

FEDERAL FUNDING AND THE RISE IN UNIVERSITY TUITION COSTS

by

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A thesis submitted in partial fulfillment of the requirements
for the Honors in the Major in Economics
in the College of Business
and in the Burnett Honors College
at the University of Central Florida
Orlando, Florida

Fall Term 2013

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Abstract

Access to education is a central part of federal higher education policy, and federal grant and loan programs are in place to make college degrees more attainable for students. However, there is still controversy about whether there are unintended consequences of implementing and maintaining these programs, and whether they are effectively achieving the goal of increased accessibility. In order to answer questions about whether three specific types of federal aid cause higher tuition rates and whether these programs increase graduation rates, four ordinary least squares regression models were estimated. They include changes in both in-state and out-of-state tuition sticker prices, graduation rates, as well as changes in three types of federal aid, and other variables indicative of the value of a degree for four-year public universities in Arizona, California, Georgia, and Florida for years 2001-2011. The regressions indicate a positive effect of Pell Grants on in-state and out-of-state tuition and fees, a positive effect of disbursed subsidized federal loans on the change in number of degrees awarded, and a positive effect of Pell Grants on graduation rates.

Dedication

This thesis is dedicated to my parents, Brad and Terri Kizzort, for their consistent support, encouragement, and love throughout my life.

Acknowledgements

I would like to thank my committee chair, Dr. Richard Hofler, for his support and guidance throughout this process. I would also like to thank Dr. David Scrogin and Dr. Sherron Roberts for their willingness to serve on my committee. Their feedback and support were invaluable as I undertook this project.

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Introduction

Access to education is a central part of federal higher education policy, and federal grant and loan programs are in place to make college degrees more attainable for students. General acceptance of education as a public good has provided support for programs like the federal direct loan program and Pell Grants. However, controversy persists about whether there are unintended consequences of implementing and maintaining these programs, and whether they are effectively achieving the intended goal of increased accessibility.

This study asks two questions related to unintended consequences and effectiveness: First, does increased federal funding increase university tuition costs? This question will be answered by observing the effects of increases in federal grant and direct loan amounts on both in-state and out-of-state tuition costs at four-year public universities in Florida, California, Arizona, and Georgia during the years 2001-2011. Second, does increased federal funding have a positive effect on graduation rates? Examining the relationship between graduation rates, federal funding, and other factors that could logically increase the likelihood of graduation will determine whether federal funding is a good investment. In order for financial aid to be useful, it should increase the number of students who graduate with a degree as well as the number who are able to start degrees because of financial aid.

By addressing these research questions, I hope to determine whether federal funding is related to increases in tuition costs and what kind of federal aid is most effective.

Literature Review

In a 1987 *New York Times* article, then Secretary of Education William J. Bennett stated that “increases in financial aid in recent years have enabled colleges and universities blithely to raise their tuitions, confident that Federal loan subsidies would help cushion the increase.” This hypothesis has since been called the Bennett hypothesis, and after two decades it is still being debated.

Congress requested a study from the National Center for Education Statistics (NCES) published in 2001, which found no relationship between the availability of grants and rising tuition costs (Cunningham et al. 2001). The NCES researchers reported a lack of confidence in the results, due to limitations of the study. The NCES independent variables included the dollar change in instructional expenditures, as well as a federal aid variable. At that point in time, all types of federal loans were reported together and could not be disaggregated. Other studies have indicated an increase in tuition at public universities for in-state students, but not for out-of-state students (Rizzo and Ehrenberg 2004), a rise in tuition at higher-ranked private institutions related to Pell Grants, but not at public or lower-ranked institutions (Singell and Stone 2003), and 75% higher tuition at private for-profit institutions whose students are eligible for financial aid over private institutions whose students are not (Cellini and Goldin 2012). As these results show, each of these studies reached different conclusions about the impact of federal aid based on the education sector they observe. The 2004 Rizzo and Ehrenberg study influenced my decision to estimate a model for in-state and out-of-state tuition costs due to the potential significance for public universities, which generally charge much higher tuition for nonresident students. Gillen’s

paper attempts to update the Bennett hypothesis by differentiating between types of aid, taking into account the effect of tuition caps for public universities as well as selectivity and price discrimination, and viewing the changes over time and not just as a snapshot of the bigger picture (2012). Gillen's emphasis on differentiating between need based and non-need based aid influenced my decision to separate aid into subsidized and unsubsidized federal direct loans, as well as Pell Grants.

Data

In order to determine whether federal aid affects tuition prices and which types of aid are effective at increasing graduation rates, four models were estimated. They include variables found in previous studies on this topic, as well as federal aid variables that are more specific than those used in some previous studies. For example, all of the studies referenced in the literature review included a Pell variable, but the Singell and Stone 2003 study did not include other federal aid variables. The Cellini and Goldin 2012 study on for-profit schools, due to limited data in this sector, included a variable distinguishing a Title IV institution from a non-Title IV institution to account for their access to federal funds. The 2001 NCES study, as mentioned in the literature review, did not have access to federal loan amounts by type.

All of the states in the sample (Arizona, California, Florida, and Georgia) experienced at least a 5% increase from 2007-2011 in the proportion of working families who can be classified as low-income (Roberts, Povich, and Mather 2013). According to the data on total Pell Grant spending at all public universities in 2011 state by state, all four of the states in this sample made it into the top ten (“Title IV Program Volume Reports”). Both in-state and out-of-state tuition costs more than doubled from 2001-2011 in all four states. In-state tuition and fees increased by 273% in Arizona, 254% in California, 158% in Georgia, and 117% in Florida. Out-of-state tuition and fees increased by 122% in Arizona, 110% in California, 122% in Georgia, and 102% in Florida. I chose to limit the number of observed states in order to collect a sample of manageable size, and these qualities indicated that the relationship between tuition costs and federal funding could be clearer if I limited the sample to these four states. Details on the sample

for each model can be found in Appendices A and B. The sample should be representative of public, four-year universities in states that have experienced large increases in tuition in the public education sector, have a growing proportion of low-income families, and receive large amounts in total Pell Grant spending at public colleges relative to the rest of the country.

The variables below are grouped by the regression model in which they were used. Each observation in each sample is at the individual university level, for each year from 2002-2011 in which all of the variables were reported. For example, the tuition and federal funding variables are represented as changes from the previous year, so all of these variables included in observations labeled year 2002 represent the change in these variables from the academic year 2001-02 to 2002-03.

Model 1

The first subsection describes the dependent variables used in the first regression model. The second includes variables that should be indicative of the value of the education to the students. Finally, the third includes the federal aid variables.

Dependent variables

The first model was estimated for two dependent variables: the change in sticker price for in-state students and the change in sticker price for out-of-state students. The sticker price includes tuition and fees, and was acquired from the *Chronicle of Education's* database.

Influences on price

The model also includes variables that should indicate the value of the education. These are new enrollment, the estimated median SAT/ACT score, and the 4-year graduation rate for that year. The estimated median score was calculated by averaging the 25th and 75th percentile

scores for the test that the majority of students submitted at that university. If the majority submitted the ACT, that score was converted to its SAT equivalent. These variables were obtained through the National Center for Education Statistics' IPEDS Data Center and the Education Trust. In part, new enrollment could indicate demand for degrees from that school. Selectivity plays a role in the quality of an education, and the estimated median SAT/ACT score is a measure of selectivity. Graduation rates are a measure of value, because the goal of federal aid programs is to graduate more students and the goal of students is to graduate. Graduation rates include first-time, full-time, degree-seeking undergraduates who receive their degree within 4 years. Binary variables were included for Florida, Georgia, and California to account for state-specific qualities, such as cost of living and public university tuition setting policies. A binary variable was added for the 2007-2009 recession, to account for its effect on tuition costs. These binary variables were omitted from the descriptive statistics.

Federal grant and loan variables

Lastly, the federal grant and loan variables include the change in total Pell Grant amounts, the changes in both the total amount of federal direct unsubsidized loans originated and disbursed, and the change in both the total amount of federal direct subsidized loans originated and disbursed (Federal Student Aid). Pell Grants and federal direct subsidized loans are need-based. Pell Grants do not have to be repaid, and the maximum award amount per student for the 2011-2012 was \$5,550. In addition to the student's financial need, the amount a student is awarded is based on whether he or she is a full-time or part-time student, whether the student is attending school for a full or partial academic year, and the cost of attendance. The Department

of Education pays the interest for students with subsidized loans during their time at the university and for six months afterwards. Unsubsidized loans do not require financial need, and the student is responsible for paying interest during all periods.

Table 1. Descriptive statistics for Model 1

Variable	Mean	Std. Dev.	Min.	Max.
<i>Dependent</i>				
Change in-state	602.40	522.43	-518	2,620
Change out-of-state	1,235.02	1,246.95	-6737	12,313
<i>Influences on price</i>				
New enrollment	398.64	984.40	-2816	9406
Estimated SAT/ACT score	1,053.62	118.53	805	1,345
Graduation rate	24.35	16.67	2.7	71
<i>Federal grant and loan variables</i>				
Change in Pell Grants	2,663,191	4,702,386	-6,159,325	30,331,389
Change in originated subsidized federal loans	4,796,413	1.13+07	-5,921,500	84,477,321
Change in disbursed subsidized federal loans	4,795,403	1.12e+07	-7674642	84,345,378
Change in originated unsubsidized federal loans	4,856,517	1.15e+07	-8,014,991	87,584,933
Change in disbursed unsubsidized federal loans	3,915,660	1.54e+07	-157,718,830	87,153,464

Number of observations = 359

Model 2

In order to evaluate the effect of a 1% change in the federal funding variables on the dependent variables in the first and second models, another model was estimated using the dependent and independent variables described in Table 1. Instead of dollars terms, the sticker prices and federal grant and loan variables are described as percentage changes from the previous year. This model allows for an easy comparison between the effects of 1% changes in the

variables of interest. There are 11 fewer observations in this sample because unlike the dollar changes from the first model, the percentages could not be calculated when zero grant or loan dollars were given in the original year. The same binary variables from Model 1 were used in this regression, but are not included in the descriptive statistics.

Table 2. Descriptive statistics for Model 2

Variable	Mean	Std. Dev.	Min.	Max.
<i>Dependent</i>				
% Change in-state	12.54	9.21	-10.93	41.40
% Change out-of-state	7.75	6.96	-23.39	55.79
<i>Indicators of value</i>				
New enrollment	403.68	932.35	-2,031	9,406
Estimated SAT/ACT score	1,052.89	118.76	805	1,345
Graduation rate	24.34	16.72	2.7	71
<i>Federal grant and loan variables</i>				
% Change in Pell Grants	12.75	18.03	-12.97	89.12
% Change in originated subsidized federal loans	633.23	6,869.13	-100	104,414.3
% Change in disbursed subsidized federal loans	630.61	6,851.71	-100	104,130.8
% Change in originated unsubsidized federal loans	352.25	3,392.96	-100	56,988.52
% Change in disbursed unsubsidized federal loans	347.04	3,351.49	-100	56,282.67

Number of observations = 348

Model 3

This model was estimated in order to determine whether federal funding increases the number of graduates, which is one goal of financial aid. The change in number of degrees awarded from the previous year is the dependent variable in this model, as a measure of how many more students are graduating at each university.

Table 3. Descriptive statistics for Model 3

Variable	Mean	Std. Dev.	Min.	Max.
<i>Dependent</i>				
Change in number of degrees awarded	-62.38	687.65	-5,281	3,268
<i>Number of graduates</i>				
Avg. estimated SAT/ACT score	1,053.65	115.53	815	1,332.5
Avg. new enrollment	336.94	583.58	-1270	3,899.75
<i>Federal grant and loan variables</i>				
Avg. change in Pell Grants	2,117,090	2,635,308	-455,776.8	16,889,852.01
Avg. change in originated unsubsidized federal loans	2,803,827	3,064,866	-1,068,448	20,806,834
Avg. change in disbursed unsubsidized federal loans	2,544,551	3,428,700	-21,127,969.5	20,030,949.5
Avg. change in originated subsidized federal loans	1,935,516	2,334,922	-1,436,831	18,941,050.75
Avg. change in disbursed subsidized federal loans	2,042,483	2,446,922	-1,343,644	20,106,522

Number of observations = 202

Number of graduates

Standardized test scores such as SAT and ACT scores have been shown to have a positive correlation with a student’s likelihood of graduating. Therefore, the average estimated median SAT/ACT score is included as an independent variable. The average change in enrollment was included because an increase in enrolled students would logically increase the number of graduates. Initially the average change in instructional expenditures was included in the model, but was dropped because the coefficient was not statistically significant and the lack of reported years decreased the sample size. All of these variables are averaged over four years, to represent a student’s experience over the course of those years. This reduced the number of

observations to 202. Because the earliest observations in the dataset are from 2002, the earliest four-year average that can be calculated is 2002-2005.

Federal grants and loan variables

The average change in Pell Grants, unsubsidized loans, and subsidized loans over four years are included in this model as well, in order to determine their relationship to the number of degrees awarded.

Model 4

Graduation rates, versus the absolute change in degrees awarded, offer another measure of effectiveness and represent the proportion of full-time undergraduates who graduate within 4 years.

Table 4. Descriptive statistics for fourth model

Variable	Mean	Std. Dev.	Min.	Max.
<i>Dependent</i>				
Graduation rate	26.34059	17.44394	4.4	71
<i>Number of graduates</i>				
Avg. estimated SAT/ACT score	1,053.65	115.53	815	1,332.5
Avg. new enrollment	336.94	583.58	-1,270	3,899.75
<i>Federal grant and loan variables</i>				
Avg. change in Pell Grants	2,117,090	2,635,308	-455,776.8	16,889,852.01
Avg. change in originated unsubsidized federal loans	2,803,827	3,064,866	-1,068,448	20,806,834
Avg. change in disbursed unsubsidized federal loans	2,544,551	3,428,700	-21,127,969.5	20,030,949.5
Avg. change in originated subsidized federal loans	1,935,516	2,334,922	-1,436,831	18,941,050.75
Avg. change in disbursed subsidized federal loans	2,042,483	2,446,922	-1,343,644	20,106,522

Number of observations = 202

An increase in the number of degrees awarded or graduates would be a desirable outcome of federal funding, but an increase in the proportion of students who successfully complete their degrees is another important outcome. In this model, the graduation rate replaces the change in degrees awarded as the dependent variable. All independent variables are the same as in the third model, because standardized test scores, new enrollment, and federal aid variables should logically influence both the number of degrees awarded as well as the graduation rate.

Results

Each regression model was estimated by ordinary least squares. Using ordinary least squares allows for meaningful interpretations of the coefficients in each model.

Model 1

This model shows the relationship between changes in the dollar amounts awarded in each federal funding category. The only funding variables that are statistically significant are Pell Grants and originated unsubsidized federal loans in the in-state specification, and only Pell Grants in the out-of-state specification. The graduation rate has a significant positive effect on both in-state and out-of-state tuition. The Florida binary variable has a statistically significant negative effect on in-state tuition. This model indicates that Pell Grants likely have a significant positive effect on tuition and fees, both in-state and out-of-state. It also indicates that the amount of originated unsubsidized federal loans could have a negative effect on tuition costs.

In-state tuition

Holding all else constant, a \$1000 change in Pell Grants awarded will increase in-state tuition and fees by \$0.02 on average. In more useful terms, an increase in Pell Grants by one standard deviation (\$4,702,386) is associated with a \$94.04 increase in tuition. By comparison, an increase in the graduation rate by one standard deviation is associated with a \$283.56 increase in tuition, a one point increase in the estimated median SAT/ACT score has a negative impact of \$113.79, and a one standard deviation increase in originated unsubsidized federal loans has a negative impact of approximately \$345. In-state students attending university in Florida experienced a tuition change that was about \$300 less on average than other states' in-state students. For an in-state student at a university in California during the recession, the predicted

increase in the change in tuition based on the average values of the control and funding variables is approximately \$654.

Table 5. Regression results for Model 1

Dependent variables	Change in-state tuition	Change out-of-state tuition
Constant	780.05 (2.22)*	590.65 (0.61)
<i>Influences on price</i>		
New enrollment	-0.04 (-1.59)	-0.05 (-0.69)
Estimated median SAT/ACT score	-0.60 (-1.59)	-0.31 (-0.31)
Graduation rate	15.56 (5.75)**	28.68 (3.90)**
Recession binary variable	17.33 (0.28)	-175.38 (-1.03)
Florida binary variable	-299.54 (-2.45)*	-16.34 (-0.05)
Georgia binary variable	15.92 (0.14)	399.18 (1.27)
California binary variable	58.77 (0.53)	289.57 (0.96)
<i>Federal grant and loan variables</i>		
Change in Pell Grants	.00002 (3.16)**	.00006 (3.62)**
Change in originated subsidized federal loans	-.00002 (-0.75)	.00001 (0.14)
Change in disbursed subsidized federal loans	.00006 (1.84)	-.000006 (-0.07)
Change in originated unsubsidized federal loans	-.00003 (-3.77)**	-.00002 (-1.28)
Change in disbursed unsubsidized federal loans	-.000003 (-1.30)	-.0000007 (-0.11)
R ²	0.36	0.17
Adjusted R ²	0.34	0.14
Prob > F	0.0000	0.0000

Notes: Numbers in parentheses are *t* statistics.

** significant at 1%, * significant at 5%

Out-of-state tuition

R-squared in the out-of-state specification is .17 versus .36 in the in-state model, indicating that less of the variability in changes of out-of-state tuition and fees is accounted for by the model. For the same one standard deviation increase in Pell Grants, the impact on the change out-of-state tuition is \$235.12. The impact of a one standard deviation increase in the graduation rate is associated with a \$259.39 increase in tuition. For an out-of-state student at a university in California during the recession, the predicted change in tuition based on the average values of the control and funding variables is approximately \$1,136.

Model 2

In this model, the dependent variables and federal funding variables are stated as percentage changes rather than dollar changes. Several of the control variables and the Pell Grant variable are statistically significant in the in-state model. Holding all else constant, a 1% increase in the change in Pell Grants awarded is associated with a 0.18% increase in in-state tuition and fees on average. The recession binary variable and the Pell Grant variable are the only statistically significant variables in the out-of-state model. A 1% increase in the change in Pell Grants awarded is associated with a 0.11% increase in out-of-state tuition and fees.

Table 6. Regression results for Model 2

Dependent variables	% Change in-state tuition	% Change out-of-state tuition
Constant	13.83 (1.86)	4.19 (0.71)
<i>Influences on price</i>		
New enrollment	-.001 (-2.01)*	-.0007 (-1.60)
Estimated SAT/ACT score	.0002 (0.03)	.003 (0.47)
Graduation rate	-0.001 (-0.02)	0.02 (0.43)
Recession binary variable	-2.44 (-1.80)	-3.35 (-3.12)**
Florida binary variable	-5.82 (-2.30)*	-1.97 (-0.99)
Georgia binary variable	-5.54 (-2.37)*	0.09 (0.05)
California binary variable	-0.90 (-0.41)	0.05 (0.03)
<i>Federal grant and loan variables</i>		
% Change in Pell Grants	0.18 (5.38)**	0.11 (4.22)**
% Change in originated subsidized federal loans	0.002 (0.05)	-0.02 (-0.70)
% Change in disbursed subsidized federal loans	-0.002 (-0.05)	0.02 (0.70)
% Change in originated unsubsidized federal loans	0.002 (0.05)	-0.003 (0.09)
Change in disbursed unsubsidized federal loans	-0.002 (-0.05)	-0.003 (-0.09)
R ²	0.15	0.07
Adjusted R ²	0.12	0.04
Prob > F	0.0000	0.0166

Notes: Numbers in parentheses are *t* statistics. ** significant at 1%, * significant at 5%

Model 3

The third model uses the change in number of degrees awarded as the dependent variable. The average change in enrollment and the average change in originated and disbursed subsidized loans over four years are the statistically significant independent variables in this model.

Table 7. Regression result for Model 3

Dependent variable	Change in degrees awarded
Constant	509.71 (1.29)
<i>Number of graduates</i>	
Avg. enrollment change	.26 (2.88)**
Avg. estimated SAT/ACT score	-0.62 (-1.63)
<i>Federal grant and loan variables</i>	
Avg. change in Pell Grants	-.00007 (-1.58)
Avg. change in originated subsidized federal loans	-.001 (-7.28)**
Avg. change in disbursed subsidized federal loans	.001 (6.46)**
Avg. change in originated unsubsidized federal loans	-.00004 (-1.07)
Avg. change in disbursed unsubsidized federal loans	.00002 (1.03)
R ²	0.31
Adjusted R ²	0.29
Prob > F	0.0000

Notes: Numbers in parentheses are *t* statistics.

** significant at 1%, * significant at 5%

Holding all else constant, a one standard deviation increase in the average change in enrollment, or approximately 584 new full-time students, is associated with 152 additional degrees awarded on average. Pell Grants and the unsubsidized federal loans variables do not

have statistically significant effects on the change in degrees awarded. Holding all else constant, a one standard deviation increase in the originated subsidized loans variable (\$2,334,922) is estimated to cause a decrease in the change in number of degrees awarded of 2,335 on average. However, the disbursed subsidized loan coefficient is positive and a one standard deviation increase (\$2,446,922) is associated with a 2,447 increase in the change in degrees awarded.

Model 4

The fourth model explains 80% of the variability in the 4-year graduation rate. The statistically significant variables are the estimated median SAT/ACT score and Pell Grants.

Table 8. Regression results for Model 4

Dependent variable	4-year graduation rate
Constant	-113.5653 (-20.84)**
<i>Number of graduates</i>	
Avg. enrollment change	.0003 (0.25)
Avg. estimated median SAT/ACT score	0.13 (25.23)**
<i>Federal grant and loan variables</i>	
Avg. change in Pell Grants	.000002 (2.66)**
Avg. change in originated subsidized federal loans	-.000003 (-1.14)
Avg. change in disbursed subsidized federal loans	.000002 (0.74)
Avg. change in originated unsubsidized federal loans	-.0000006 (-1.32)
Avg. change in disbursed unsubsidized federal loans	.00000002 (0.10)
R ²	0.80
Adjusted R ²	0.79
Prob > F	0.0000

Notes: Numbers in parentheses are *t* statistics.

** significant at 1%, * significant at 5%

All else constant, a one standard deviation increase in Pell Grants (\$2,635,308) is associated with a 5.27% increase in the 4-year graduation rate. The third model shows that Pell Grants do not affect the change in number of degrees awarded, but in this model, it appears that they do positively affect the proportion of students who graduate within four years. For comparison, a one standard deviation increase in the average estimated median SAT/ACT score is estimated to have a 15.02% increase in the graduation rate.

Conclusion

These results are subject to a number of limitations, including omitted variables, the lack of reported data on some variables, and the form of the third model.

Possibility of Omitted Variables

The results of this study could be subject to omitted variable bias. For example, it is very likely that the Hope and Lifetime Learning tax credits implemented in 1997 have a significant effect on tuition prices. The dollar amount of these credits that are claimed currently exceeds that of the Pell Grant program. The data on which students are claiming these credits and at which universities they are used is not available at a level that would be useful. The IRS reports the number and amount of these tax credits claimed by income level, but there is no university or student level data.

Some previous studies have also included much larger regressions that include many variables the researchers think could be significant. Due to the smaller scope of this paper relative to other research on this topic such as the NCES study, not all of the possible independent variables could be collected.

Dropped Observations in Second Model

Because some percentage changes in the federal loan variables could not be calculated, the sample size is smaller than the sample from Model 1. Additionally, the observations that had to be dropped often represented large changes in the federal loan variables due to the increase from zero loan dollars in the previous year to a greater number the next year. Although it allowed for a useful percentage comparison, it resulted in a loss of information that likely affected the quality of the model.

Limited Sample

Due to the smaller scope of this paper and in order to collect more years of data, the states included were limited to four. This could limit the ability of the results to be applied in other states, depending on a variety of factors that could differ from this sample. For example, political conditions generally differ by state and can affect how public universities set tuition.

Evaluation of Results

This study found that changes in Pell Grant amounts may have a statistically significant and positive effect on the change in both in-state and out-of-state tuition and fees. The change in originated unsubsidized loans may have a negative effect on the change in in-state tuition and fees. The regression results are not necessarily contradictory to the findings of the previous research on this topic. The 2001 NCES study was only able to observe financial aid variables for the 1997-98 and 1998-99 academic years. It is possible that the increase in observed years in this study could account for the significant positive effect of changes in Pell Grants on changes in both in-state and out-of-state tuition from the first model, as well as the second model's positive Pell Grant coefficient. However, contrary to the 2004 Rizzo and Ehrenberg study the Pell Grant coefficient in the first model was significant and was larger for the out-of-state specification than the for in-state specification. Differences in the samples used could potentially explain that difference, as only flagship universities in all states were studied in the 2004 paper and the time periods studied do not overlap. The estimation results from the first model also indicated that the amount of originated unsubsidized federal loans could have a negative effect on in-state tuition rates.

The change in the number of degrees awarded appears to be positively affected by the average change in enrollment and change in the disbursed amount of subsidized loans, and negatively affected by the originated amount of subsidized loans. This shows that increases in the dollar amount of loans that are given out may contribute to more students graduating.

As far as improving the percentage of students who complete their degree in four years, Pell Grants and standardized test scores have significant effects. This result indicates that if encouraging higher rates of college completion is the primary objective of federal aid, Pell Grants may be the most effective option. However, the other models suggested that Pell Grants are the type of federal aid that affect tuition increases the most. A more complete set of data including more states and other federal programs like higher education tax credits could further clarify which types of aid affect tuition costs the most, and which are the most effective at encouraging higher graduation rates and numbers of graduates.

Appendix A: Model 1 and 2 Sample Details

University Name	Model 1 Observation years	Model 2 Observation years
Albany State University	2002-2011	2002-2011
Arizona State University	2002-2011	2002-2011
California State University, Bakersfield	2002-2011	2002-2011
California State University, Channel Islands	2010-2011	2011
California State University, Chico	2002-2011	2002-2011
California State University, Dominguez Hills	2002-2011	2002-2011
California State University, East Bay	2009-2011	2010-2011
California State University, Fresno	2011	2011
California State University, Fullerton	2011	2011
California State University, Long Beach	2009-2011	2010-2011
California State University, Los Angeles	2003-2011	2003-2011
California State University, Monterey Bay	2010-2011	2010-2011
California State University, Northridge	2009-2011	2010-2011
California State University, Sacramento	2002-2005, 2009-2011	2002-2005, 2009-2011
California State University, San Bernardino	2002-2011	2002-2011
California State University, San Marcos	2002-2011	2002-2011
California State University, Stanislaus	2011	2011
Clayton State University	2010-2011	2010-2011
Columbus State University	2002-2011	2002-2011
Florida Agricultural & Mechanical University	2002-2005, 2010-2011	2002-2005, 2010-2011
Florida Atlantic University	2011	2011
Florida Gulf Coast University	2009-2011	2010-2011
Florida International University	2009-2011	2009-2011
Florida State University	2009-2011	2009-2011
Fort Valley State University	2002 2009-2011	2002, 2009-2011
Georgia College & State University	2002-2011	2002-2008, 2010-2011
Georgia Institute Of Technology	2009-2011	2009-2011
Georgia Southern University	2002-2011	2002-2011

Georgia Southwestern State University	2011	2011
Georgia State University	2002-2011	2002-2011
Humboldt State University	2002-2011	2002-2011
Kennesaw State University	2009-2011	2010-2011
New College Of Florida	2011	2011
North Georgia College & State University	2010-2011	2010-2011
Northern Arizona University	2002-2011	2002-2011
San Diego State University	2002-2011	2002-2011
San Francisco State University	2002-2011	2002-2011
San Jose State University	2011	2011
Savannah State University	2002-2008	2002-2008
Sonoma State University	2002-2011	2002-2011
Southern Polytechnic State University	2011	2011
University Of Arizona	2011	2011
University Of California, Berkeley	2002-2011	2002-2011
University Of California, Davis	2002-2011	2002-2011
University Of California, Irvine	2002-2011	2002-2011
University Of California, Los Angeles	2009-2011	2010-2011
University Of California, Merced	2011	2011
University Of California, Riverside	2002-2011	2002-2011
University Of California, San Diego	2010-2011	2010-2011
University Of California, Santa Barbara	2002-2011	2002-2011
University Of California, Santa Cruz	2002-2011	2002-2011
University Of Central Florida	2009-2011	2010-2011
University Of Florida	2002-2011	2002-2011
University Of Georgia	2002-2011	2002-2011
University Of North Florida	2009-2011	2010-2011
University Of South Florida	2009-2011	2010-2011
University Of West Florida	2002-2011	2002-2011
University Of West Georgia	2002-2011	2002-2011
Valdosta State University	2002-2011	2002-2011

Appendix B: Model 3 and 4 Sample Details

University Name	Model 3 and 4 Observation years
Albany State University	2005-2011
Arizona State University	2005-2011
California State University, Bakersfield	2005-2011
California State University, Chico	2005-2011
California State University, Dominguez Hills	2005-2011
California State University, Los Angeles	2006-2011
California State University, Sacramento	2005
California State University, San Bernardino	2005-2011
California State University, San Marcos	2005-2011
Columbus State University	2005-2011
Florida Agricultural & Mechanical University	2005
Fort Valley State University	2011
Georgia College & State University	2005-2011
Georgia Southern University	2005-2011
Georgia State University	2005-2011
Humboldt State University	2005-2011
Northern Arizona University	2005-2011
San Diego State University	2005-2011
San Francisco State University	2005-2011
Savannah State University	2005-2008
Sonoma State University	2005-2011
University Of California, Berkeley	2005-2011
University Of California, Davis	2005-2011
University Of California, Irvine	2005-2011
University Of California, Riverside	2005-2011
University Of California, Santa Barbara	2005-2011
University Of California, Santa Cruz	2005-2011
University Of Florida	2005-2011
University Of Georgia	2005-2011
University Of West Florida	2005-2011

University Of West Georgia
Valdosta State University

2005-2011
2005-2011

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