Impacts of Public 2-year College Spending and Tuition on For-Profit 2-year Colleges

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1 Introduction

Two-year college students made up nearly 30 percent of students attending college in 2018 (Snyder et al., 2019). Those wanting to attend a 2-year college have to make a choice of what type of institution to attend: public, private nonprofit, or private for-profit. Although there is a wealth of economic studies on higher education, only a small portion of the literature focuses on for-profit colleges. The purpose of this paper twofold. First, I will examine the question of whether 2-year for-profit and public institutions compete in the same market; then, I will estimate the effect public college spending has on nearby for-profit colleges. This is important as for-profit colleges have been seen as providing lower quality outcomes, but costing significantly more when compared to their public counterparts (Deming et al., 2012). Cellini (2009) used a regression discontinuity design on data of schools in California to explore this topic. The author focused on counties that had a bill for increased higher education spending. There were 101 community college bond measures voted on from 1995-2002 that ranged from $8 to $658 million in value. She then compared counties where a bill barely passed with counties where a bill was barely rejected. She found that, in California, increasing public funding resulted in an increase in public 2-year enrollment, and a decrease in the number of for-profit schools per capita. Specifically, she found that the passage of a $100 million bond results in a net loss of two for-profit schools. Since the average size of 1 for-profit in California is about 350 students (Cellini, 2005), her findings suggest that in California, about 700 students (about the size of two for-profits) shift away from for-profits and into community colleges with the passage of a $100 million bond. Cellini et al. (2016) found that when the Obama administration passed the Gainful Employment regulations, which restricted access to federal student aid at sanctioned for-profit colleges, enrollment at 2-year publics increased. These two papers show how increased funding and restrictions set on for-profits affect for-profit and public enrollment. However, there has not been a study that has looked at how spending at 2-year public affect enrollment at nearby 2-year for-profits. This paper extends the literature by filling this gap.

I will use a similar approach to that used by Deming and Walters (2017), who estimate the effect of spending and tuition at public colleges on public enrollment. As reverse causaulity is of major concern when estimating the impact of spending and tuition changes on enrollment, (Deming and Walters, 2017) addressed this issue by using budget shocks and tuition caps as joint instruments for spending and tuition. They found a positive, statistically significant impact of spending on enrollment. They went further to estimate the the spillover effects of their instruments on private colleges that are in the same county as public colleges. They found limited evidence of spillovers within the county. My analysis will not only focus on the effects of these instruments on private colleges, but will also look at the impact of spending at 2-year public colleges on nearby for-profits. I exploit variation in public college spending and tuition induced by state budget cuts and tuition caps imposed by state legislatures. Also, this analysis will not use county to define which colleges are nearby colleges, but will use each institution's latitude and longitude coordinates to evaluate which colleges are truly nearby.

I find that decreased spending at public colleges not only decreases enrollment at these colleges, but also leads to increases in enrollment in nearby for-profit colleges. Specifically, I find that a 10% decrease in spending at a public 2-year in a certain year results in about a 20% increase in 2-year for-profit enrollment in the subsequent year. These results suggest that as the quality of public colleges decreases due to a decrease in spending, students turn to for-profits for education and career advancement. Although there could be benefits to choosing a for-profit over a public college, there may be students that leave with undesirable consequences, such as high debt or dropping out due to lack of options at a specific for-profit college (Iloh and Tierney, 2014).

2 Background

2.1 For-Profit and Public Two-Year Colleges

From fall 1990 to fall 2013, the number of 2-year publics grew less than 2%, whereas Title IV[1] 2-year for-profits saw a growth of about 74%[2]. During that same time period, enrollment at public 2-years grew about 33%, whereas enrollment at for-profits grew by about 102%. Deming et al. (2012) found when compared with 2-year and 4-year public colleges, students that attend 2-year or 4-year for-profits are typically older, come from less wealthy families, and are less likely to be employed after finishing school. In addition, for-profits are typically more expensive and students tend to leave with more debt. According to Deming et al.

[1]Title IV schools are institutions where students are eligible for federal student aid. There are certain regulations an institution must follow in order to be eligible for this accreditation.

[2]This study focuses on for-profit colleges that are Title IV eligible. Cellini and Goldin (2014) estimates that there are about 670,000 Non-Title IV for-profit college students out of 2.47 million for-profit college students each year.

(2012), as of 2009, students at for-profits left with more than twice as much debt than those from community colleges. Likewise, for-profit college students were about three times as more likely to default on their loans than community college students.

Cellini (2009) showed that the two institution types overlapped considerably in what programs they offer. Given this information, the natural question is why do students enroll in for-profit institutions? Iloh and Tierney (2014) surveyed and interviewed 75 students at a for-profit and 62 students at a community college enrolled in nursing or surgical technician associate degree programs. One of the main questions the researchers focused on was why and how do students choose to attend for-profit colleges and community colleges. The main objectives of the public 2-year system is to move students to a 4-year college, and to offer vocational training (Brint et al., 1989). The cost of attendance is usually a lot less when compared with for-profits as community colleges rely on state and local appropriations. One of the primary reasons community college respondents chose community college was because of cost. Many students took comfort in the fact that there were many offerings and majors available at a community college (as compared with a smaller vocational school) as their interests or desires might change throughout their experience. Other factors included in their decision were the ability to transfer to a four-year college, the social life on campus, and the peer-to-peer interaction (Iloh and Tierney, 2014).

For-profits tend to be smaller, more expensive, and have the primary objective of providing vocational training (Cellini, 2009). Although they offer many of the same programs, for-profits often act quickly to rising demand and offer certain programs quicker then their public counterparts. The main source of revenue for Title IV for-profits is tuition (usually financed through federal grants and loans) (Deming et al., 2013). Many students that enrolled in a for-profit college considered enrolling in a community college, but found it too difficult due to institutional constraints. These institutional constraints include ambiguous admissions information, waitlists, and limited space for new students. Many of the for-profit respondents were older and had a family. They found for-profit college appealing as school fit their schedule. In addition, many respondents stated that it was important to be in a shorter term program, as they did not have to take as many remedial and general courses. Although the cost of attendance at the for-profit was significantly higher, many students believed that this their debt burden was justified as they felt they had stronger opportunities in the labor market[3] (Iloh and Tierney, 2014). In addition to results found by Cellini (2009) and Cellini et al. (2016), Goodman and Henriques (2015) added to the literature by showing how state appropriations affect total for-profit enrollment in that state. The authors found that a 10% cut in appropriations is related to a 2% rise in for-profit enrollment. However, as evidenced in figure 3, we cannot attribute this as being causal,

[3]This may have resulted from a number of reasons. Some reported that they associated higher costs with better quality. Others stated that they felt the for-profit had more local connections.

as there is significant pre-trends of appropriations on enrollment. I will however look at how aggregate spending at public 2-years at the state level affects aggregate for-profit enrollment in that state.

2.2 The Rise and Fall of For-Profits

As seen in figure 1, the number of students enrolling in for-profits has risen steadily and quickly until 2010, but has fallen at about the same rate since then. Most of this fall in the number of for-profit colleges, and thus for-profit students, can be attributed to the Department of Education's "Gainful Employment" regulations. Under the Obama administration, the Department of Education put forth regulations to restrict access to federal student aid to for-profit schools where the average debt to earnings ratio of graduating students was high (of Education, 2010). Since 2010, more than 2,000 for-profits and career colleges have closed (Green, 2019).

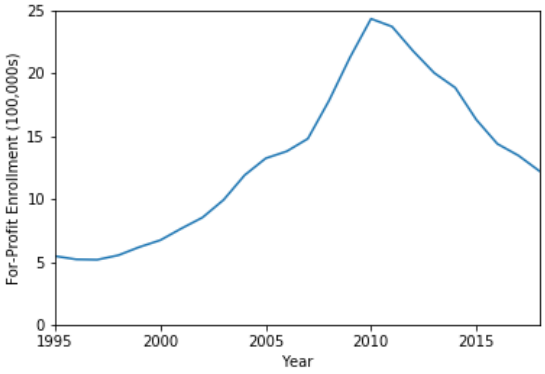

Figure 1: The number of students enrolled in private for-profit colleges increased greatly from 1995 to 2010. Since 2010, for-profit enrollment has declined, probably due to stricter regulations imposed by the Obama administration (Snyder et al., 2019).

Recently, discussions about for-profit colleges has reemerged as the Department of Education under the Trump administration has been rolling back some these regulations (Green, 2019). In her first two years of office, DeVos delayed critical parts of the rule arguing that transparency is better than regulation. Instead of having colleges meet specific criteria, the Department pushed for expanding an existing database, the College Scoreboard, to provide information such as tuition and fees, student debt, and earnings prospects. These changes were set to be in effect July 2020.

2.3 Impact of Spending for Public Colleges

Table 1 shows that state appropriations have dropped from $4,830 per student in 2000, to $2,929 per student in 2013 [4]. These drops have been associated with drops in spending at 2-year publics. Spending cuts may decrease enrollment and degree completion at colleges as it could decrease the quality of instruction, increase class sizes, and decrease the number of course offerings (Bettinger and Long, 2009; Bahr, 2014). Deming and Walters (2017) studied how changes spending and tuition affected enrollment and completion rates at public colleges. Reverse causality is of major concern when estimating the impact of spending and tuition changes on enrollment. In anticipation to rising demand for public education, colleges might increase their spending. Similarly, colleges might also change prices in response to changes in demand (Deming and Walters, 2017). Deming and Walters (2017) addressed this issue by using budget shocks and tuition caps as joint instruments for spending and tuition. When a state is on a constrained budget, they might not be able to award the amount requested by public colleges. This budget shock affects colleges in different degrees. A college that is heavily reliant on state appropriations for their revenue would be more affected by a budget shock than a college that is relatively less reliant on state appropriations. The authors argued that when a college is faced with a budget shock, the college can choose to either cut spending, increase tuition, or both in order to decrease revenue loss. In addition to budget shocks, state legislatures can impose tuition caps. Since a tuition cap would disallow tuition to be set above a certain level, a college may be forced to cut spending in order to offset the loss in revenue from a low tuition. Using these instruments (budget shock and tuition cap) in a two-stage least squares squares approach, the authors show that for public colleges, a 10% increase in spending increased current enrollment by about 3%. The increased spending not only had an impact on the current year, but also subsequent years. Increased spending in one year was also found to increase enrollment by 3% in the current year, 8% in the next year, 8.4% two years after, and 8.3% three years after[5]. This gives credence to the idea that spending at public colleges creates a crowd-out effect such that increasing spending would allow more individuals to attend public colleges instead of for-profits. Snyder et al. (2019) found that in 2019, nearly 99 percent of 2-year publics had open admissions, meaning that if a student met certain criteria, usually if they had obtained a GED or graduated from high school, they were allowed to enroll. Spending could make attending a public college more attractive as waitlists could be shorter, more courses could be offered, and more services could be available to the students.

[4] Financial data is in terms of 2015 dollars using the Higher Education Cost Adjustment (HECA)

[5] These increases are non-additive

3 Data

Higher education data is taken from the Delta Cost Project (DCP) at American Institutes for Research. The DCP has compiled data from the Integrated Postsecondary Education Data System (IPEDS). IPEDS conducts annual surveys of higher education institutions (such as colleges, universities, and technical and vocational institutions). Institutions that administer federal student financial aid are required to participate in IPEDS. IPEDS collects institution-level data that include: student enrollment, degree completion, revenue, expenditures, state appropriations, and institutional characteristics. All financial variables are in 2015 dollars (using the HECA index). Table 1 shows a summary of the IPEDS data for 2000 and 2013. State unemployment rates from the Bureau of Labor Statistics as well as state-level data from the Census and the American Community Survey were matched to the DCP data. Tuition cap and freeze data for 2-year public colleges were taken from Deming and Walters (2017).

	2-year public		2-year private for-profit	
	2000	2013	2000	2013
Institution count	933	909	538	726
Tuition and fees	2627	3704	11426	14825
Enrollment	5426	7254	295	537
Spending	12411	8990	10678	13511
State appropriations	4830	2929	-	-

Table 1: Summary statistics for 2-year public and for-profit colleges in 2000 and 2013. Spending and state appropriations are in per student terms. Financial data is in terms of 2015 dollars using the Higher Education Cost Adjustment (HECA)

Students attending public two year institutions tend to attend school 8 miles (at the median) from their home, whereas students attending private for-profit two year institutions tend to attend school 11 miles (at the median) from their home (The National Center for Education Statistics 2011). Thus, if these two institution-types were to compete for students, they would be within the same geographic location

And how do you handle entirely online schools?. In this study, I will evaluate the effect each public 2-year institution has on the for-profit institutions that it is close to. Specifically, I will look at the enrollment at the for-profits that are within 25 of public 2-years[6].

[6]According to the CIRP Freshman Survey, the median distance for a community college enrollee from their home to college was 8 miles (Hillman and Weichman, 2016). Appendix also contains analysis using for-profits within 20, 30, and 50 miles of public 2-years.

4 Methods and Results

4.1 Instruments

As previously discussed, when faced with a budget cut a public institution can choose to either reduce spending or increase tuition. This budget shock should have a greater impact on public institutions that rely more heavily on state appropriations as a source of revenue. State legislative budget decisions are usually made across the board, thus when one institution experiences a budget cut, most institutions in that state also experience a budget cut (Parmley et al., 2009). An ideal instrument would take into account both an institution's reliance on state appropriations, as well as the magnitude of state appropriations an institution received in a given year. $Z_{i,t}$, or budget shock, addresses these two points:

$$Z_{i,t} = \frac{Approps_{i,90}}{Rev_{i,90}} \times \frac{Approps_{s(i),t}}{Pop_{s(i),t}}$$

where $Approps_{i,90}$ is the revenue from state appropriations for institution i in 1990, $Approps_{s(i),t}$ is the revenue from state appropriations of state $s(i)$ where institution i resides in time t, $Rev_{i,90}$ is institution i's total revenue in 1990, and $Pop_{s(i),t}$ is the college aged population (aged 18 to 24) in state $s(i)$. That first term in $Z_{i,t}$ gives institution i's reliance on state appropriations (as a source of revenue) in 1990[7]. The second term is state appropriations per college-age student in the state $s(i)$ where institution i is located, which gives a magnitude of state appropriations. One would expect that an increase in budget shock Z would lead to an increase in spending if tuition is kept constant. Likewise, an increase in budget shock Z should lead to a decrease in tuition if spending is kept constant.

The state legislature can also impose tuition caps. Tuition cap can be broken down further into two variables: $TuitCap_{i,t}$ and $TuitMax_{i,t}$. $TuitCap_{i,t}$ is binary variable measuring if a state legislature has put a cap or freeze on tuition prices. $TuitMax_{i,t}$ is the maximum percentage a college can raise their tuition in year t. If there is a freeze, then this value is equal to 0 and $TuitCap_{i,t}$ is equal to 1. If there is no freeze or cap, $TuitCap_{i,t}$ and $TuitMax_{i,t}$ are both equal to 0. Thus, $TuitCap_{i,t}$ will measure the impact of having any type of tuition cap, whether it be a tuition freeze or cap. The combination of these two variables will show us the impact of the existence and intensity of tuition caps on our variable of choice. One would expect $TuitCap$ would have a negative effect on tuition at public institutions, and a negative effect on spending; whereas an increase in $TuitMax$ would have a positive effect on tuition at public institutions, and a positive effect on spending.

Deming and Walters (2017) used these three instruments, $TuitCap$, $TuitMax$, and Z, to evaluate the

[7] 1990 is a natural choice for baseline year as it is the first year that data on our instruments is available. As shown in Deming and Walters (2017), any year can be used as a baseline without changing the results very much.

(causal) impact of changes in tuition and spending on enrollment and degree completion for public institutions. I will use these three instruments to evaluate the effect of changes in tuition and spending at public institutions on enrollment at for-profit institutions. We first need to evaluate the validity of our instruments. We can test the pre-trends using the following reduced form equation:

$$Y_{i,t} = \alpha_i + \mu_t + W'_{i,t}\theta + \sum_{l=-L}^{L} [\rho_l^Z Z_{i,t-l} + \rho_l^C TuitCap_{i,t-l} + \rho_l^M TuitMax_{i,t-l}] + \nu_{i,t} \quad (1)$$

Figure 4 in the appendix shows the results of this regression. For the budget shock instrument, we find no evidence of any pre-trend relationship with log enrollment. Specifically, we fail to reject the null hypothesis that the four pre-trend coefficients are jointly equal to zero ($p = 0.70$). We likewise find no evidence of pre-trend relationship between TuitCap and log enrollment ($p = 0.89$), as well as between TuitMax and log enrollment ($p = 0.61$). Thus, figure 4 shows that our instruments are not related to pre-trends in log enrollment.

4.2 Two-Stage Least Squares Model

Two-stage least squares will be used. In each stage, I will employ a first difference[8] approach. Thus, the first stage is:

$$\Delta X_{i,t} = \phi_{s(i)} + \omega_t + \Delta W'_{s(i),t}\lambda + \pi_1 \Delta Z_{i,t} + \pi_2 \Delta TuitCap_{i,t} + \pi_3 \Delta TuitMax_{i,t} + u_{i,t}$$

where $\Delta F_{i,t} = F_{i,t} - F_{i,t-1}$ for $F \in \{X, Z, W', TuitCap, TuitMax\}$, $X_{i,t}$ is log spending or log tuition, $W_{s(i),t}$ is a control matrix that contains time variant covariates of state s where i resides, including unemployment, share of male individuals, share of black individuals, average log income, state population, percent of individuals in state $s(i)$ with some college, and percent of individuals in state $s(i)$ with a bachelor's degree or above. ω_t and $\phi_{s(i)}$ are year and institution fixed effects.

I will initially evaluate how tuition and spending changes affect public 2-year institution enrollment. Using a first difference approach for the second stage yields:

$$\Delta Y_{i,t} = \Phi_{s(i)} + \Omega_t + \Delta W'_{s(i),t}\Lambda + \beta_1 \Delta \log \widehat{spending}_{i,t} + \beta_2 \Delta \log \widehat{tuition}_{i,t} + \varepsilon_{i,t} \quad (2)$$

where $\Delta F_{i,t} = F_{i,t} - F_{i,t-1}$ for $F \in \{Y, W', \log \widehat{spending}, \log \widehat{tuition}\}$, $Y_{i,t}$ is log enrollment for public

[8] Recall that using a first difference (changes) approach will yield the same results as using a fixed effects (levels) approach when there are two time periods. However, the two approaches are different when there are more than two time periods. First difference will be used in this analysis as it requires less restrictive assumptions for causal estimation. I have also used a fixed effects model. Results are in the appendix.

institution i in state $s(i)$, and Ω_t and $\Phi_{s(i)}$ are year and state fixed effects. This is the same model used by Deming and Walters (2017).

Table 2 shows the effect of our instruments, budget shock, TuitCap, and TuitMax, on Log Spending and Log Tuition. The results imply that a $1,000 increase in the budget shock variable increases spending by about 5.8%. A tuition cap increases spending about 0.9%[9]. Additionally, a $1,000 increase in the budget shock variable decreases tuition by about 9.8%. A tuition cap decreases tuition about 4.5%. A 10 percentage point increase in max tuition increases tuition by about 4.6%. Deming and Walters (2017) found similar results when including all public institutions.

	First stage		Second stage
	Log Spending	Log Tuition	Log Enrollment
	(1)	(2)	(3)
Z	0.058***	-0.098***	
	(0.01)	(0.01)	
TuitCap	0.009**	-0.045***	
	(0.00)	(0.01)	
TuitMax	-0.058	0.457***	
	(0.04)	(0.10)	
Log Spending			0.404
			(0.33)
Log Tuition			-0.063
			(0.13)

Table 2: 2SLS - Evaluating the impact of lagged log spending and log tuition on log public enrollment. Standard errors are clustered by institution. $^{*}p < 0.10;^{**}p < 0.05;^{***}p < 0.01$

Table 17 shows the results when using a "levels" models as opposed to a changes model. Table 3 shows how log enrollment changes for up to three years after changes in tuition and spending. We see that a 10 percent increase in spending in year t increases enrollment by about 8.9% in year $T+1$, and 11.3% in year $T+2$. Deming and Walters (2017) find similar results when looking at public 2-years, namely that a 10 percent increase in spending in year t increases enrollment by about 10% in years $T+1$, $T+2$, and $T+3$. The differences seen could be a result of using slightly different datasets. Deming and Walters (2017) use the IPEDS data while I am using the Delta Cost Project data, which aggregates some institutions that have multiple campuses into one single unit in the IPEDS data. Thus, one would expect there to be slight differences in results. The advantage of using data from Delta Cost Project is that it makes IPEDS data longitudinally consistent. However, as shown by Jaquette and Parra (2016), this database collapses multiple institutions within some public university system into a single unit, which would probably slightly bias our results. In future versions of this paper, I plan to use the IPEDS data (as it has proved to be a difficult

[9]Although Deming and Walters (2017) found the coefficient for tuition cap to be positive, they did not find it statistically significant at the 0.10 level, whereas I find it to be statistically significant at the 0.01 level. This result is counterintuitive as one would expect a tuition cap to lead to spending cuts.

endeavour).

	Current year	T+1	T+2	T+3
Log Spending	0.404	0.887**	1.134***	0.501
	(0.33)	(0.35)	(0.42)	(0.37)
Log Tuition	-0.063	0.107	0.108	-0.219
	(0.13)	(0.14)	(0.18)	(0.18)

Table 3: 2SLS - Evaluating the impact of lagged log spending and log tuition on log public enrollment. Standard errors are clustered by institution. $^{*}p < 0.10;^{**}p < 0.05;^{***}p < 0.01$

4.3 Tuition and Spending Changes on For-Profit Institution Enrollment

In order to evaluate the effect of tuition and spending (at public 2-year institutions) on for-profit enrollment, I will alter the second stage to be the following:

$$\Delta Y_{c(i),t} = \Phi_i + \Omega_t + \Delta W'_{s(i),t}\Lambda + \beta_1 \Delta \log \widehat{spending}_{i,t} + \beta_2 \Delta \log \widehat{tuition}_{i,t} + \varepsilon_{i,t} \tag{3}$$

where $\Delta F_{i,t} = F_{i,t} - F_{i,t-1}$ for $F \in \{Y, W', \log \widehat{spending}, \log \widehat{tuition}\}$, $Y_{c(i),t}$ is the log of aggregate enrollment for the for-profit institutions nearest to public institution i in state $s(i)$, and Ω_t and Φ_i are year and state fixed effects. Notice that the only difference from equation 2 is the dependent variable, $Y_{c(i),t}$. If there were n for-profit institutions within the specified distance of a public 2-year college, $Y_{c(i),t}$ would be the log of the aggregated enrollment for the n nearby for-profit institutions.

Table 4 shows the impact of spending and tuition at a public 2-year college on log enrollment a for-profit 2-year colleges within 25 miles of the public 2-year. A 10% decrease of spending (about a $1,000 decrease in spending per student) at a public 2-year college from year $T-1$ to year T results in about a 20% increase in enrollment year $T+1$, a 14% increase in year $T+2$, and a 19% increase in year $T+3$ of nearby for-profit enrollment. This 20% increase would translate to about a 900 person[10] increase in nearby for-profit enrollment. These effects seem to die down after 4 years (point estimates become less, and are not statistically significant at the .05 level). Similar values, which can be found in the appendix, result when updating this distance to anywhere between 20 and 40 miles.

4.4 Robustness Checks

Some argue that the data for for-profit colleges is not accurate before 2000 (NEED SOURCE HERE). Table 5 presents the results when I restrict the model to the years 2000-2013.

[10]The mean number of for-profit enrollment such that a community college is within 25 miles is 4,479 students

	Current year	T+1	T+2	T+3	T+4
Log Spending	-0.994	-2.093**	-1.428*	-1.939**	-1.350
	(0.82)	(0.90)	(0.80)	(0.90)	(1.08)
Log Tuition	0.517	-0.621	-0.087	-0.396	0.479
	(0.48)	(0.46)	(0.50)	(0.40)	(0.51)

Table 4: 2SLS - Evaluating the impact of lagged log spending and log tuition from public 2-year colleges on log 2-year for profit enrollment using DCP data from 1990-2013. (Summing the enrollment for private for-profit colleges within 25 miles of a public 2-year college). Standard errors are clustered by institution. $^{*}p < 0.10;^{**}p < 0.05;^{***}p < 0.01$. We evaluate the differences between OLS and 2SLS results later in this section.

	Current year	T+1	T+2	T+3
Log Spending	-0.754	-1.354**	-1.675***	-2.187**
	(0.65)	(0.66)	(0.59)	(0.89)
Log Tuition	0.809*	-0.403	-0.145	-0.354
	(0.43)	(0.39)	(0.42)	(0.35)

Table 5: 2SLS - Evaluating the impact of lagged log spending and log tuition from public 2-year colleges on log 2-year for profit enrollment using DCP data from 2000-2013. (Summing the enrollment for private for-profit colleges within 25 miles of a public 2-year college). Standard errors are clustered by institution. $^{*}p < 0.10;^{**}p < 0.05;^{***}p < 0.01$

Further restricting my sample to colleges where more than 33% of the students are not exclusively distance learners (using only years 2000-2013) yields the results in table 7.

	Current year	T+1	T+2	T+3
Log Spending	-1.000	-1.700**	-1.876***	-2.243***
	(0.65)	(0.70)	(0.59)	(0.87)
Log Tuition	0.546	-0.602	-0.543	-0.380
	(0.41)	(0.40)	(0.41)	(0.33)

Table 6: 2SLS - Evaluating the impact of lagged log spending and log tuition from public 2-year colleges on log 2-year for profit enrollment using DCP data from 2000-2013. (Summing the enrollment for private for-profit colleges within 25 miles of a public 2-year college). Standard errors are clustered by institution. $^{*}p < 0.10;^{**}p < 0.05;^{***}p < 0.01$

Notice that the point estimates differ slightly from the original results; however, the same basic pattern emerges. There are large (negative) impacts of public spending changes on for profit enrollment.

If we use OLS instead of 2SLS, we get the following results:

	Current year	T+1	T+2	T+3
Log Spending	-0.023	-0.031**	-0.035**	-0.033*
	(0.01)	(0.02)	(0.02)	(0.02)
Log Tuition	-0.015	0.021	0.021	0.029
	(0.02)	(0.03)	(0.02)	(0.02)

Table 7: OLS - Evaluating the impact of lagged log spending and log tuition from public 2-year colleges on log 2-year for profit enrollment using DCP data from 2000-2013. (Summing the enrollment for private for-profit colleges within 25 miles of a public 2-year college). Standard errors are clustered by institution. $^{*}p < 0.10;^{**}p < 0.05;^{***}p < 0.01$

Notice that although the coefficients for log spending in the OLS regression all are of smaller magnitude, they are of the same sign.

5 Conclusion

I find that changes in spending at public 2-years not only (positively) impact their own enrollment, but also (negatively) impact enrollment of nearby for-profit institutions. This gives credence to the claim that individuals view public 2-years and for-profits as substitutes, albeit imperfect ones. Thus, as Cellini (2009) and Goodman and Henriques (2015) have shown, for-profits and public 2-years compete in the same market. Furthermore, my results show that as spending at a public 2-year decreases by 10%, this results in an increase of nearby for-profit enrollment by between 14 and 21 % in the next 3 years. As state appropriations for public colleges continue to decrease, we would expect spending to also decrease. This is further evidence that increasing public funding may crowd out private for-profits. This is likely due to spending impacting class size, increasing course offerings, decreasing waitlists, providing more amenities and offering more guidance (Deming and Walters, 2017).

My results support that which Deming and Walters (2017) has found, namely the importance of increasing spending at public institutions. This would likely increase enrollment and degree attainment at public institutions. In addition, this support of public institutions would decrease enrollment at for-profit schools. This support would also lead to more students attending public institutions instead of for-profits, which might mean they would leave with less debt and better outcomes.

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5.1 Public Enrollment

Panel B: two-year institutions				
Log total spending	0.283	1.020***	1.052***	0.951***
	(0.253)	(0.315)	(0.371)	(0.345)
Log tuition	-0.083	0.097	0.087	-0.100
	(0.133)	(0.169)	(0.201)	(0.204)

Figure 2: Results from the Deming and Walters paper.

5.2 For-Profit Enrollment (20 miles)

First and second stages of Deming and Walters including only public 2 years that have at least one for profit institution within **20 miles** of its campus.

	First stage		Second stage
	Log Spending	Log Tuition	Log Enrollment
	(1)	(2)	(3)
Z	0.057***	-0.059***	
	(0.01)	(0.02)	
TuitCap	0.011*	-0.045***	
	(0.01)	(0.01)	
TuitMax	-0.048	0.588***	
	(0.06)	(0.14)	
Log Spending			0.703**
			(0.28)
Log Tuition			0.016
			(0.12)

Table 8: 2SLS - Evaluating the impact of lagged log spending and log tuition on log public enrollment. Only public colleges that have a for-profit college within 20 miles of its campus are included. Standard errors are clustered by institution. $^{*}p < 0.10;^{**}p < 0.05;^{***}p < 0.01$

	Current year	T+1	T+2	T+3
Log Spending	0.703**	1.015***	0.773**	0.873**
	(0.28)	(0.33)	(0.32)	(0.34)
Log Tuition	0.016	0.212	0.082	0.136
	(0.12)	(0.14)	(0.14)	(0.15)

Table 9: 2SLS - Evaluating the impact of lagged log spending and log tuition on log public enrollment. Only public colleges that have a for-profit college within 20 miles of its campus are included. Standard errors are clustered by institution. $^{*}p < 0.10;^{**}p < 0.05;^{***}p < 0.01$

Adding the enrollment of for-profit institutions within 20 miles of a public 2-year institution.

	Current year	T+1	T+2	T+3
Log Spending	-1.244	-1.619*	-1.294	-1.856**
	(0.90)	(0.87)	(0.84)	(0.89)
Log Tuition	0.065	-0.294	0.062	-0.271
	(0.58)	(0.59)	(0.55)	(0.40)

Table 10: 2SLS - Evaluating the impact of lagged log spending and log tuition on log for profit enrollment. (Summing the enrollment for private FP colleges within 20 miles of a public 2-year college). Standard errors are clustered by institution. $^{*}p < 0.10;^{**}p < 0.05;^{***}p < 0.01$

5.3 For-Profit Enrollment (30 miles)

First and second stages of Deming and Walters including only public 2 years that have at least one for profit institution within **30 miles** of its campus.

	First stage		Second stage
	Log Spending	Log Tuition	Log Enrollment
	(1)	(2)	(3)
Z	0.058***	-0.073***	
	(0.01)	(0.02)	
TuitCap	0.010*	-0.045***	
	(0.01)	(0.01)	
TuitMax	-0.058	0.579***	
	(0.05)	(0.11)	
Log Spending			0.638**
			(0.27)
Log Tuition			0.001
			(0.10)

Table 11: 2SLS - Evaluating the impact of lagged log spending and log tuition on log public enrollment. Only public colleges that have a for-profit college within 30 miles of its campus are included. Standard errors are clustered by institution. $^{*}p < 0.10;^{**}p < 0.05;^{***}p < 0.01$

	Current year	T+1	T+2	T+3
Log Spending	0.575**	1.055***	0.885**	0.876***
	(0.26)	(0.33)	(0.34)	(0.33)
Log Tuition	-0.041	0.223*	0.177	0.163
	(0.10)	(0.13)	(0.14)	(0.13)

Table 12: 2SLS - Evaluating the impact of lagged log spending and log tuition on log public enrollment. Only public colleges that have a for-profit college within 30 miles of its campus are included. Standard errors are clustered by institution. $^{*}p < 0.10;^{**}p < 0.05;^{***}p < 0.01$

Adding the enrollment of for-profit institutions within 30 miles of a public 2-year institution.

	Current year	T+1	T+2	T+3
Log Spending	-0.718	-1.657**	-2.018**	-1.652*
	(0.74)	(0.80)	(0.91)	(0.90)
Log Tuition	0.215	-0.568	-0.705	-0.405
	(0.44)	(0.43)	(0.51)	(0.43)

Table 13: 2SLS - Evaluating the impact of lagged log spending and log tuition on log for profit enrollment. (Summing the enrollment for private FP colleges within 30 miles of a public 2-year college). Standard errors are clustered by institution. $^{*}p < 0.10;^{**}p < 0.05;^{***}p < 0.01$

5.4 For-Profit Enrollment (50 miles)

First and second stages of Deming and Walters including only public 2 years that have at least one for profit institution within **50 miles** of its campus.

	First stage		Second stage
	Log Spending	Log Tuition	Log Enrollment
	(1)	(2)	(3)
Z	0.051***	-0.090***	
	(0.01)	(0.02)	
TuitCap	0.009**	-0.044***	
	(0.00)	(0.00)	
TuitMax	-0.048	0.572***	
	(0.04)	(0.09)	
Log Spending			0.334
			(0.30)
Log Tuition			-0.071
			(0.10)

Table 14: 2SLS - Evaluating the impact of lagged log spending and log tuition on log public enrollment. Only public colleges that have a for-profit college within 50 miles of its campus are included. Standard errors are clustered by institution. $^{*}p < 0.10;^{**}p < 0.05;^{***}p < 0.01$

	Current year	T+1	T+2	T+3
Log Spending	0.334	1.030***	0.859**	0.765**
	(0.30)	(0.39)	(0.40)	(0.39)
Log Tuition	-0.071	0.136	0.053	0.005
	(0.10)	(0.12)	(0.13)	(0.13)

Table 15: 2SLS - Evaluating the impact of lagged log spending and log tuition on log public enrollment. Only public colleges that have a for-profit college within 50 miles of its campus are included. Standard errors are clustered by institution. $^{*}p < 0.10;^{**}p < 0.05;^{***}p < 0.01$

Adding the enrollment of for-profit institutions within 50 miles of a public 2-year institution.

	Current year	T+1	T+2	T+3
Log Spending	-0.609	-3.610***	-3.753***	-1.758*
	(0.77)	(1.33)	(1.45)	(0.93)
Log Tuition	0.388	-1.044**	-1.138**	-0.243
	(0.35)	(0.45)	(0.51)	(0.31)

Table 16: 2SLS - Evaluating the impact of lagged log spending and log tuition on log for profit enrollment. (Summing the enrollment for private FP colleges within 50 miles of a public 2-year college). Standard errors are clustered by institution. $^{*}p < 0.10;^{**}p < 0.05;^{***}p < 0.01$

	First stage		Second stage
	Log Spending	Log Tuition	Log Enrollment
	(1)	(2)	(3)
Z	0.136***	-0.069***	
	(0.02)	(0.02)	
TuitCap	-0.026**	-0.043***	
	(0.01)	(0.01)	
TuitMax	0.406***	0.070	
	(0.10)	(0.30)	
Log Spending			0.379***
			(0.14)
Log Tuition			0.183
			(0.17)

Table 17: 2SLS - Evaluating the impact of log spending and log tuition on log for profit enrollment using a "levels" model. Standard errors are clustered by institution. $^{*}p < 0.10;^{**}p < 0.05;^{***}p < 0.01$

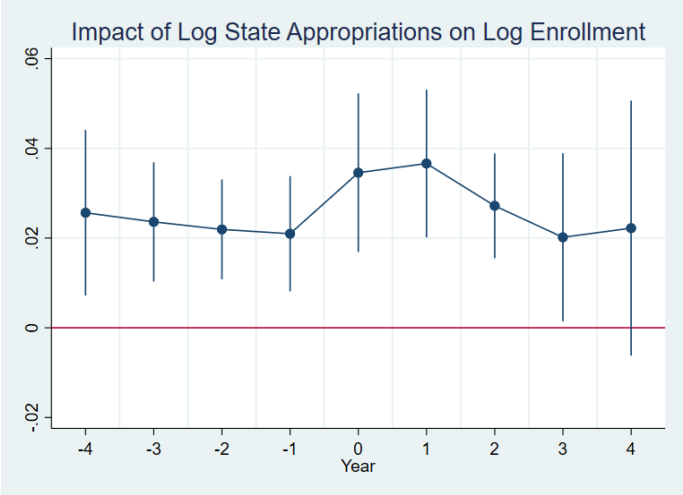
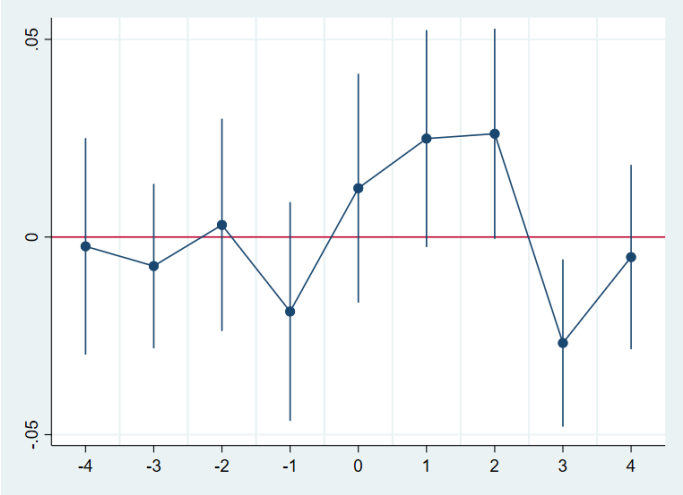
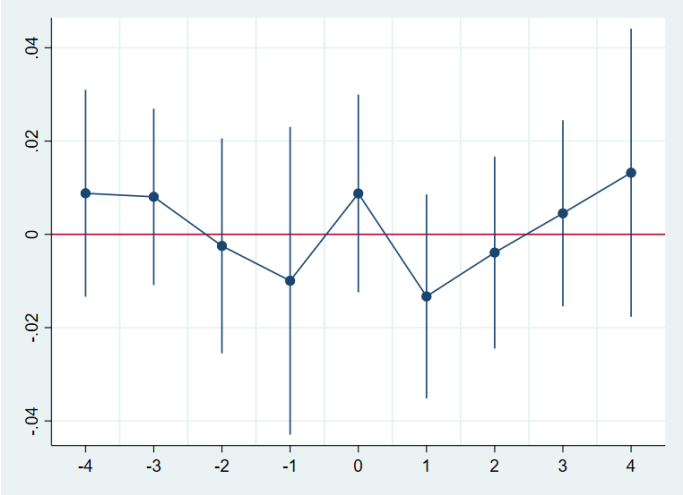


Figure 3: The plots above show the estimates and 95 percent confidence intervals for coefficients of the regression of log enrollment on the lags and leads of log state appropriations. Standard errors are clustered at the institution level.

Impact of Budget Shock on Log Enrollment



Impact of Having a Tuition Cap on Log Enrollment



Impact of Maximum Tuition Cap on Log Enrollment

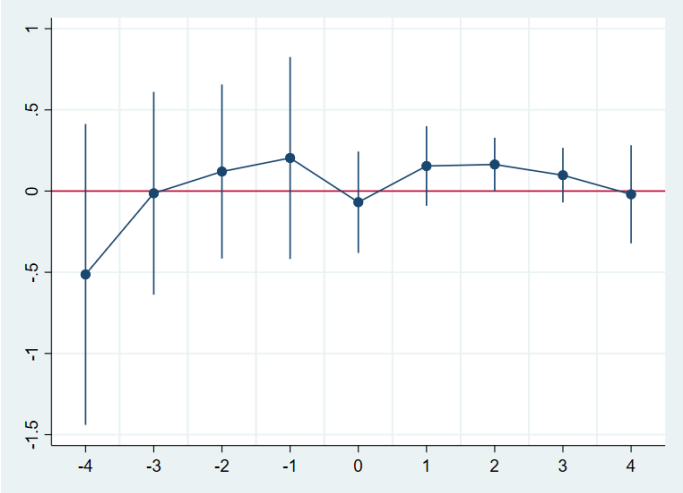


Figure 4: The plots above show the estimates and 95 percent confidence intervals for coefficients of the regression of log spending on the lags and leads of budget shock, an indicator of whether there is a tuition cap in place, and the maximum percentage increase allowed when I cap is in place. This regression model is defined in equation 1. Standard errors are clustered at the institution level.