The Effect of Teachers' Unions on Educational Outcomes

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Abstract

Collective bargaining through public-sector unions can affect the distribution of resources and influence overall effectiveness of public projects. Using panel data from 1960 to 1990, this paper estimates the effect of teachers' unions on school district resource allocation and students' educational achievement. I find that unionization has no effect on student outcomes. While they may change the sources of revenue, teachers' unions do not affect school budgets. Similarly, instrumental variable estimation using changes in state-level collective bargaining law finds non-positive effects of unionization on school inputs. It is important to understand the mechanism by which teachers' unions affect public education.

1 Introduction

As Los Angeles public school teachers finally came to an agreement on January 22, 2019, concluding a week-long strike, it has come to national attention the power of teachers' unions over the city and the state. After winning caps on class sizes and pay-raises, among other concessions, teachers returned to the classrooms.

This was just the most recent case of teachers' unions showing their influence on school district policies as collective bargaining agents for teachers. The Collective Bargaining Agreements (CBAs) that result affect all parts of school operations. The two major teachers' unions, the National Education Association and the American Federation of Teachers, spend more than any other public sector union on lobbying. Consequently, it's important to understand their impact on the schools, the students, and the teachers themselves.

In the last 60 years, teachers' unions have been growing, perhaps due to educational reform intended to improve the quality of public school teaching. As state governments employees, federal labor laws do not necessarily apply to public school teachers. States tend to fall into one of three categories: 1. those that require school districts to collectively bargain with a teachers' union, 2. those that allow districts to choose whether or not to collectively bargain, 3. those that ban collective bargaining between districts and teachers' unions.

Some argue that collective bargaining and the resulting agreements (collective bargaining agreements or CBAs) prevent districts from running schools effectively, limiting what they can do for their students. Excessive protections as a result of CBAs may also reduce the quality of teachers hired. Proponents of teachers' unions

1

point out that collective bargaining guarantees teachers basic dignities that allow them to perform their jobs more effectively. With more time to prepare and smaller class sizes, satisfied teachers should be in a better position to help their students.

2   Literature Review

Past empirical studies have attempted to measure this impact of teachers' unions on students' educational outcomes, but seem to disagree in their conclusions. Anecdotal evidence, like the case of the Los Angeles public school teachers, would seem to suggest that teachers' unions have a positive effect on school inputs, leading to higher wages and better working conditions.

Using test scores of 14,000 fourth graders, Eberts and Stone (1984) make one of the first attempts to empirical evaluate the impact of unionization on performance, controlling for socioeconomic factors. Their study finds that scores are seven percent higher. However, cross-sectional findings are often affected by unobserved or unmeasured variables that bias results.

Kleiner and Petree (1988), instead, use state-level data from 1972-1982 to develop a longitudinal analysis on the effect of unionization on test scores (specifically, the SAT and ACT). Consistent with what Eberts and Stone (1984) found, their analysis revealed a positive effect of unionization on test scores, but an ambiguous impact on graduation rates.

Perhaps one of the most comprehensive studies on the subject was conducted by Hoxby (1996). She identifies two types of unions: rent-seeking and efficiency

enhancing. Rent-seeking unions attempt to protect and maximize utility for the teachers they represent, whereas efficiency enhancing unions use their superior knowledge of effective resource allocation to best maximize student achievement. Hoxby uses Census of Governments (COG) data and a combined instrumental variable and difference-in-difference approach. By instrumenting for unionization events using the passage of statewide laws, she further avoids potentially omitted variables that may bias results in cross-sectional analysis. Hoxby found that teachers' unions do in fact increase school inputs. Contrary to prior literature, she finds a net negative effect on student performance.

Frandsen (2016) uses panel data from the Current Population Survey (CPS), the Census Bureau's database on government finances, and the NBER Public Sector Collective Bargaining Law Data Set, developed by Valletta and Freeman (1988) and updated by Kim Rueben (1996). He finds that that collective bargaining rights increase union membership, but have minimal impact on wages, hours, and benefits for teachers, which also contradicts what Hoxby (1996) found.

Grissom and Strunk (2010) consider the differences in strength of unions. They find that stronger unions have greater influence over policy compared to weaker unions. By imposing more rigid restrictions on policy-makers' decisions, they have the power to potentially provide lawmakers information about how to more effectively serve students.

Brunner, Hyman, and Ju (2019) account for these differences in union power in their study. They use school financial data from National Center for Education Statistics (NCES) surveys, as well as the NBER Public Sector CB Law Dataset used

by Frandsen (2016). They find that teachers' unions played a significant role in determining both the amount of state aid translated into education expenditures, as well as the allocation of those funds. The actions of teachers' unions appear to reflect the rent-seeking behavior described by Hoxby (1996), as they tended to increase school district budgets and channeled those increases towards teacher compensation, consistent with Hoxby (1996) and contrary to Frandsen (2016).

Lovenheim (2009) uses hand-collected data on teachers' union election certifications in Iowa, Indiana, and Minnesota combined with COG data. In contrast to Hoxby (1996), he finds no effect on teacher pay and a negligible effect on student-teacher ratios. Similarly, Lovenheim's study indicates that teachers' unions have little net effect on students' educational attainment. This appears to contradict most of the established literature. In an attempt to replicate the work done by Hoxby (1996), Lovenheim finds mis-classification rates of up to 47% in the Census of Governments Labor Relations Survey. He suggests that this error is correlated with the outcome variables, biasing the estimates upward. Coulson (2010) attempts to generalize Lovenheim's conclusions beyond the sample of those three states mentioned. He points out that teachers' wage increase had already begun in the 1950's, and other factors, including the economic recession of the 1970's, likely contributed to this. Perhaps, as Coulson suggests and shown by Grissom and Strunk (2010), the NEA and AFT have greater influence on political action, rather than collective bargaining.

Paglayan (2018) uses an original longitudinal dataset that attempts to overcome the limitations of the COG dataset. She uses the NBER Public Sector CB Law

Dataset, similar to Frandsen (2016) and Brunner et al. (2019), but combines it with education statistics that had previously not been digitized. Applying a similar difference-in-differences model as previous authors, Paglayan finds that the introduction of mandatory collective bargaining laws did not increase the level of resources for education. States with bargaining had lower student-teacher ratios, higher teacher salaries, and higher per-student expenditures, but those differences predated changes in collective bargaining rights.

Lindy (2011) uses New Mexico as a natural experiment because of its unique legal situation. In 1993, it made collective bargaining mandatory. When the legislation to renew this in 1999 was vetoed, collective bargaining became optional until 2003, when the new Governor made it mandatory again. In comparing New Mexico to national averages, Lindy finds that mandatory collective bargaining leads to higher SAT scores and lower graduation rates, but an ambiguous effect on per-pupil expenditures. He suggests that this difference in effect on SAT scores and graduation rates may be because any positive effect on student achievement comes at the expense of lower-performing students.

3 Data

Similar to Frandsen (2016), Paglayan (2018) and Brunner et al. (2019), I use the NBER Public Sector CB Law Dataset (Valetta and Freeman, 1988) for the main identification of changes in laws regarding collective bargaining, including right-to-work laws. This contrasts with Hoxby (1996) and Anzia and Moe (2012), among

other authors, who rely on the Census of Governments (COG) for identification of union participation. As mentioned above, Lovenheim (2009) found measurement error in the COG correlated with outcome variables that bias the estimates. Restricted by the availability of data, I limit the sample to the period from 1960 to 1990.

To measure student achievement, including dropout rates, I use data from the NCES, specifically, the State Comparisons of Education Statistics, Schools and Staffing Survey (SASS), and the Digest of Economic Statistics. I rely on data digitalized by Paglayan on the main measures of public education resources: student-teacher ratios, average teacher salaries, and per-pupil expenditures. In an effort to address the concerns raised by Coulson (2010), I attempt to account for private schools and general macro-economic trends, in addition to general demographic characteristics, using data from the NCES, as well as the Current Population Survey, Federal Reserve Economic Data and the Surveillance, Epidemiology, and End Results Program. I use data on the state-level, the level at which most relevant union-related laws have been enacted.

4   Methods

I follow model similar to that of Hoxby (1996) in order to identify the effect of the unions collective bargaining efforts. The education production function is approximated as:

$$A_i = \alpha_1 x_{1i} + ... + \alpha_n x_{ni} + \gamma z_i \tag{1}$$

This function is subject to the budget constraint:

$$Y_i = p_1 x_{1i} + ... p_n x_{ni} \tag{2}$$

With $U_i \in 0, 1$ as an indicator for unionization status and W_i a vector of demographic variables that affect the school inputs and school budgets, the following equations identify the potential effects of unions. The first states that the school budget is a linear function of unionization.

$$Y_i = \lambda U_i + \mu W_i \tag{3}$$

The second states that the school inputs are a linear functions of unionization.

$$X_{ji} = \sigma_j U_i + \rho_j W_i \tag{4}$$

Finally, the third states that productivity of the inputs is a function of unionization, for some function f.

$$\alpha_j = f_j(U_i) \tag{5}$$

For both the rent-seeking and efficiency-enhancing types of unions identified by Hoxby (1996), we'd expect $\lambda > 0$ (unions increase school budgets). We would expect $\sigma_j > 0$ for those inputs that benefit teachers if they are rent-seeking; we expect $\sigma_j > 0$ for inputs that help students if they are efficiency enhancing.

I use the high school graduation rate as my primary indicator of educational

production. I also include the states' average SAT verbal and SAT math scores as another measure of student achievement. With both measures, I attempt to verify the findings of Lindy (2011) and possibly reconcile the differing conclusions in the literature. Throughout the paper, I control for several demographic characteristics, including the school-age population, number of children in poverty, public school enrollment, racial distribution, and housing. By using data from 1960 to 1990, I factor in the characteristics from before and after unionization for proper comparison.

By including state fixed-effects, I hope to minimize identification problems, as some things like housing and geography are relatively fixed over time. To account for possible spillover effects to nearby states, I have an indicator for regions of the country, as specified by the NCES. The effect of students switching schools overtime is likely negligible. While there may be demographic shifts as parents seek better schools for their children, these are likely affected by differences in the school inputs and the educational outcomes, rather than unionization status. Since I look at same-year effects on outputs, these demographic shifts should be captured by their respective controls. I also include time-fixed effects in order to eliminate characteristics with time-trends, like those mentioned by Coulson (2010).

I first estimate the education production function (1) to find the coefficients for the individual inputs. This will help identify the inputs that maximize student achievement, and consequently, help determine efficiency-enhancing behavior. Then, using equation (3), I attempt to confirm the general effectiveness of teachers' unions, as both rent-seeking and efficiency-enhancing unions would have incentive to try to increase the schools' budgets available. From estimating equation (4) for the various

8

inputs, I find the effect of unionization status on procuring these inputs. I expect such inputs as teachers' salaries to reflect rent-seeking behavior, while other inputs, like per-student expenditure, to reflect efficiency enhancing behavior.

In order to account for some potential omitted variables correlated with teachers participation in teachers' unions, I adopt an instrumental variable strategy. Similar to Hoxby (1996) and Brunner et al. (2019), I use state collective bargaining laws as an instrument, since these changes in law are uncorrelated with the educational outcomes themselves. By doing this, I can separate the effect of unionization from the factors that may incentivize teachers to unionize. With this instrument, I re-estimate equations (3) and (4) to find the effect of teachers' unions on those inputs. By substituting these results back into equation (1), I will be able to determine the overall effect on education production.

5   Results

I begin by estimating the education production function in Table 1 to find the productivity of the inputs with respect to high school graduation. Increasing the number of public school staff members had a small significant positive effect on graduation and insignificant positive effect on test scores. The increase in public school teachers had a greater significant effect on graduation, but significant negative effects on test scores. An increase in the student-teacher ratio has a small but positive effect on graduation, but negative effects on test scores, although only significant for the SAT verbal score. Higher teacher salaries are associated with increases in all outcomes.

9

Higher per-pupil expenditure is associated with very small decreases in graduation rates and test scores, while higher non-wage per-pupil has a very small positive effect on all measures.

Table 1: Education Production

| | (1) | (2) | (3) |
VARIABLES	lnhsgrad	satverb	satmath
lnpublicteachers	0.749***	-54.547***	-31.190
	(0.032)	(16.101)	(23.175)
lnpublicstaff	0.045**	13.981	2.663
	(0.020)	(10.035)	(14.444)
studteachratio	0.008**	-6.345***	-2.243
	(0.003)	(1.693)	(2.438)
avgteachsal	0.000	0.002***	0.001
	(0.000)	(0.001)	(0.001)
ppexpend	-0.000***	-0.036***	-0.017
	(0.000)	(0.011)	(0.016)
nonwageppexpend	0.000***	0.038***	0.020
	(0.000)	(0.012)	(0.018)
R-squared	0.998	0.958	0.923

Standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 2 shows the effect of unionization on school budget, broken down into funding from different sources. There are small, statistically insignificant increases in federal and state revenue. The statistically significant decrease in local revenue likely causes the effect on total revenue to be negative, although that effect is not statistically significant either.

Table 2: Effect of Union on Budget

VARIABLES	(1) lntotalrevenue	(2) lnfedrevenue	(3) lnstaterevenue	(4) lnlocalrevenue
cbteachers	-0.05	0.03	0.04	-0.20**
	(0.05)	(0.10)	(0.11)	(0.08)
population	0.00**	0.00*	0.00	0.00*
	(0.00)	(0.00)	(0.00)	(0.00)
schoolage	-0.00**	-0.00	-0.00	-0.00*
	(0.00)	(0.00)	(0.00)	(0.00)
childpoverty	-1.73***	-3.45***	-2.65*	-0.39
	(0.57)	(1.26)	(1.47)	(0.99)
enrollment	0.00***	0.00	0.00	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
R-squared	1.00	0.99	0.99	1.00

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3: Effect of Union on Inputs

VARIABLES	(1) lnpublicteachers	(2) studteachratio	(3) avgteachsal	(4) ppexpend	(5) nonwageppexpend
cbteachers	-0.03**	0.76***	-1,871.25**	54.55	189.17
	(0.02)	(0.27)	(901.85)	(169.43)	(160.29)
population	0.00*	0.00*	-0.00	-0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
schoolage	-0.00	-0.00***	0.01	0.00	-0.00
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
childpoverty	-3.00***	-2.33	-7,781.77	2,454.20	2,876.56
	(0.19)	(3.03)	(10,259.67)	(1,927.48)	(1,823.48)
enrollment	0.00***	0.00***	-0.01	-0.00	0.00
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
R-squared	1.00	0.95	0.96	0.93	0.87

Standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 3 shows the effect of unionization on school inputs. Teachers' unions seem to lead to decreases in the number of teachers hired and their average salaries, while increasing student-teacher ratios. Taken in the context of Table 2, the decrease in revenue likely prevents school districts from hiring as many teachers or paying them as high of salaries compared to states with less participation in teachers' unions.

Together with the coefficients in Table 1, it seems that as more teachers participate in teachers' unions, the restricted budgets lead to decreases in hiring and salaries, as well as an increase in student-teacher ratio, contributing to the effects on educational outcomes.

I then instrument unionization by the legislation regarding collective bargaining. Figure 1 shows the changes over time as collective bargaining on behalf of teachers was increasingly allowed, and subsequently required by law.

Figure 1: Collective Bargaining from 1960-1990
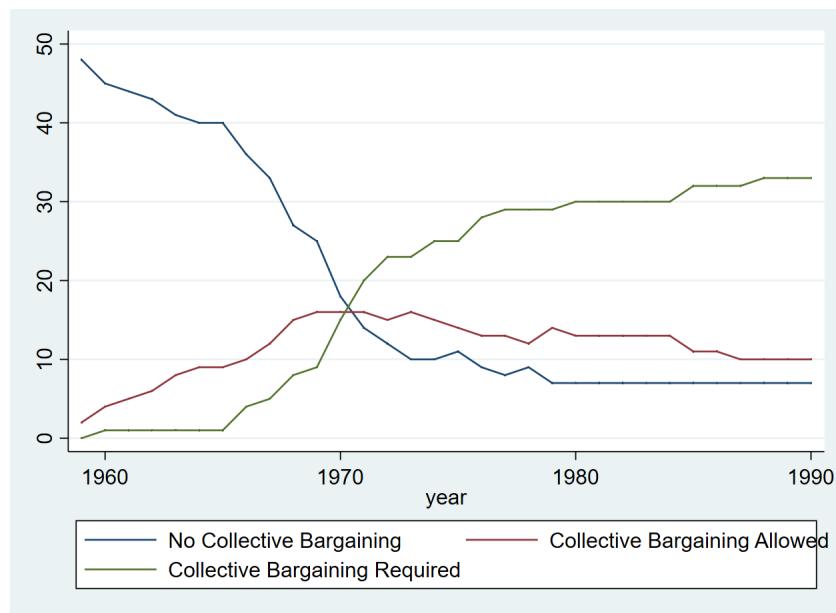
Figure 2 represents the first-stage graphically. There does not appear to be a significant difference between states banning collective bargaining and those permitting it, allowing school districts to choose to bargain with teachers' unions. States that require collective bargaining, on the other hand, clearly increase the percentage of teachers that are members of teachers' unions to over twice the level of those that

13

ban or simply allow it.

Figure 2: CB Law Effect on Unionizing
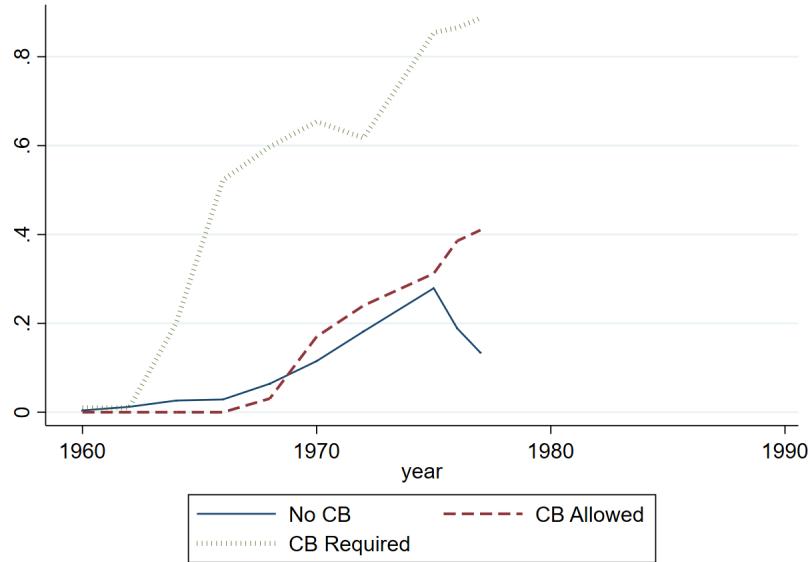
In Table 4, I apply the instrumental variable strategy to observe the effect on educational outcomes. As more teachers participate in unions, there is a statistically insignificant increase in SAT scores in both the Verbal and Math sections. There is also a negligible decrease in graduation rates. I use the same instrument to investigate the effects on school budgets and the individual school inputs to determine how unionization might cause these changes in graduation and test scores.

Table 4: Effect of Unionization on Student Outcomes

	(1)	(2)	(3)
VARIABLES	lnhsgrad	satverb	satmath
teachersunion	-0.01	10.32	19.11
	(0.03)	(11.02)	(14.84)
population	0.00	-0.00	0.00
	(0.00)	(0.00)	(0.00)
schoolage	0.00*	-0.00***	-0.00**
	(0.00)	(0.00)	(0.00)
childpoverty	-3.36***	-429.37***	-396.13***
	(0.13)	(42.28)	(56.93)
enrollment	0.00**	0.00**	0.00**
	(0.00)	(0.00)	(0.00)
R-squared	1.00	0.95	0.92

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5 is the reduced form regression for the effect of collective bargaining law on school budgets. I find insignificant positive effects on federal and state revenue for schools from states that require collective bargaining. There are also insignificant negative effects on total revenue and a significant negative effect on local revenue. I suggest that these differences are due to the increase in unionization caused by the

change in collective bargaining law, as evidenced by the first stage in Figure 2.

Table 5: OLS Regression

OLS Regression

VARIABLES	(1) lntotalrevenue	(2) lnfedrevenue	(3) lnstaterevenue	(4) lnlocalrevenue
cbreq	-0.04	0.02	0.03	-0.20***
	(0.03)	(0.04)	(0.05)	(0.08)
population	0.00	0.00*	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
schoolage	-0.00	0.00	0.00**	-0.00**
	(0.00)	(0.00)	(0.00)	(0.00)
childpoverty	-1.77***	-2.64***	-1.09	-2.25**
	(0.45)	(0.58)	(0.74)	(1.10)
enrollment	0.00**	-0.00	-0.00	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
R-squared	0.99	0.99	0.99	0.97

Standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Applying the instrumental variable estimation to schools budgets gives Table 6. By using changes in collective bargaining law to find the effect on school budgets, I find results similar to those in Table 2. Participation in teachers' unions is associ-

ated with with statistically insignificant increases in federal and state revenue and marginally significant decrease in local revenue. Again, there is no significant effect on total revenue, though the coefficient is positive in this case.

Table 6: Effect of Union on Budgets - IV

	(1)	(2)	(3)	(4)
VARIABLES	lntotalrevenue	lnfedrevenue	lnstaterevenue	lnlocalrevenue
cbteachers	0.10	0.16	0.16	-0.15*
	(0.07)	(0.13)	(0.10)	(0.09)
population	0.00***	0.00***	0.00**	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
schoolage	-0.00**	-0.00***	-0.00	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
childpoverty	-1.66***	-3.39***	-2.59***	-0.37
	(0.49)	(0.45)	(0.76)	(0.49)
enrollment	0.00***	0.00	0.00	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
R-squared	1.00	0.99	0.99	1.00

Robust standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Figure 3: Trends Over Time
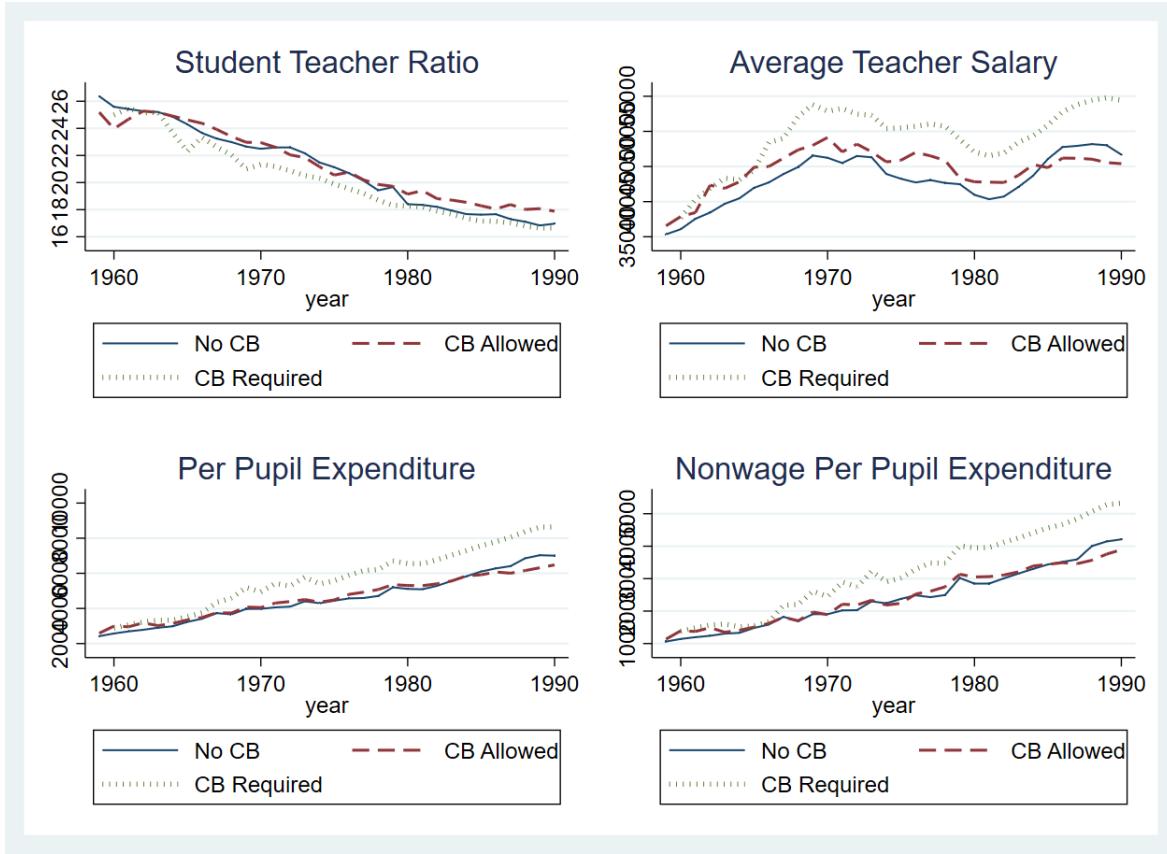
Figure 3 shows these trends of the school inputs over time with respect to collective bargaining law in the state. While the general directions of the trends are similar with or without collective bargaining requirement, there is a noticeable difference in magnitude captured in Table 7, the reduced form. Like with Table 5, the reduced form for changes in school budgets, I would argue these differences can be explained by Figure 2, which shows the increase in unionization due to changes in CB law.

Table 7: OLS Regression

OLS Regression

VARIABLES	(1) lnpublicteachers	(2) studteachratio	(3) avgteachsal	(4) ppexpend	(5) nonwageppexpend
cbreq	-0.02**	0.32**	-1,321.41***	-225.71**	-90.58
	(0.01)	(0.13)	(382.57)	(98.49)	(76.32)
population	-0.00	0.00***	0.00***	0.00	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
schoolage	0.00	-0.00	-0.01***	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
childpoverty	-2.65***	-12.20***	10,409.89**	5,980.08***	4,329.64***
	(0.12)	(1.66)	(4,872.49)	(1,254.42)	(972.01)
enrollment	0.00***	0.00	0.01***	0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
R-squared	1.00	0.92	0.92	0.90	0.88

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 8 displays the effect of unionization on school inputs, but with unionization being instrumented by the changes in collective bargaining law. This design yields similar results to Table 3. There is a small, but statistically significant decrease in teachers hired, accompanied by a statistically significant increase in student-teacher

19

ratio, correlated with increased participation in teachers' unions. Average teacher salaries also decrease by a notable, statistically significant amount.

Table 8: Effect of Union on Inputs - IV

VARIABLES	(1) lnpublicteachers	(2) studteachratio	(3) avgteachsal	(4) ppexpend	(5) nonwageppexpend
cbteachers	-0.03	0.35	-3,589.86**	59.35	208.73
	(0.03)	(0.38)	(1,653.18)	(244.69)	(217.23)
population	0.00*	0.00*	-0.00	-0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
schoolage	-0.00	-0.00***	0.01	0.00	-0.00
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
childpoverty	-3.00***	-2.60	-8,907.57	2,457.34*	2,889.37**
	(0.17)	(3.05)	(7,759.09)	(1,429.89)	(1,342.30)
enrollment	0.00***	0.00***	-0.01	-0.00	0.00
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
R-squared	1.00	0.95	0.96	0.93	0.87

Robust standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Unlike Table 3, there is a significant effect on per-pupil expenditures in the opposite direction. While Table 3 showed an insignificant increase in expenditures, there is a statistically significant decrease in this case.

6 Discussion

The results discussed in the previous section appear to go against traditional logic about the effect of unions. Contrary to Hoxby (1996) and Brunner et al. (2019), I find that unionization does not appear to be associated with increases in school inputs. Increased participation in teachers' unions is correlated with increases in federal and state funding, but a decrease in local funding. This could be due to federal and state sources crowding out local funding sources, possibly deterring them from contributing to state budgets. Combined, the effect on total funding for schools remains ambiguous. As a result, school districts may be restricted in their spending, compared to those states with less union representation.

Those states with higher participation in unions have had lower average teacher salaries, but no effect on hiring or student-teacher ratios. They was also no effect on per-pupil expenditures. While I hesitate to conclude that there is a negative effect to unions on inputs, it is evident that there is not a positive effect. If total funding is staying the same, it is uncertain for what the money is being used. There are many other places the funding could go that have not been mentioned in this paper, including the benefits received by teachers. While Frandsen (2016) attempts to account for some of these, there are numerous other channels. For those he does consider, he finds minimal impact from an increase in union membership.

Grissom and Strunk (2010) may provide some insight here. They suggest that stronger teachers' unions are more effective at lobbying than collective bargaining. It is possible that, as participation in the unions increased, they redirected their efforts toward influencing policy, rather than negotiating over the day-to-day operations of

21

school districts and teachers.

Per the education production function estimated in Table 1, hiring more teachers and having lower student-teacher ratios seem to have opposite effects. This is the case for both graduation and test scores. Intuitively (and shown in the data), an increase in the number of teachers is linked with a decrease in the student-teacher ratio, so these effects ought to go in the same direction. It is worth noting that, while significant, the magnitude of the effects from student-teacher ratio was very small in comparison to that of the number of teachers.

For all educational measures, the effects were statistically insignificant. Given the overall effects on inputs measured were negative or close to zero, it would seem unionization itself has no impact on student outcomes. Average teacher salary had essentially no effect on graduation rate or SAT scores. Although teachers' unions did not have a statistically significant effect on most inputs included in this paper, there was a significant decrease in average teacher salary. This may hint toward efficiency-enhancing behavior, as the input that unions were willing to sacrifice was one that did not affect student achievement.

In this paper, I look only at the same-year effects on the outcome variables with respect to unionization and inputs. In subsequent studies, it would be helpful to consider lagged effects on the outcomes, as changes in inputs like per-pupil expenditure and student-teacher ratios may not immediately impact educational achievement measures like graduation rates and test scores.

7 Conclusion

There has been a lot of disagreement in the literature about the true effect of teachers' unions and collective bargaining on school budgets and resources and students. With limited data publicly available, past studies have applied various techniques to similar datasets to answer this question. Using panel data on unionization of teachers in the United States and state laws that facilitated collective bargaining, I combine multiple aspects of these strategies in an effort to conduct a rigorous analysis, while attempting to avoid the pitfalls of previous papers.

By observing states in periods before and after unionization, as well as instrumenting passage of statewide laws, I isolate the effects of unionization from events that might cause teachers to unionize. I find no effect of participation in teachers' unions on student outcomes. In the intermediary stages, there seems to be a small decrease in local revenue, but overall no effect on school budgets. Similarly, unionization has a non-positive effect on teacher hiring, teacher salaries, or per-pupil expenditure.

These conclusions raise the question of why teachers are unionizing? There are many benefits, including insurance, pensions, and job protections not discussed by this study or others. Collective bargaining is not the only mechanism by which unions can affect public education. Perhaps it is necessary to look beyond the effects on hiring and salaries to understand how collective bargaining and unionization influence students, schools, and US education policy.

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Appendix A. Summary Statistics

Table 1: Summary Statistics

	(1) all mean/sd	(2) no cb mean/sd	(3) cb allowed mean/sd
High School Graduates	48851.92	57212.37	51147.86
	(29272.27)	(57806.24)	(54221.60)
satverb	445.50	463.00	453.01
	(36.75)	(31.42)	(32.52)
satmath	483.47	503.19	498.18
	(39.06)	(32.00)	(35.24)
cbteachers	0.06	0.19	0.76
	(0.14)	(0.24)	(0.28)
Public School Teachers	40454.42	48633.79	42658.31
	(21688.34)	(49308.16)	(45181.70)
Public School Staff	74919.44	86179.45	77764.95
	(40199.76)	(84890.88)	(86773.04)
Student Teacher Ratio	23.24	21.07	18.58
	(3.56)	(3.03)	(2.78)
Average Teacher Salary	41481.43	45378.96	50979.80
	(6766.61)	(6528.17)	(8983.75)
Per Pupil Expenditure	3654.84	4727.77	6727.27
	(1389.32)	(1272.00)	(2028.52)
Nonwage Per Pupil Expenditure	1804.46	2528.85	3927.81
	(907.55)	(905.93)	(1450.96)
Public School Revenue	1450334.74	1835962.22	2668513.71
	(1296368.89)	(2379500.67)	(3719460.22)
Public School Revenue from Federal sources	137834.90	166185.44	166628.29
	(92729.91)	(185482.03)	(237676.35)
Public School Revenue from State sources	702969.20	851256.89	1216548.36
	(665988.47)	(1048168.55)	(2004917.18)
Public School Revenue from Local sources	609530.64	818519.89	1269092.29
	(657023.43)	(1193125.91)	(1691521.37)
Observations	607	367	623

Appendix B. Graphs

Public School Teachers

Log Public School Teachers

Public School Staff

Log Public School Staff

	No CB	CB Allowed
	CB Required	
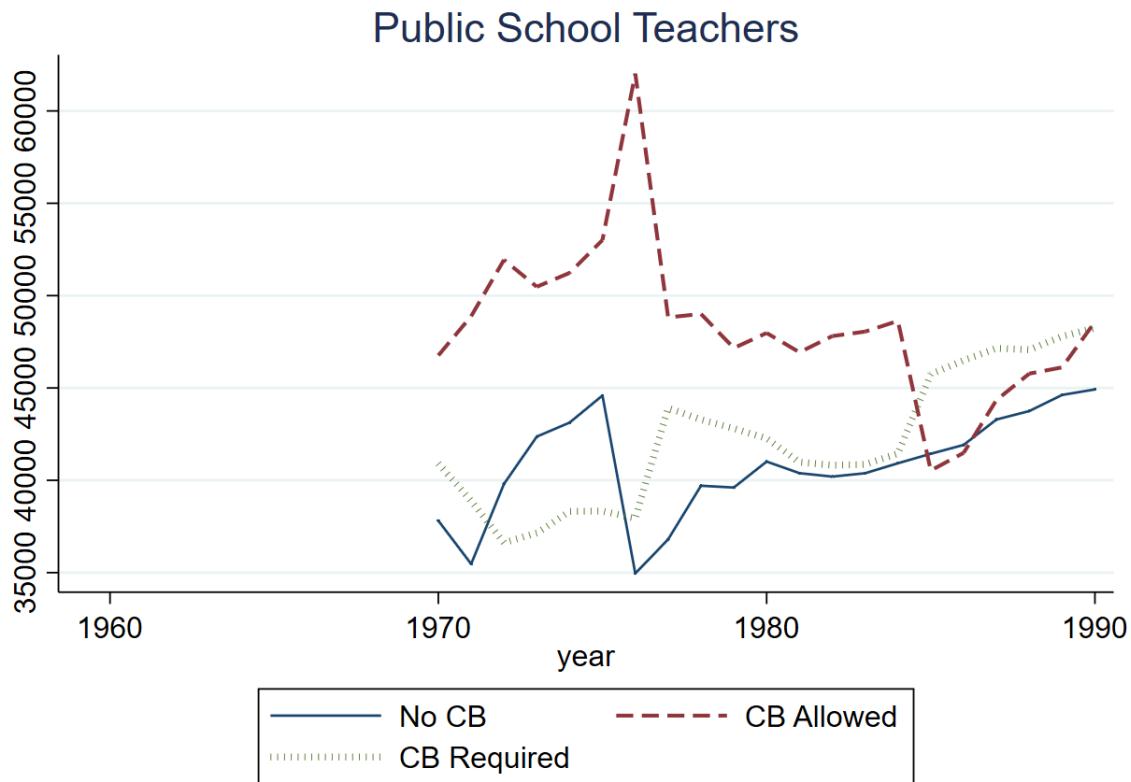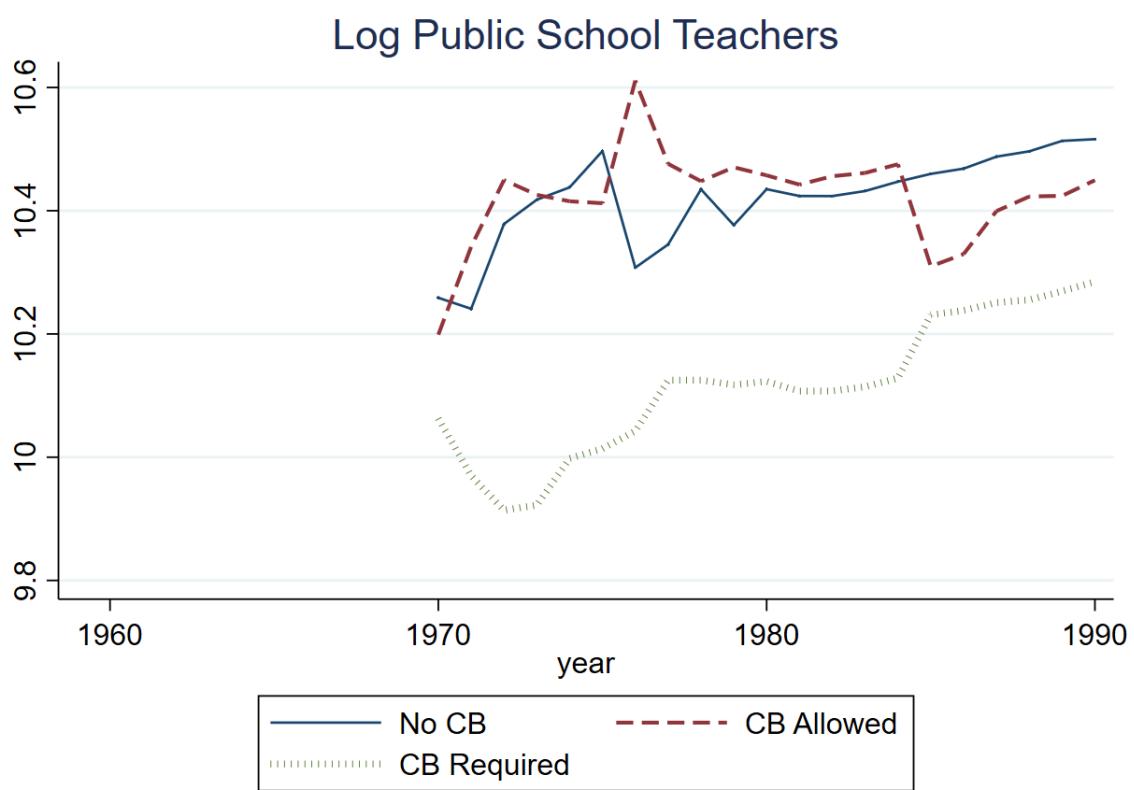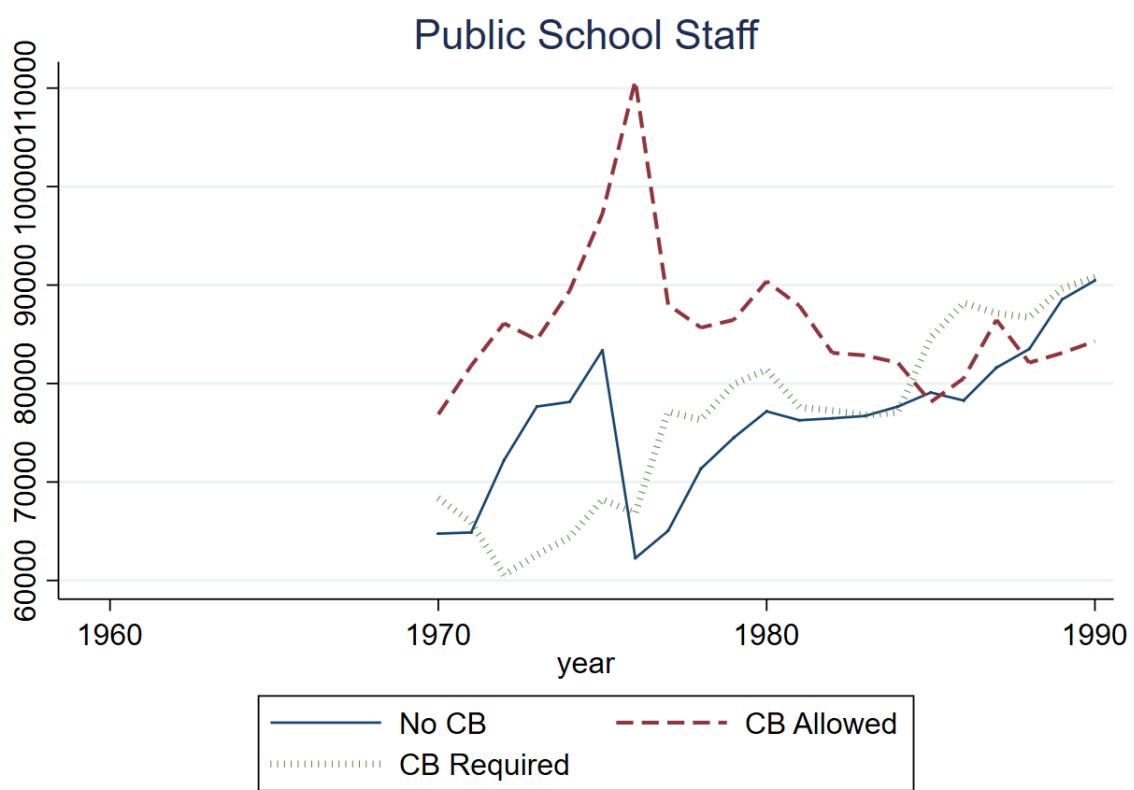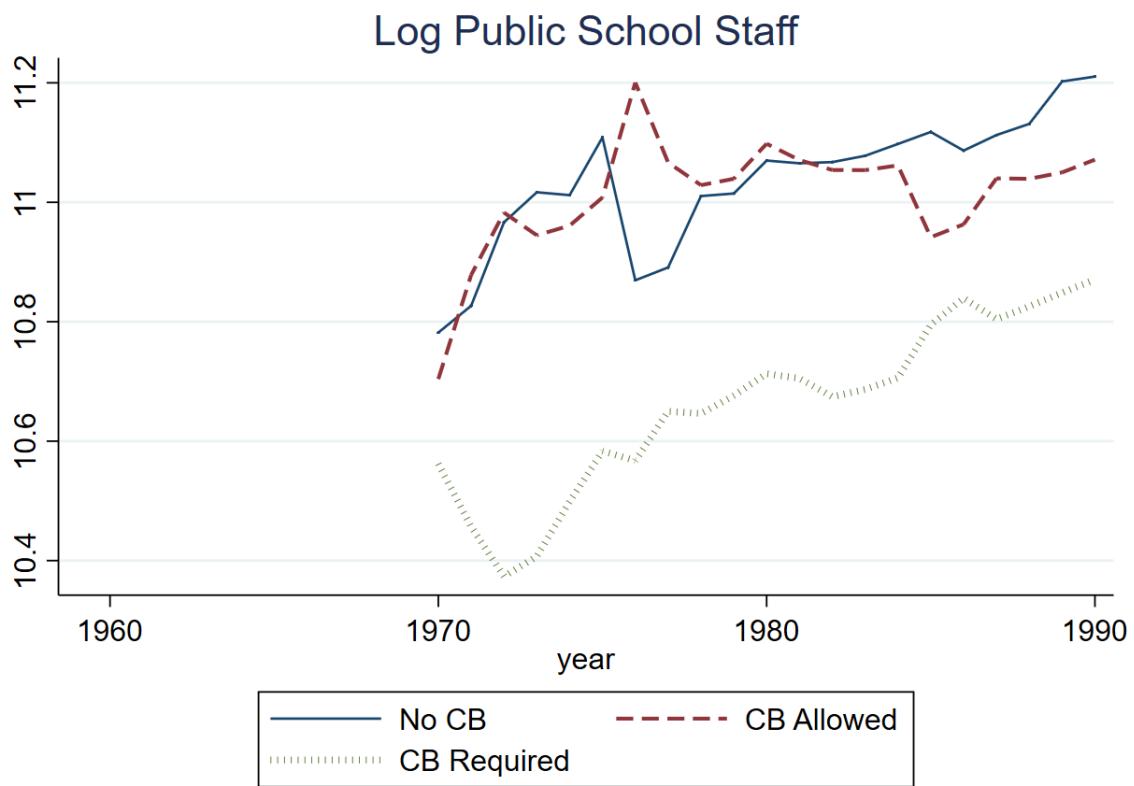
Log Public School Revenue
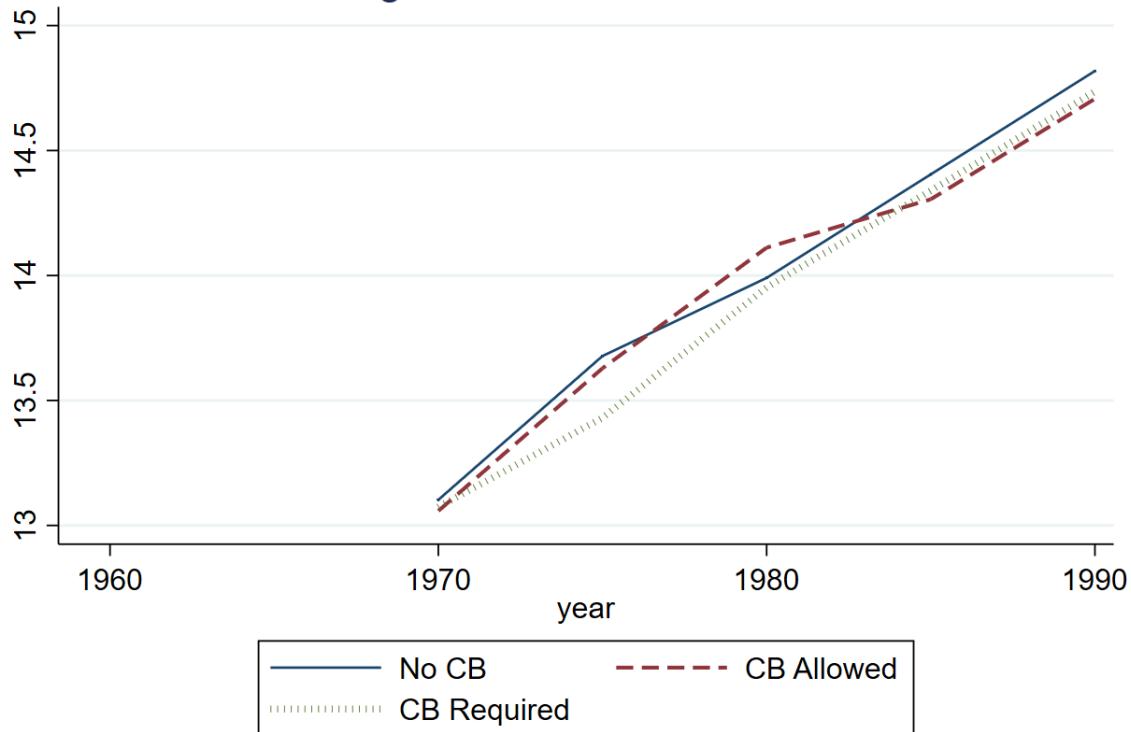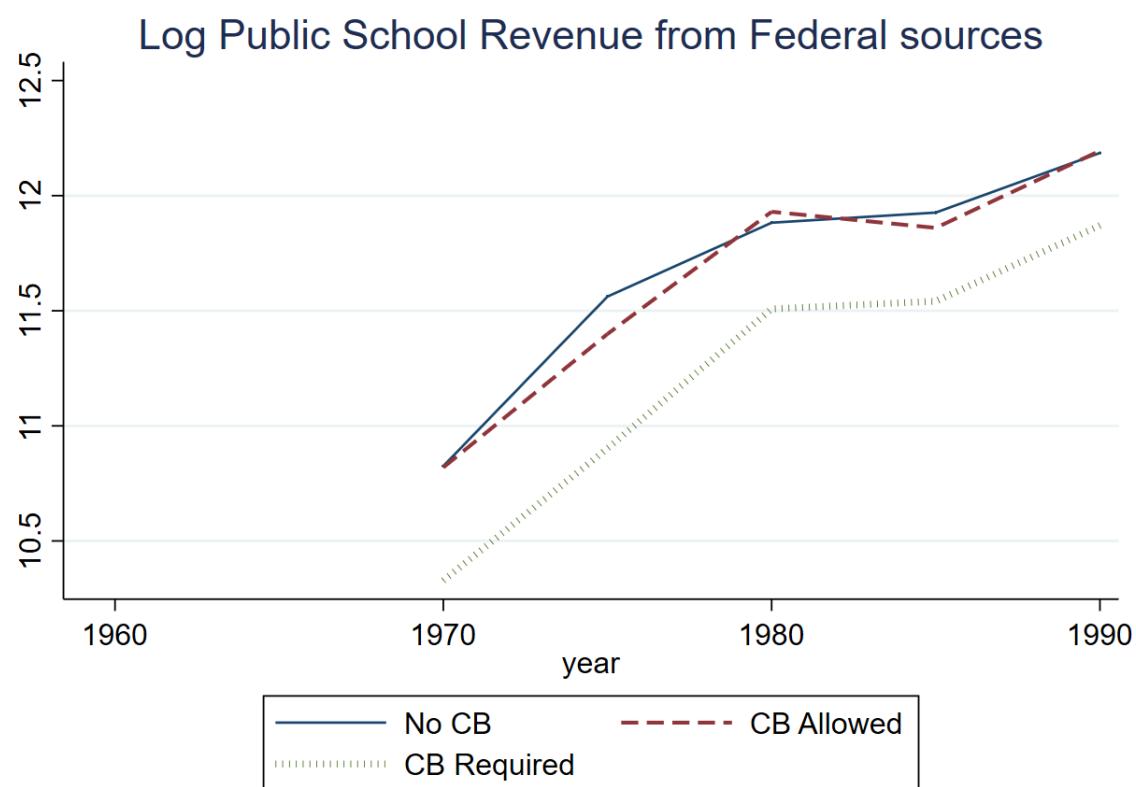
Log Public School Revenue from Federal sources

Log Public School Revenue from State sources

Legend:
- No CB (solid line)
- CB Allowed (dashed line)
- CB Required (dotted line)

Log Public School Revenue from Local sources