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EC 499: State Funding and College Graduation Rates

Introduction

Every year students pay thousands of dollars to attend universities across the nation with the goal of graduating with a degree of their choosing to find a job in the market place. Large universities require a great amount of resources to operate, so state governments help fund universities to reduce the cost of tuition for students. The decision to enter the workforce or attend college is a decision everyone makes. A person's finances play a large role in their decision. I will look at how a state's college graduation rates are affected by the amount of money the state provides for these universities. States are making budget cuts to various parts of government. If a state can spend less money on universities, but the universities can continue to produce quality graduates, then states will decrease spending on higher education. The state will then allocate the funds to other areas.

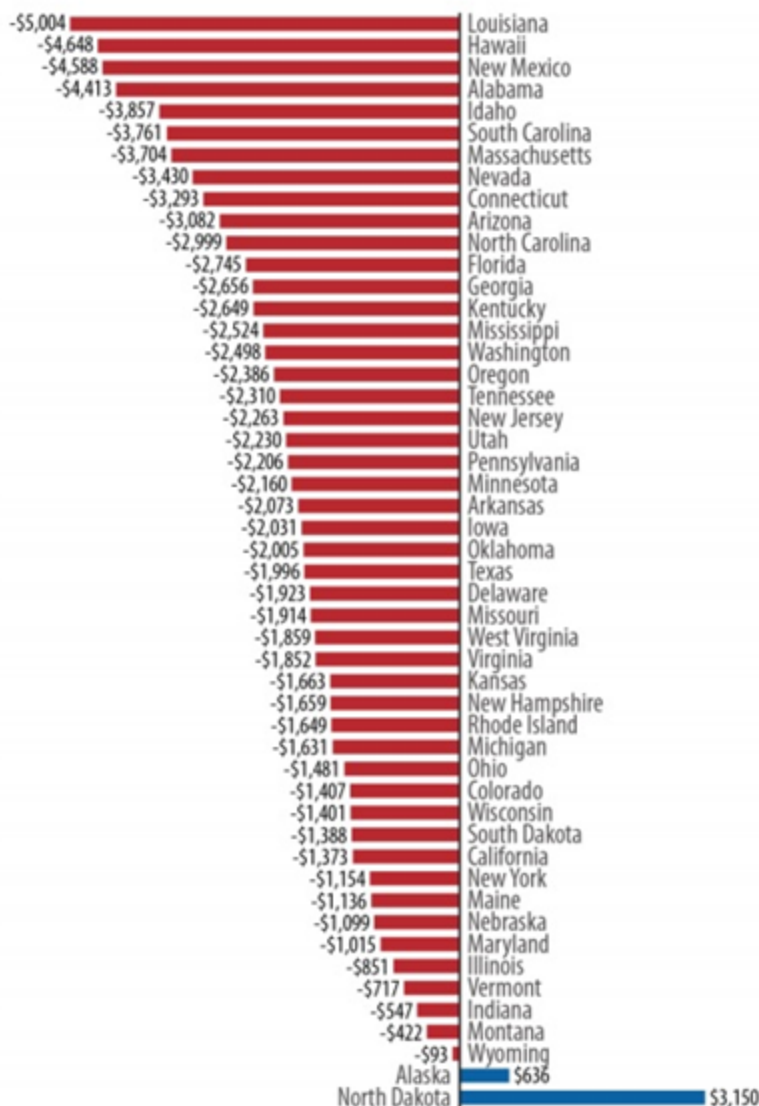
Background

States have long allocated part of their budget to fund higher education. Since 1980, every state has been decreasing the amount, while student demand for higher education has been steadily growing since the mid-1970s, and based on trends since 1980, average state fiscal support for higher education will reach zero by 2059 (Mortenson 2012). States have always justified these cuts based on the fact that universities can raise tuition to offset the decreased funding. This is one of the reasons why states are not as worried about cutting funding. Unlike other government departments, universities can control incoming money.

Figure 2

State Funding for Higher Education Remains Far Below Pre-Recession Levels in Most States

Change in state spending per student, inflation adjusted, FY08 - FY14*



*FY=Fiscal year

Source: CBPP calculations using data from Illinois State University's annual Grapevine Report and the State Higher Education Executive Officers Association. Illinois funding data is provided by the Fiscal Policy Center at Voices for Illinois Children. Because enrollment data is only available through the 2013 school year, enrollment for the 2013-14 school year is estimated using data from past years.

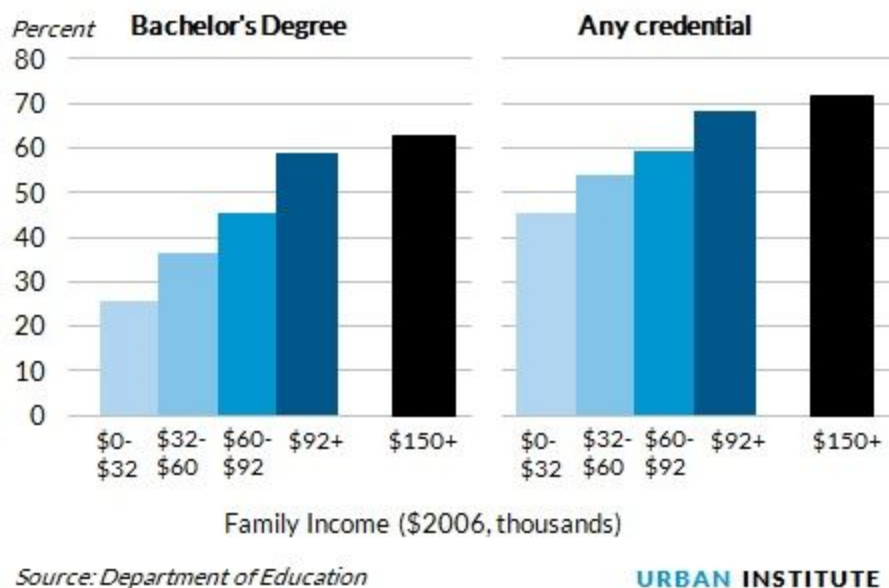
The graph from the Center on Budget and Policy Priorities shows that the majority of states have recently decreased funding. The declining state support for higher education leads directly to increased tuition charges to students (Mortenson 2012).

Nelson (2015) talks about how family income is correlated with graduating college.

As the graph shows, the higher family income is, the more likely they are to graduate college.

This is not surprising considering that higher income families are able to handle rising tuition prices better than low income families.

Higher education graduation rates by income



Literature Review

A lot of literature has been written about college graduation rates. Dwyer, McCloud, and Hodson (2012) looked at graduation and college debt. They find that lower levels of debt support college completion. They also show that debt in excess of \$10,000 affects the graduation rate, and the people in the bottom 75% of income are more influenced by debt than other

demographics. Scott, Bailey, and Kienzl (2006) discussed graduation rates between public and private colleges in the United States. Their results are that even though private colleges have higher graduation rates, public colleges are able to graduate a slightly higher amount than private colleges, given equivalent resources and student populations. Webber and Ehrenberg (2010) looked at if expenditures other than instructional expenditures affected graduation and persistence rates in American higher education. They found that reallocating funding from instruction to student services may enhance both rates at institutions whose rates are currently below the medians in the sample. There is little research on college graduation and state funding. Most of the research focuses on graduation rates and other factors.

Economic Theory

The main economic theory that relates to the changing amount of funds' effect on graduation rates are marginal cost and marginal benefit. People decide if the benefit of going to college will outweigh the costs. Tuition is a large part of the cost of attending college. It has been argued that less state funding may lead to higher tuition. The higher tuition affects the cost/benefit calculation of potential students, and also affects the college dropout decision. If someone drops out of college, they accrue all of the costs, but do not gain the benefit of a college degree. If the cost was lowered, dropping out wouldn't be as risky financially. With lowered costs, more people who would not have went to college originally, may start attending, and dropping out may be more common because it is less severe, thus lowering the graduation rate. If tuition is higher, then that increases the severity of dropping out. Higher costs may lead to less

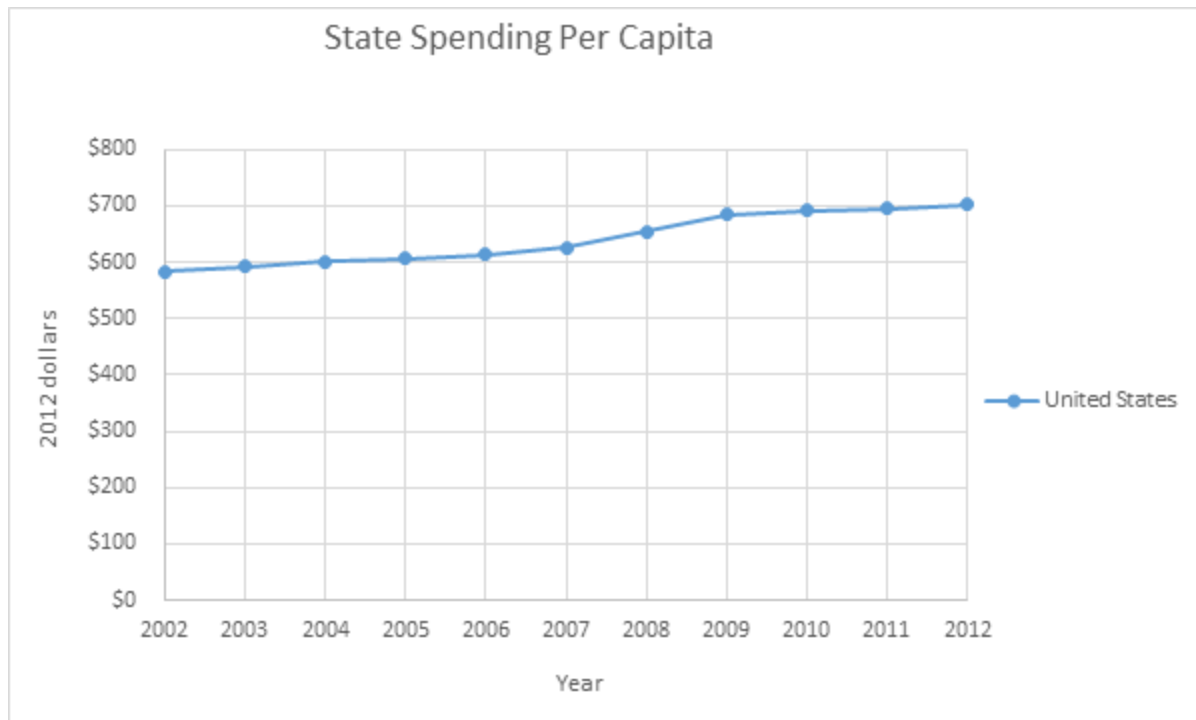
people attending college, and thus making it so the people who do attend are less likely to drop out, thus increasing college graduation rates.

Empirical Strategy/Data

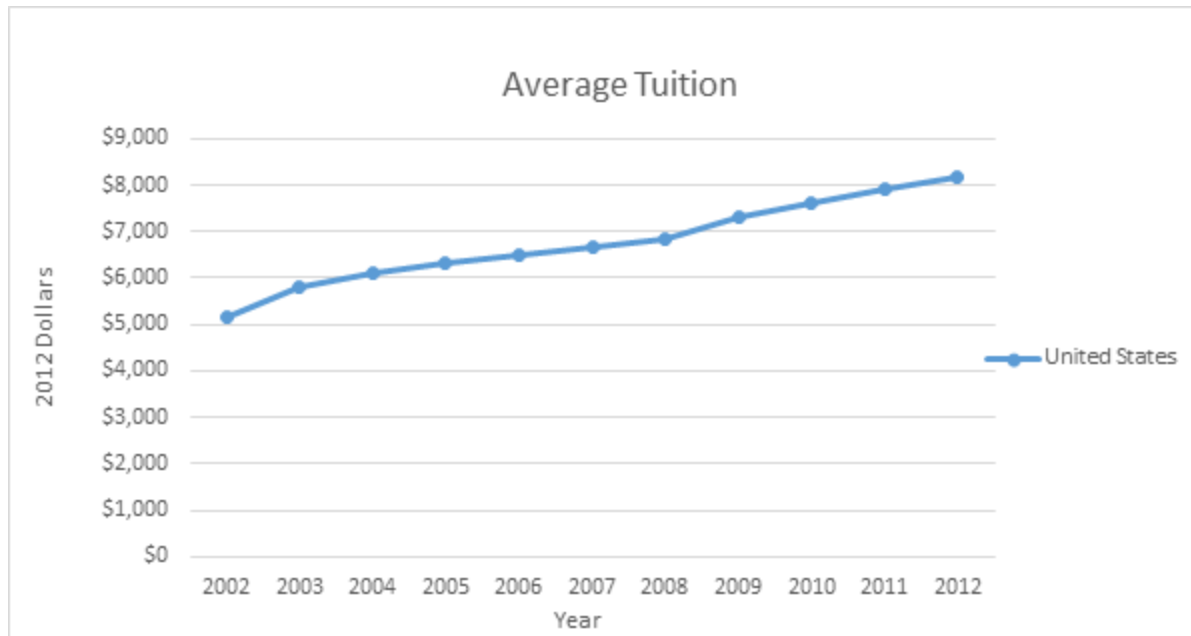
Variable	Obs	Mean	Std. Dev.	Min	Max
stateid	750	25.5	14.4405	1	50
state	0				
state_abbrev	0				
year	750	2005	4.323377	1998	2012
grad_100_rate	550	27.50945	10.0215	6.3	56.5
grad_150_rate	550	52.55636	9.064343	21.3	71.5
unemployment_rate	750	5.606533	2.085111	2.3	13.8
grossstate_t	750	252456.8	309858.3	14939	2125717
personal_income	750	2.12e+08	2.54e+08	1.25e+07	1.77e+09
statespend_g	550	732.68	197.4284	284	1354
tuition	550	6110.471	2253.055	2511	14435
population	750	5937427	6530395	500017	3.80e+07
cpi	750	195.8886	21.08331	163	229.594
pcincome	750	40.19011	6.209645	27.5682	61.67164
rltuition	550	6763.321	2238.178	3052.015	14435.38

The above is a table of summary statistics of the data used in the regressions. The data that will be used is state-level panel data. Two types of graduation rates are used in the data. The first graduation rate, grad_100_rate is the percentage of students who graduated in 4 years to complete a 4-year degree, and grad_150_rate is the percentage of students who graduated in 6 years to complete a 4-year degree. The rates are from the Chronicle of Higher Education. State spending is measured in real 2012 dollars, and based on state support for higher education spending per capita. The data comes from National Center for Education Statistics. The graph below shows the average state spending per capita for the United States in 2012 dollars from

2002-2012. Although the graph shows state spending has increased in that time span, state spending has been decreasing in general.



Unemployment rate, gross state product, and average income per household for each state are included as well. I included these economic factors because they play a key role in the amount the state spends for higher education. The CPI and state population are included for calculations to be used later. These statistics are from the Bureau of Labor Statistics.



Tuition is included as well. It is the average cost of attaining a 4-year degree from a public university by each state. It is from the Digest of Education Statistics. The graph above shows the national average tuition for a 4-year degree in the United States in 2012 dollars. As mentioned earlier, tuition has been steadily rising. There will also be two types of dummy variables as part of the regression. One for each state and one for each time period. The time frame is from 1998-2012. The time frame with complete data is from 2002-2012. The earlier periods before 2002 are used for lagged variables on economic factors. The regression will be a level-level regression.

The first regression I will be looking at is to see if the decline in state funding lead to colleges and universities to raise tuition. The regression being used is: `reg rltuition L.statespending L2.statespending L3.statespending L4.statespending L.pcincome stdum* yrdum*, robust`. The variable “rltuition” is tuition converted into 2012 dollars. The variable pcincome is average

personal income per capita by state in real 2012 dollars in per capita terms. The state spending variables are lagged to see if previous spending had an effect on tuition.

The second regression I will be looking at is for the 4-year graduation rate. The regression being used is: `reg grad_100_rate rltuition L.rltuition L2.rltuition L3.rltuition L4.rltuition L.statespending L2.statespending L3.statespending L4.statespending L.unemploymentrate L2.unemploymentrate L3.unemploymentrate L4.unemploymentrate stdum* yrdum*, robust`. This regression regresses 4-year graduation rates on tuition, unemployment, and state spending. Lagged variables of tuition, state spending, and unemployment rate are included to see if the previous variables had an effect on the 4-year graduation rate. State and year dummies are used to control for factors other than the independent variables.

The third regression I will be looking at is for the 6-year graduation rate. The regression being used is: `reg grad_150_rate rltuition L.rltuition L2.rltuition L3.rltuition L4.rltuition L.statespending L2.statespending L3.statespending L4.statespending L.unemploymentrate L2.unemploymentrate L3.unemploymentrate L4.unemploymentrate stdum* yrdum*, robust`. This regression regresses 6-year graduation rates on tuition, unemployment, and state spending. Again, lagged variables and state dummies are included.

Results

Linear regression

Number of obs = 350
 F(60, 289) = 686.33
 Prob > F = 0.0000
 R-squared = 0.9721
 Root MSE = 415.33

rltuition	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
statespending						
L1.	-.0392671	.7089312	-0.06	0.956	-1.43459	1.356056
L2.	-.6039417	.6866311	-0.88	0.380	-1.955374	.7474901
L3.	.0302667	.7059486	0.04	0.966	-1.359186	1.419719
L4.	.3617136	.6458343	0.56	0.576	-.9094216	1.632849
pcincome						
L1.	-90.78658	22.3494	-4.06	0.000	-134.7748	-46.79834

The results from the first regression show that state spending is not statistically significant at the 5% level because the p-values are greater than 0.05. However, average per capita income is statistically significant because the p-value is zero, and it has a negative effect. A one dollar increase in a state's average per capita income causes average tuition to decrease by about 90 dollars. The results suggest that a richer states have lower average tuition. Next I checked if the sum of the state spending variables is significant using the regression: lincom

L.statespending+L2.statespending + L3.statespending + L4.statespending.

rltuition	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
(1)	-.2512285	1.090368	-0.23	0.818	-2.397297	1.89484

The coefficient is not statistically significant at the 5% level because the p-value is greater than 0.05. The results show that decreasing state funding does not have a discernible effect on tuition, and that the increase in tuition is caused by other factors.

Linear regression

Number of obs = 350
 F(68, 281) = 502.52
 Prob > F = 0.0000
 R-squared = 0.9787
 Root MSE = 1.6626

grad_100_rate	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
rltuition						
--.	.0006472	.0004636	1.40	0.164	-.0002652	.0015597
L1.	.0004989	.0005895	0.85	0.398	-.0006615	.0016592
L2.	-.0005918	.0005779	-1.02	0.307	-.0017294	.0005457
L3.	.0003242	.0004618	0.70	0.483	-.0005849	.0012333
L4.	.0005519	.0002416	2.28	0.023	.0000764	.0010275
statespending						
L1.	-.0020731	.0026392	-0.79	0.433	-.0072682	.003122
L2.	-.0017739	.0034631	-0.51	0.609	-.0085908	.0050431
L3.	.0004583	.0030632	0.15	0.881	-.0055714	.0064881
L4.	-.0019687	.0027214	-0.72	0.470	-.0073256	.0033882
unemploymentrate						
L1.	-.4223645	.1927302	-2.19	0.029	-.8017427	-.0429863
L2.	-.062638	.2047467	-0.31	0.760	-.4656701	.340394
L3.	-.0173739	.192951	-0.09	0.928	-.3971869	.362439
L4.	.0094011	.2294145	0.04	0.967	-.442188	.4609902

From the table above, the last lag of rltuition and the first lag variable of the unemployment rate are statistically significant. For the 4-year graduation rate, all data is inconclusive, except for the those two variables. The last lag of rltuition has a very small positive effect on 4-year graduation rates. The first lag of unemployment has a negative impact on the 4-year graduation rate. A 1% increase in the unemployment rate caused a -0.42 percentage point decrease in the 4-year graduation rate. Next I tested if the lagged variables rltuition, state spending, and unemployment rate had a significant effect on 4-year graduation rates.

```

. test L.rltuition L2.rltuition L3.rltuition L4.rltuition

( 1)  L.rltuition = 0
( 2)  L2.rltuition = 0
( 3)  L3.rltuition = 0
( 4)  L4.rltuition = 0

      F( 4, 281) =    2.87
      Prob > F =    0.0233

. test L.statespending L2.statespending L3.statespending L4.statespending

( 1)  L.statespending = 0
( 2)  L2.statespending = 0
( 3)  L3.statespending = 0
( 4)  L4.statespending = 0

      F( 4, 281) =    0.47
      Prob > F =    0.7553

. test L.unemploymentrate L2.unemploymentrate L3.unemploymentrate L4.unemploymentrate

( 1)  L.unemploymentrate = 0
( 2)  L2.unemploymentrate = 0
( 3)  L3.unemploymentrate = 0
( 4)  L4.unemploymentrate = 0

      F( 4, 281) =    2.72
      Prob > F =    0.0301

```

As seen above, rltuition and unemployment rate are jointly significant. I used the lincom command for both rltuition and unemployment rate to see if the sum of the variables are significant. I used: lincom rltuition+L.rltuition+L2.rltuition+L3.rltuition+L4.rltuition

grad_100_r~e	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
(1)	.0014304	.0002894	4.94	0.000	.0008608	.002

The sum of rltuition is significant and has a small positive effect on the 4-year graduation rate.

The higher the tuition, the higher the 4-year graduation rate. I would explain this by the fact that

people who are willing to pay higher costs for college are less inclined to drop out because they want to obtain the benefits of a college degree.

I used: `lincom L.unemploymentrate + L2.unemploymentrate + L3.unemploymentrate + L4.unemploymentrate`

<code>grad_100_r~e</code>	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
(1)	-.4929754	.2646881	-1.86	0.064	-1.013999	.0280478

The unemployment rate is not statistically significant at the 5% level, but it is significant at the 10% level. It states a 1% increase in the unemployment rate leads to about a -0.49 percentage point decrease in the 4-year graduation rate. This makes sense given that people tend to have more money when the economy is doing better, and can afford the increasing costs every year.

Linear regression

Number of obs = 350
 F(68, 281) = 417.08
 Prob > F = 0.0000
 R-squared = 0.9625
 Root MSE = 1.9643

grad_150_rate	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
rltuition						
--.	.0009453	.0004329	2.18	0.030	.000093	.0017975
L1.	-.0002782	.0005039	-0.55	0.581	-.0012701	.0007137
L2.	-.0006697	.0005611	-1.19	0.234	-.0017743	.0004349
L3.	.0007803	.0004535	1.72	0.086	-.0001124	.001673
L4.	-.0000812	.0002148	-0.38	0.706	-.000504	.0003416
statespending						
L1.	-.0005356	.0029296	-0.18	0.855	-.0063024	.0052311
L2.	-.0067308	.0043074	-1.56	0.119	-.0152097	.001748
L3.	.0047104	.0032524	1.45	0.149	-.0016918	.0111125
L4.	-.0024221	.0026587	-0.91	0.363	-.0076557	.0028114
unemploymentrate						
L1.	-.384513	.2513677	-1.53	0.127	-.8793159	.1102898
L2.	.1708136	.1999812	0.85	0.394	-.2228379	.5644651
L3.	-.0328194	.1832736	-0.18	0.858	-.3935828	.327944
L4.	.0164185	.2593041	0.06	0.950	-.4940067	.5268436

The data for the 6-year graduation rate is similar to the 4-year rate. The only statistically significant variable is the initial rltuition variable. It has a small positive effect on the 6-year graduation rate. Again, almost all of the data ended up being inconclusive. I tested all of the variables that have lagged variables.

```
. test L.rltuition L2.rltuition L3.rltuition L4.rltuition
```

```
( 1) L.rltuition = 0
( 2) L2.rltuition = 0
( 3) L3.rltuition = 0
( 4) L4.rltuition = 0
```

```
F( 4, 281) = 0.89
Prob > F = 0.4686
```

```

. test L.statespending L2.statespending L3.statespending L4.statespending

( 1)  L.statespending = 0
( 2)  L2.statespending = 0
( 3)  L3.statespending = 0
( 4)  L4.statespending = 0

      F( 4, 281) =    1.12
      Prob > F =    0.3491


. test L.unemploymentrate L2.unemploymentrate L3.unemploymentrate L4.unemploymentrate

( 1)  L.unemploymentrate = 0
( 2)  L2.unemploymentrate = 0
( 3)  L3.unemploymentrate = 0
( 4)  L4.unemploymentrate = 0

      F( 4, 281) =    0.95
      Prob > F =    0.4340

```

The lagged variables are not jointly significant. The p-values are all very high. There isn't enough evidence to conclude that the lagged variables had an effect. However, I still used the lincom command for tuition to see if the sum had any effect. I used: lincom rltuition+L.rltuition+L2.rltuition+L3.rltuition+L4.rltuition

grad_150_r~e	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
(1)	.0006965	.0002576	2.70	0.007	.0001894	.0012036

The result is statistically significant. It states that higher tuition has a positive effect on the 6-year graduation rate, similar to the 4-year rate.

Conclusion

The research question I asked was if state funding had an effect on college graduation rates.

More specifically, if decreasing state funding had an effect on the 4-year and 6-year graduation rates. I used 4-year and 6-year graduation rates for public universities by state. I compiled data on average tuition for a 4-year degree by state, unemployment rates, state population, gross state product per capita, state spending per capita, average personal income, and the CPI for each year.

First I regressed tuition on state spending and average income. The results showed state funding had no discernible effect on tuition, but that richer states had lower tuition. Next, I tested 4-year and 6-year graduation rates with tuition, unemployment, state spending with lags for each of those variables, and dummy variables for each state and year. After the statistical analysis, the data ended up inconclusive. State spending had no discernible effect on college graduation rates.

The interesting outcome in the first regression is that state funding had little to no effect on tuition. Many experts have stated that the decrease in funding is the direct cause for increasing tuition. The data states that this is not the case, and other factors are contributing to rising tuition.

For future research, I would recommend increasing the time period to include more instances.

The 10 year period is sufficient, but decreasing state funding has been occurring for a longer period. I would also use more economic variables in the regression of the graduation rates. One variable I recommend would be the average household income with 14-17 year olds instead of average income. This demographic is more closely related to the people who would be entering college.

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