* is the natural logarithm of the end-of-year endowment assets per full time enrollment. *EndowmentGrowth* is the annual percentage change in endowment assets. *Enrollment* is the natural logarithm of the number of total students enrolled for credit in the fall of the academic year. *Tuition* is the natural logarithm of the published tuition and fees. *LoanAid* is the natural logarithms of the average amount of student loan aid received by full-time first-time undergraduates. *RateElasticity* is the percentage change in student loans in response to a percentage change in the real interest rate. Columns (1), (4), (7), (10), and (13) present the results for all universities; columns (2), (5), (8), (11), and (14) for public universities; and columns (3), (6), (9), (12), and (15) for private universities. OLS with fixed effects for institutions and year. Robust standard errors. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

	(1)	(2)	(3)	(4)	(5)	(6)
Universities:	All	Public	Private	All	Public	Private
Dependent Variable:	*Yield*	*Yield*	*Yield*	*GraduationRate*	*GraduationRate*	*GraduationRate*
Discount	5.873	-2.734	8.395	-1.882	0.024	-1.809
	(1.357)***	(2.560)	(1.635)***	(0.571)***	(0.646)	(0.886)**
FemaleRatio	-0.059	0.111	-0.078	0.085	-0.057	0.149
	(0.066)	(0.161)	(0.074)	(0.027)***	(0.032)*	(0.040)***
ForeignRatio	0.182	0.146	0.196	0.036	0.099	0.057
	(0.082)**	(0.183)	(0.094)**	(0.037)	(0.053)*	(0.051)
LnAssets	1.099	-0.152	1.793	0.524	0.407	-0.234
	(0.809)	(1.113)	(1.215)	(0.315)*	(0.284)	(0.618)
GDPgrowth	-6.923	-7.316	-5.010	-4.933	-1.535	-10.523
	(6.369)	(9.151)	(8.560)	(2.785)*	(2.511)	(5.093)**
Endowment	-0.086	0.389	-0.697	-0.262	-0.355	-0.564
	(0.361)	(0.445)	(0.571)	(0.147)*	(0.128)***	(0.293)*
Enrollment	-2.219	0.836	-2.906	1.058	0.773	1.418
	(1.250)*	(2.979)	(1.470)**	(0.498)**	(0.566)	(0.791)*
Tuition	0.417	1.797	-0.761	2.675	3.040	-0.034

	(1.743)	(2.710)	(2.341)	(0.640)***	(0.598)***	(1.176)
EndowmentGrowth	-1.105	-7.735	7.799	3.841	1.249	13.898
	(4.255)	(4.945)	(7.167)	(1.588)**	(1.246)	(3.778)***
LoanAid	0.568	-0.623	0.870	0.406	-0.295	0.497
	(0.626)	(1.235)	(0.742)	(0.256)	(0.263)	(0.420)
RateElasticity	0.088	0.196	0.062	0.120	-0.099	0.271
	(0.083)	(0.166)	(0.097)	(0.034)***	(0.035)***	(0.055)***
Institution FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-10.867	-24.495	-4.707	-2.374	4.269	43.812
	(23.687)	(42.999)	(33.374)	(9.156)	(9.455)	(17.023)**
R^2	0.07	0.07	0.07	0.94	0.97	0.88
N	9,691	3,229	6,462	15,978	7,846	8,132

(Table 5 continued……)

	(7)	(8)	(9)	(10)	(11)	(12)
Universities:	All	Public	Private	All	Public	Private
Dependent Variable:	*Retention*	*Retention*	*Retention*	*TransferOut*	*TransferOut*	*TransferOut*
Discount	1.700	0.649	2.363	-0.278	-7.933	8.302
	(0.551)***	(0.793)	(0.778)***	(1.244)	(1.521)***	(2.084)***
FemaleRatio	0.095	0.040	0.131	0.067	0.184	0.008
	(0.026)***	(0.039)	(0.035)***	(0.017)***	(0.026)***	(0.025)
ForeignRatio	0.003	0.077	-0.017	0.001	0.427	-0.141
	(0.035)	(0.065)	(0.045)	(0.046)	(0.075)***	(0.062)**
LnAssets	-0.193	0.252	-0.844	-4.853	-3.391	-6.800
	(0.304)	(0.346)	(0.546)	(0.357)***	(0.454)***	(0.693)***
GDPgrowth	-4.090	-5.600	-2.162	7.917	12.145	-10.550
	(2.695)	(3.087)*	(4.475)	(9.818)	(11.032)	(17.208)
Endowment	0.171	-0.202	0.718	-0.046	-0.507	1.430
	(0.142)	(0.156)	(0.259)***	(0.187)	(0.195)***	(0.391)***
Enrollment	-1.938	-1.458	-1.748	2.370	-0.389	5.011
	(0.480)***	(0.691)**	(0.696)**	(0.398)***	(0.530)	(0.720)***
Tuition	0.355	3.786	-2.837	-0.439	3.262	-3.073
	(0.618)	(0.733)***	(1.032)***	(0.420)	(0.924)***	(1.015)***
EndowmentGrowth	2.686	1.833	6.627	16.939	8.583	34.040
	(1.534)*	(1.521)	(3.325)**	(6.238)***	(6.255)	(13.236)**
LoanAid	-0.817	-0.386	-0.926	4.744	2.629	4.455

	(0.250)***	(0.326)	(0.373)**	(0.809)***	(1.148)**	(1.236)***
RateElasticity	-0.071	0.035	-0.145	0.077	0.346	-0.142
	(0.033)**	(0.044)	(0.049)***	(0.175)	(0.258)	(0.243)
Institution FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Constant	86.813	44.897	125.386	54.959	34.826	86.525
	(8.853)***	(11.579)***	(14.980)***	(6.804)***	(9.389)***	(11.739)***
R^2	0.87	0.89	0.83	0.15	0.18	0.18
N	15,768	7,662	8,106	4,054	2,210	1,844

(Table 5 continued……)

	(13)	(14)	(15)
Universities:	All	Public	Private
Dependent Variable:	*SAT75*	*SAT75*	*SAT75*
Discount	-112.856	32.831	-128.400
	(14.415)***	(27.142)	(17.350)***
FemaleRatio	-1.385	-1.972	-1.093
	(0.165)***	(0.420)***	(0.178)***
ForeignRatio	4.421	8.475	3.875
	(0.468)***	(1.242)***	(0.495)***
LnAssets	106.525	52.657	110.498
	(3.948)***	(7.181)***	(5.535)***
GDPgrowth	82.433	-516.729	268.404
	(106.224)	(168.240)***	(132.705)**
Endowment	11.668	13.920	9.692
	(2.394)***	(3.286)***	(3.467)***
Enrollment	-42.956	-6.148	-58.272
	(4.378)***	(8.687)	(5.584)***
Tuition	103.940	201.259	160.961
	(4.367)***	(13.487)***	(8.749)***
EndowmentGrowth	16.980	-18.170	-125.537
	(75.473)	(93.063)	(120.551)
LoanAid	-102.352	-137.171	-98.652
	(7.894)***	(18.137)***	(8.771)***
RateElasticity	-0.096	-4.478	0.884
	(1.471)	(3.369)	(1.593)
Institution FE	Yes	Yes	Yes

Year FE	Yes	Yes	Yes
Constant	-60.035	83.702	-622.343
	(73.999)	(154.188)	(94.405)***
R^2	0.66	0.54	0.70
N	4,523	1,358	3,165

Overall, tuition discounting helps institutions increase their admission yield and retention rate. However, it does not improve the graduation rate or the quality of the incoming students. In fact, among private universities, a significant number of students are actually moving to a different college if the opportunity exists.

4.4 Tuition Discounting and Financial Indicators

To further understand the financial health of the institutions, we study the effects of tuition discounting on various measures of financial stability and risks of the universities. We specially consider the level of debt, equity ratio, liquidity, and total asset turnover. A higher level of debt is associated with a greater probability of default. It also effectively restricts the university's ability to spend all its resources since fixed interest and principal payments must be made on time from available funds. For profit-motivated corporations, there is an added benefit associated with debt – the interest expenses can be tax deductible. However, non-profit institutions do not make tax payments and thus, do not benefit from the tax deductibility of interest. Thus, holding too much debt is especially precarious for non-profit institutions and higher levels of debt would be associated with greater financial risks and constraints. On the other hand, the equity portion of a university's balance sheet is largely composed of accumulated retained earnings and endowments. Larger amounts of equity provide better cushion for universities to function in times of financial

constraints and distress. Thus, higher values of the equity ratio can be considered better for reducing the financial risks of a university.

Liquidity, representing the current asset position of an institution's total assets, is related to the short-term capital management of the universities. Institutions with higher amounts of liquid assets can better manage their financial obligations. Even though liquid assets do not earn high rates of return, liquidity is a major indicator of the financial management efficiency of the universities. Better managed colleges and universities should have higher amounts of liquidity. Finally, an efficient organization creates higher amounts of sales while minimizing investments in physical assets. Total asset turnover in the context of universities measures the net amount of tuitions and fees generated per dollar worth of assets. Higher values of the total asset turnover will be associated with better managed universities.

The results of the formal regressions are presented in Table 6. The estimates in column (1) show that there is a positive and statistically significant relationship between tuition discounting and the level of leverage. This indicates that the institutions providing greater tuition discounting are heavily indebted and thus, have significant amount of credit risk. Similarly, the relationship between tuition discounting and equity ratio is negative in column (2). When breaking down the sample, the results are stronger for private universities in columns (3) and (6). The coefficients of *Discount* in regressions involving the public universities have the consistent signs in columns (2) and (5), but only statistically significant when the dependent variable is *EquityRatio* in column (5). The implicit guarantee provided by the States when it comes to public universities may be a reason why the relationship between *Discount* and *TotalDebt* is statistically insignificant.

Table 6: Tuition Discounting and Financial Indicators

The dependent variables in the four columns are *TotalDebt* (calculated as the ratio of the total liabilities to total assets), *EquityRatio* (calculated as the ratio of total net assets to total assets), *Liquidity* (calculated as the ratio of the current assets to the total assets), and *AssetTurnover* (calculated as the ratio of total amount of tuition and fees, after excluding discounts and allowances to total assets). The independent variable of interest *Discount* is computed as the ratio of total institutional aid to gross tuition. Gross tuition is calculated by multiplying the nominal amount of tuition and fees by the size of the cohort, while total institutional aid is calculated by multiplying average institutional aid by the number of students receiving the aid. *DevMED* identifies how much an institution's *Discount* deviates from the median discount offered by similar institutions in the same State during the same year. *FemaleRatio* is the ratio of female students to all students. *ForeignRatio* is the ratio of foreign students to all students. *LnAssets* is the natural logarithm of the institution's total assets. *GDPgrowth* is the growth rate of real GDP of the State. *Endowment* is the natural logarithm of the end-of-year endowment assets per full time enrollment. *EndowmentGrowth* is the annual percentage change in endowment assets. *Enrollment* is the natural logarithm of the number of total students enrolled for credit in the fall of the academic year. *Tuition* is the natural logarithm of the published tuition and fees. *LoanAid* is the natural logarithms of the average amount of student loan aid received by full-time first-time undergraduates. *RateElasticity* is the percentage change in student loans in response to a percentage change in the real interest rate. Columns (1), (4), (7), and (10) present the results for all universities; columns (2), (5), (8), and (11) for public universities; and columns (3), (6), (9), and (12) for private universities. OLS with fixed effects for institutions and year. Robust standard errors. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

	(1)	(2)	(3)	(4)	(5)	(6)
Universities:	All	Public	Private	All	Public	Private
Dependent Variable:	*TotalDebt*	*TotalDebt*	*TotalDebt*	*EquityRatio*	*EquityRatio*	*EquityRatio*
Discount	0.008	0.009	0.014	-0.015	-0.067	-0.014
	(0.002)***	(0.011)	(0.003)***	(0.003)***	(0.016)***	(0.003)***
FemaleRatio	-0.000	-0.001	-0.001	0.001	0.003	0.001
	(0.000)	(0.001)	(0.000)***	(0.000)***	(0.001)***	(0.000)***
ForeignRatio	-0.000	-0.000	0.002	0.002	0.000	-0.002
	(0.000)	(0.001)	(0.000)***	(0.001)***	(0.001)	(0.000)***
LnAssets	0.026	0.023	0.010	-0.031	-0.033	-0.010
	(0.004)***	(0.005)***	(0.004)***	(0.004)***	(0.007)***	(0.004)***
GDPgrowth	0.039	0.045	-0.080	-0.126	-0.150	0.143
	(0.031)	(0.042)	(0.097)	(0.039)***	(0.053)***	(0.093)
Endowment	-0.005	0.002	-0.072	-0.001	-0.023	0.071
	(0.002)***	(0.002)	(0.002)***	(0.002)	(0.003)***	(0.002)***
Enrollment	0.005	0.018	-0.002	0.014	0.062	0.002
	(0.006)	(0.010)*	(0.004)	(0.007)**	(0.014)***	(0.004)
Tuition	0.067	0.067	0.106	-0.134	-0.162	-0.104
	(0.009)***	(0.011)***	(0.006)***	(0.010)***	(0.011)***	(0.005)***
EndowmentGrowth	0.008	0.026	-0.254	-0.003	-0.005	0.248
	(0.018)	(0.021)	(0.072)***	(0.023)	(0.032)	(0.068)***
LoanAid	0.002	-0.004	0.037	0.000	0.028	-0.037
	(0.003)	(0.005)	(0.006)***	(0.004)	(0.006)***	(0.006)***
RateElasticity	-0.001	-0.001	-0.001	-0.000	0.003	0.001

	(0.000)	(0.001)*	(0.001)	(0.000)	(0.001)***	(0.001)
Institution FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.758	-0.737	-0.481	2.229	1.813	1.479
	(0.114)***	(0.167)***	(0.061)***	(0.136)***	(0.157)***	(0.057)***
R^2	0.93	0.94	0.27	0.88	0.86	0.27
N	13,960	6,826	7,134	16,018	7,864	8,154

(Table 6 continued……)

	(7)	(8)	(9)	(10)	(11)	(12)
Universities:	All	Public	Private	All	Public	Private
Dependent Variable:	*Liquidity*	*Liquidity*	*Liquidity*	*AssetTurnover*	*AssetTurnover*	*AssetTurnover*
Discount	-0.049	0.017	-0.069	-0.074	0.004	-0.170
	(0.009)***	(0.010)	(0.014)***	(0.006)***	(0.007)	(0.010)***
FemaleRatio	-0.000	0.000	0.000	0.000	-0.001	0.001
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)***	(0.000)***
ForeignRatio	0.001	0.001	0.002	0.003	0.001	0.004
	(0.000)***	(0.001)*	(0.000)***	(0.000)***	(0.000)	(0.000)***
LnAssets	-0.058	-0.116	-0.031	-0.163	-0.138	-0.150
	(0.003)***	(0.005)***	(0.004)***	(0.002)***	(0.002)***	(0.003)***
GDPgrowth	0.059	-0.003	-0.185	-0.136	-0.025	-0.084
	(0.071)	(0.038)	(0.112)*	(0.048)***	(0.051)	(0.078)
Endowment	-0.008	0.006	-0.031	-0.001	0.005	-0.022
	(0.001)***	(0.002)***	(0.003)***	(0.001)	(0.001)***	(0.002)***
Enrollment	0.046	0.042	0.017	0.154	0.147	0.145
	(0.003)***	(0.009)***	(0.005)***	(0.002)***	(0.002)***	(0.003)***
Tuition	0.039	0.017	0.036	0.158	0.140	0.120
	(0.003)***	(0.010)*	(0.007)***	(0.002)***	(0.003)***	(0.005)***
EndowmentGrowth	-0.063	0.028	0.130	-0.026	-0.022	-0.068
	(0.042)	(0.019)	(0.083)	(0.029)	(0.026)	(0.058)
LoanAid	-0.007	-0.003	-0.019	0.034	0.028	-0.003
	(0.005)	(0.004)	(0.007)***	(0.003)***	(0.004)***	(0.005)
RateElasticity	0.001	-0.000	0.002	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)*	(0.001)	(0.001)	(0.001)
Institution FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Constant	0.754 (0.042)***	1.867 (0.151)***	0.808 (0.071)***	0.261 (0.028)***	0.075 (0.033)**	0.976 (0.050)***
R^2	0.23	0.16	0.44	0.58	0.49	0.63
N	13,920	6,826	7,094	13,960	6,826	7,134

The coefficient for tuition discounting is negative and statistically significant in Column (7) of Table 6 where the dependent variable is *Liquidity*. This indicates that institutions offering significant tuition discounting have worsening liquidity position. Similarly, the relationship between total asset turnover and tuition discounting is negative and statistically significant in Column (10). However, these relationships are stronger for private universities. The coefficients of *Discount* in columns (9) and (12) are statistically significant. But the coefficients of *Discount* for public universities are statistically insignificant. Overall, the results presented here indicate that tuition discounting has largely negative impact on a college's risk and liquidity – and these results are stronger for private universities.

4.5 Tuition Discounting and College Reputation, Out-of-Sample Tests

To understand how tuition discounting affects a college's reputation, we devise a set of out-of-sample tests. In this process, we split our sample into two roughly half time periods. The dependent variable *USNewsRank* is computed as % increase in U.S. News and World Report annual national university ranking for the college over the period 2010 and 2015. Although higher values of rankings are less desirable, we adjust the values in a way that higher values are better for colleges. The independent variable of interest *DiscountChange* is computed as % change over time period 2006 and 2010. This methodology has a few advantages. First, this is a change in change regression methodology. Therefore, this allows us to examine whether a change in the independent

variable results in a change in dependent variable. Second, the dependent and independent variables are not contemporaneous. So, the likelihood of these variables being jointly determined, and thus endogenous, is significantly reduced. Finally, since it could be argued that changes in university policies take long time to bear results, this methodology can provide guidance on such an issue.

The results are presented in Table 7. We estimate three regression models. In the first one, we run the model for all universities – both private and public. The coefficient for *DiscountChange* is negative and statistically significant. It indicates that over a longer time period, an increase in tuition discount does not result in an increase in university reputation. In columns (2) and (3) we do the same exercise for public and private universities separately. A similar negative relationship is observed among the public and private institutions, but they are statistically insignificant.

Table 7: Tuition Discounting and College Reputation, Out-of-Sample Tests

Dependent variable in the first three columns *USNewsRank* represent the % improvement in U.S. News and World Report National University Ranking between 2010 and 2015. The dependent variable in the last three columns are *RankImprove* – a dummy variable that takes the value of 1 if the university improved in ranking during the same time period, 0 otherwise. The independent variable of interest *Discount* is computed as the ratio of total institutional aid to gross tuition. Gross tuition is calculated by multiplying the nominal amount of tuition and fees by the size of the cohort, while total institutional aid is calculated by multiplying average institutional aid by the number of students receiving the aid. *DiscountChange* is the percentage change for *Discount* over the time period 2006 and 2010. *FemaleRatio* is the ratio of female students to all students. *ForeignRatio* is the ratio of foreign students to all students. *LnAssets* is the natural logarithm of the institution's total assets. *GDPgrowth* is the growth rate of real GDP of the State. *Endowment* is the natural logarithm of the end-of-year endowment assets per full time enrollment. *EndowmentGrowth* is the annual percentage change in endowment assets. *Enrollment* is the natural logarithm of the number of total students enrolled for credit in the fall of the academic year. *Tuition* is the natural logarithm of the published tuition and fees. *LoanAid* is the natural logarithms of the average amount of student loan aid received by full-time first-time undergraduates. *RateElasticity* is the percentage change in student loans in response to a percentage change in the real interest rate. Columns (1) and (4) present the results for all universities; columns (2) and (5) for public universities; and columns (3) and (6) for private universities. The first three columns are simple OLS regressions with robust standard errors and the last three are Logit models with robust standard errors. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

	(1)	(2)	(3)	(4)	(5)	(6)
Universities:	All	Public	Private	All	Public	Private

Dependent Variable:	*USNewsRank*	*USNewsRank*	*USNewsRank*	*RankImprove*	*RankImprove*	*RankImprove*
DiscountChange	-0.325	-0.029	-0.273	-4.602	-0.639	-10.230
	(0.156)**	(0.137)	(0.307)	(2.142)**	(3.015)	(4.180)**
FemaleRatio	0.001	0.003	-0.002	-0.006	-0.013	-0.010
	(0.001)	(0.002)	(0.003)	(0.023)	(0.042)	(0.031)
ForeignRatio	-0.002	0.005	-0.008	-0.026	-0.015	-0.038
	(0.004)	(0.005)	(0.006)	(0.041)	(0.092)	(0.049)
LnAssets	0.006	-0.002	0.045	1.154	1.365	1.740
	(0.056)	(0.031)	(0.162)	(0.414)***	(0.655)**	(0.754)**
GDPgrowth	-0.403	0.462	1.507	-2.669	-4.971	10.097
	(0.578)	(0.526)	(1.773)	(6.694)	(8.386)	(22.710)
Endowment	-0.015	0.002	-0.031	-0.195	-0.194	-0.410
	(0.023)	(0.015)	(0.103)	(0.242)	(0.278)	(0.493)
Enrollment	0.042	0.028	0.066	-0.753	-1.842	-0.635
	(0.088)	(0.047)	(0.194)	(0.542)	(0.997)*	(0.762)
Tuition	0.066	0.062	0.110	0.995	1.195	0.510
	(0.040)*	(0.044)	(0.086)	(0.475)**	(0.911)	(0.815)
EndowmentGrowth	-0.008	-0.595	0.317	0.208	-1.524	11.375
	(0.587)	(0.280)**	(1.760)	(6.415)	(7.210)	(17.487)
LoanAid	0.113	-0.087	0.166	1.909	2.107	1.803
	(0.107)	(0.071)	(0.188)	(0.964)**	(1.837)	(1.605)
RateElasticity	-0.078	-0.004	-0.192	-0.457	-0.093	-1.078
	(0.045)*	(0.010)	(0.076)**	(0.302)	(0.442)	(0.418)***
Constant	-2.061	-0.332	-3.644	-41.535	-38.478	-46.186
	(0.886)**	(0.584)	(1.905)*	(10.267)***	(15.369)**	(18.017)**
R^2 or χ^2	0.11	0.09	0.27	50.66	17.85	24.82
N	233	150	85	233	148	85

Since ranking data are in ordinal scale and thus, does not allow for the measurement of relative strength of the change, we devise a logit regression model. The dependent variable is the indicator variable *RankImprove*, which takes the value of 1 if there is an improvement in the rank of the university and 0 otherwise. The results are presented in Columns (4)-(6) of Table 7. In Column (4), we present the results for all universities. Column (5) is estimated for public universities and Column (6) for private universities. The coefficient estimate for *DiscountChange*

is negative and statistically significant for all universities and private universities only, but it is negative and statistically insignificant for public universities. This is consistent with the argument that tuition discounting is unrelated to the reputation on the public universities, while it has little bearing on the reputation of the private universities.

V. Conclusions

We examine and evaluate the effectiveness of tuition discounting both as an enrollment management tool and as revenue management tool. We first use profitability measures *Operating Surplus*, *Profit Margin*, and *Revenue Growth* as proxies in measuring the effectiveness of tuition discounting from the profit management point of view for both public and private institutions over the period of 2006 to 2015. Our results show that the risk adjusted *Operating Surplus* for public universities is significantly higher than that for private universities. This indicates that public institutions as a whole are in stronger financial position than private institutions.

Additionally, we use panel data regressions to formally test several hypotheses. First, we explored the impact of tuition discounting on financial health of the institutions. We show that the profitability has a positive relationship with tuition discounting up to a point. If discounting becomes too large, it has a negative relationship with profitability. Therefore it can be argued that tuition discounting can be a positive differentiating factor for the institutions. However, it should not be used as a competitive strategy since its benefits decrease at higher levels.

Second, tuition discounting is not always an efficient tool for enrollment management. We study the impact of tuition discounting on some of the variables such as yield, retention, graduation

rate, transfer out rate, and SAT scores. Overall, tuition discounting helps institutions increase their admission yield and retention rate. However, it does not improve the on time graduation rate or the quality of the incoming students. The impact of tuition discounting in lowering drop-outs and graduation rate could indicate that it takes students on average a longer period to graduate from these institutions and the competitive students in private universities use these institutions as a bridge to transfer up, thus higher transfer out rate.

Third, to further understand the relationship between tuition discounting and financial health of institutions, we explore the effects of tuition discounting on the various measures of financial stability and risk of the universities such as level of debt, equity ratio, liquidity, and asset turnover. Institutions relying more on tuition discounting utilize more financial leverage, has higher debt, and experience lower liquidity and higher asset turnover. We can conclude that higher tuition discounting is associated with more financial risk and less asset utilization efficacy.

Finally, we explore the relationship between tuition discounting and university reputation in U.S. News and World Report rankings. Using out-of-sample tests, we find that public university reputations are unrelated to higher tuition discounting. However, this relationship is negative for private institutions. This result is consistent with the idea that students choose a private college for reputation and a public school for affordability.

While we attempt to study the effects of tuition discounting from the perspective of the financial health of the universities, further research is required to understand whether a better financial model can be developed for higher education in the U.S. It is widely accepted that education creates positive externalities for the society and the economy. The benefits of education for the individual and the society far outweigh the costs of providing it to students. However, there

is an important debate going on who pays for the education and how to effectively control the costs. If ever increasing tuition discounts become a part of reality for the educational institutions, it may impair their ability to fulfill the core mission of providing quality instruction to students.

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