Teachers' Union Strength and School Reopening Decisions: Evidence from Connecticut

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April 9, 2023

This paper explores the role that teacher union strength played in the reopening decisions of public schools in Connecticut throughout the '20-'21 academic school year. To do so, I construct a measure of union strength that combines the number of pages in a union's collective bargaining agreement with a text analysis that measures the expansiveness of their contract's leave policies. I find that school districts with strong unions were less likely to offer in-person classes throughout the 2020-2021 academic year. However, this effect becomes insignificant when accounting for the local incidence of COVID-19. Instead, I find that differences in the vote share for the Democratic presidential nominee of 2020 and the number of COVID-19 cases were stronger predictors of reopening decisions. The results contradict the consensus within the literature that unions and political attitudes prevented schools from reopening. These results suggest that using more geographically granular data and a longer time horizon to define reopening decisions describes the differences in results.

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1 — Introduction

Pandemics are costly in many ways. One of the less obvious means through which these costs can manifest is through the complex (and often simultaneous) interaction of public health interventions coupled with the need to increasingly compensate labor for taking on the additional risk that is associated with contracting a highly communicable and deadly virus. A confounding factor in assessing the risk faced by any individual in this context is their spatial proximity to others who are potentially infectious. Economic theory posits that the public-health optimal internalization of these externalities are most likely to be achieved in competitive sectors where individuals and business can more fluidly negotiate their terms of employment. This paper tests this theory by analyzing the role that organized labor has on output in environments of wage stickiness, low competition, and differential population density in the context of a pandemic.

This is done by examining the relative political power of public school districts' teachers' unions in Connecticut during the COVID-19 pandemic. Because these unions are responsible for negotiating the terms of their employment with the state at multi-year intervals, I proxy for the relative political strength of a union by combining measures of the number of pages in their most recent collective bargaining agreement (CBA) with a text analysis that measures the expansiveness of these contract's leave policies. Using this measure, I discover that school districts with powerful unions had a significantly lower chance of providing in-person classes throughout the 2020-2021 academic year, but that this outcome becomes insignificant when I account for the local incidence of COVID-19. Further analyses of union strength which combines the exogenous timing of the union's pre-scheduled CBA renegotiations reveal no additive effect – suggesting that non-union factors were primarily responsible.

Using a series of additional tests which account for spatial endogeneity coupled

with highly localized data at both the school district and city level, I provide evidence that both differences in the vote share for the Democratic presidential nominee of 2020 and the local incidence of COVID-19 were far stronger predictors of reopening decisions than was union strength.

These findings stand in contrast to a relative consensus within the literature which posits that unions and political attitudes, rather than COVID-19, prevented schools from reopening. Importantly, I replicate the null result of COVID-19 cases on reopening decisions, but only when using data at the county level. Thus, this paper provides evidence in favor of using both more geographically granular data and a longer time horizon when defining reopening decisions.

2 — Literature Review

Academics have rushed to quantify the ramifications of the COVID-19 pandemic. While these efforts span almost all academic subjects, this section of this paper will focus on those specifically related to the relationship between the causes and consequences of school reopening decisions.

2.1. Effects of Remote Learning during the Pandemic

There are myriad reasons why remote learning is costly. From a parent's perspective, schooling is the primary form of daycare for children across the world.[1] When schools close childcare duties fall on families. Tedeschi (2020) shows that these duties disproportionately fell on women. 1.6 million American women dropped out of the labor force from March to September 2020 – many of whom were tasked with taking care of children who could not go to school. Garcia and Cowan (2022) document that parents of school-aged children during the pandemic saw significant reductions in work hours, earnings, and the likelihood of working full-time. How-

1. Accounting for this function dramatically increases the estimates of the importance of K-12 schooling (Green et al., 2020).

ever, they find that only women saw significant decreases in the probability of being employed at all and that all of these effects were concentrated among those whose skills or profession did not lend themselves well to telework.

These factors lead to increases in both racial and socio-economic inequities. Black and Hispanic students were disproportionately less likely to be able to attend school in person throughout the pandemic (Camp et al., 2022). Even if there were differences in in-person learning opportunities, the elimination of the benefit of peer effects that are only achievable in in-person school settings dramatically reduces the equalizing forces of education and further exacerbates inequalities (Agostinelli et al., 2022). A great number of papers across different settings document substantial learning and health deficits that arose due to school closures (Engzell et al., 2021; Hawrilenko et al., 2021; Betthäuser et al., 2023). In each setting, the effects are largest for those of lesser means.

Worse yet, these inequalities are likely to continue if the exodus from public schools as a result of school closures continues. A majority of independent school districts in the United States experienced enrollment increases during the pandemic (Flanders, 2021). Scafidi et al. (2021) shows that the main determinant of these enrollment changes is whether the public school districts in the student's home county only offered virtual instruction at the beginning of the academic year. Musaddiq et al. (2022), analyzing administrative data from Michigan, document that public school enrollment declined 3% on average and 10% with a substantial increase in homeschooling rates.

Unfortunately, the estimates from research on the reductions in human capital from school closures during the pandemic are very large. At baseline, we have strong reason to believe in the causal relationship between years of schooling and later-in-life outcomes. Jaume and Willén (2019) demonstrate that students who were exposed to teacher strikes as children have lower wages, higher likelihoods of unemployment, and lower levels of skill in their occupation twenty and thirty years

later. Worse yet, they show these effects are intergenerational.

Recent estimates reveal that the average student will have lost 0.3-0.9 effective years of schooling in their lifetime which corresponds to an average 2% reduction in the present discounted value of their lifetime earnings as a result of school closures during the pandemic (Azevedo et al., 2021; Fuchs-Schündeln et al., 2022). Comparing the standardized exam outcomes of students from the same district before the pandemic to those exposed to school closures reveals massive reductions in learning (Singh et al., 2022). Similar (albeit smaller) effects are found when analyzing exam performance across students exposed to hybrid or distance learning relative to in-person instruction (Goldhaber et al., 2022; Jack et al., 2022).

2.2. Reopening Decisions

DeAngelis and Makridis (2021) provide the first analysis of the causes of school reopenings in this setting by studying whether school districts in locations with stronger teachers' unions were less likely to offer in-person instruction for the Fall 2020 academic semester. Their paper analyzes 835 of the largest public school districts in the United States which represents approximately 38% of the population of students enrolled in public schools. They employ four proxies for union strength: (1) whether the school district is located in a right-to-work state, (2) a state-level ranking of teachers' union strength, (3) the percent of employed wage and salary workers who are members of a labor union at the state level and (4) county-level data for the number of professional workers in a labor union between 2015 and 2017. Across each measure, they find that the decision to reopen schools for in-person instruction at the beginning of the Fall 2020 semester was predicted by teachers union strength rather than COVID-19 case and death rates.

Following the lead of Allcott et al. (2020) who document massive individual-level differences between Republicans and Democrats in social distancing behavior and beliefs about both COVID risk and the future severity of the pandemic, many re-

searchers next turned their attention to exploring the explanatory power of political attitudes about the pandemic on reopening decisions. Hartney and Finger (2022) leverage county-level variation in vote shares for the Presidential election and find that the degree of polarization was an important predictor for Fall 2020 reopening decisions as Republican (Democratic) districts were more (less) likely to reopen in person. However, they find that the severity of exposure to the pandemic up until that point had no significant additive effect. These findings of political attitudes dominated public health concerns were also demonstrated by Collins (2023).

However, in contrast to the earlier research on the causes of reopenings, Houston and Steinberg (2022) find that COVID-19 case and death rates were meaningfully related to initial rates of in-person instruction by following reopening decisions for the entire 2020-21 academic year rather than just the beginning of the Fall. In replicating the earlier work, they find that the role of teachers union strength became less predictive of these decisions as the school year continued. Interestingly, pre-pandemic public support for teachers emerges as an important explanatory variable in their paper – highlighting the importance of local differences in ideology. Relatedly, Jabbari et al. (2023) provide evidence that the modes of instruction chosen by school districts during the pandemic appropriately reflected parents' safety concerns for their children. Christian et al. (2022) corroborate these findings by analyzing weekly learning mode data for school districts in Ohio. They demonstrate that an increase in the number of COVID cases reduces the probability of in-person instruction and that these decisions are spatially dependent.[2]

2. There is a related literature of the causes of college reopening decisions. Huntington-Klein (2020) measures the extent to which different universities reopened by employing continuous mobile phone location data. He finds that external local cues, such as the local prevalence of the COVID-19 virus, the behavior of nearby large colleges, and the local political environment, are highly important in explaining variation in reopening levels. Additionally, Klinenberg and Startz (2022) highlights the importance of financial incentives as colleges with larger shares of in-person-activity-related revenue were more likely to reopen in person. They identify that these incentives are consistent with both differences in in-person activity across institution types (public vs. private) and political attitudes. These findings are consistent with those of DeAngelis and Makridis (2022) who show that public school revenues and expenditures per student are both highly predictive indicators of reopening decisions for public school districts.

3 — Data

I construct a dataset of weekly school district-level observations. I first gather data regarding the mode of learning (in-person, hybrid, or virtual) at a weekly level for each of the 174 school districts in Connecticut from the Connecticut State Department of Education. I limit all observations to falling between August 2020 and May 2021 to capture the entire 2020-2021 academic school year. This corresponds to 40 weeks; thus, culminating in 6,960 district-by-week observations.

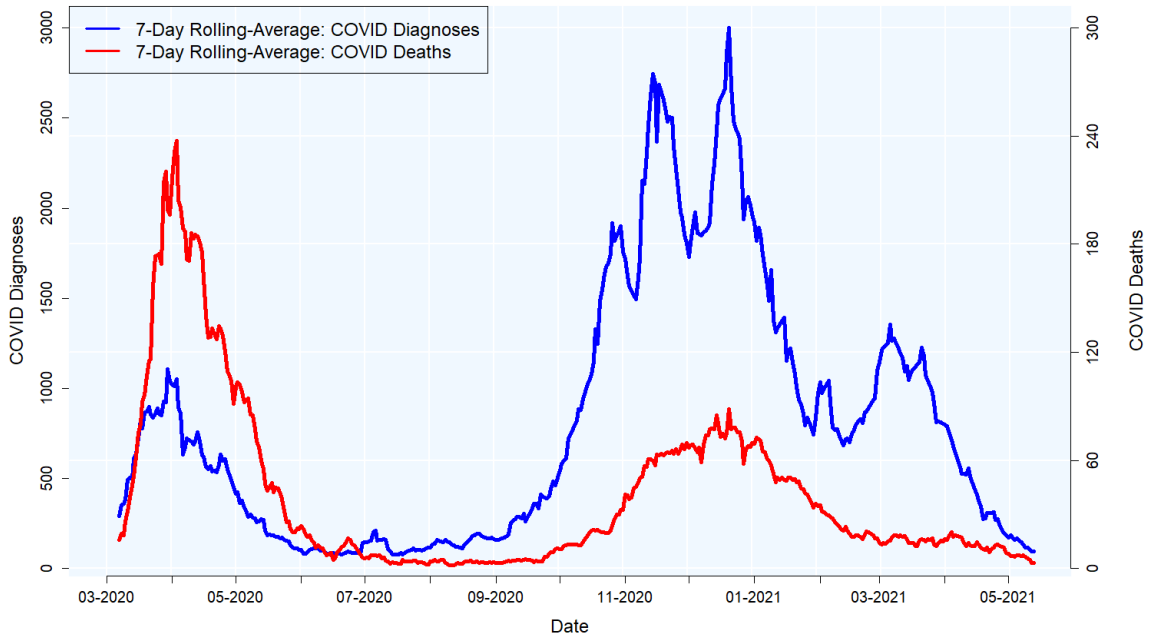
I next collect information regarding the collective bargaining agreement for each school district's teacher's union. This data comes from the Connecticut Coalition for Achievement Now's (ConnCAN) Teacher Contract Database. It represents a comprehensive collection of school district's CBA between teachers' unions and the school district board which contains a copy of the most recently agreed upon CBA for each union in a district. It is from these CBAs that I create a proxy for union strength.[3]

The Connecticut Department of Health and Human Services provides weekly level data on COVID-19 outcomes at the county, city, and even school district levels. The city and county-level data include information on both the number of new cases and deaths reported every weekday from March 2020 to the present. The school-district level data is aggregated across all of the schools within the district and only includes confirmed COVID-19 diagnoses of students and staff rather than the total population living within the district. To avoid day-of-the-week reporting biases in these data, I calculate a 7-day rolling average for each of the outcome variables before matching them over. A time series graph of the number of cases of (and deaths from) COVID-19 can be seen in Figure 1.

I also match in several demographic variables that the literature has identified as potentially important in determining variations in school reopenings. The Connecticut Secretary of State provides data on election outcomes at the school dis-

3. For more information, please see the Identification section.

Figure 1 — Rolling Average of COVID-19 Cases & Deaths in CT



trict level which allows me to calculate the share of votes in the 2020 election for the Democratic Presidential and Vice Presidential candidates Joe Biden and Kamala Harris. The Connecticut State Department of Public Health offers Annual Town and County Population for Connecticut. I couple this with information from the Land Area by Town dataset from CTData at Trinity College's Liberal Arts Action Lab.

Other basic demographic information is not yet available at the school district level. Thus, given that I have nearly two times as many cities identified within my main data frame as is available from the U.S. Census' American Community Survey's (ACS) Metropolitan Statistical Area, I rely upon the Geospatial Data Tools dataset from CTdata to act as a zip code-to-school district crosswalk. Thus, I gather ACS data on the median income, the percentage of the population aged 65 or older, and the share of the population that is white at the zip code level. I aggregate these to a town level and then match them into the primary data frame.

Finally, to address any spatial dependence in reopening decisions, I gather school district shape files offered by the University of Connecticut's Map and Geographic Information Center. I use the shape files to calculate both the geographic centroid and area of each district. The centroid information is used for later analysis for the calculation of each district's n-nearest neighbor(s).

3.1. Summary Statistics

Table 1 displays the statistics employed in the analyses which rely upon cross-sectional data. The dependent variable used in these cases is *Share Open* which aggregates the number of weeks in the school year that the school district offered in-person instruction. The average school district was open for 50% available weeks during the 2020-2021 school year. However, this is slightly misleading as the variable captures holiday weeks such as Thanksgiving, Winter Break, and Spring Break.

The second category variables in Table 1 contain those that proxy for teacher union strength. *Index* is a standardized index that measures teacher union strength by using a "bag-of-words approach" which measures the expansiveness of the contract as measured by the number of topics covered by the leave policies in the union's CBA. *CBA Pages* is my second measure of union strength. It measures the length of the contract as measured by the number of pages of content it contains. This variable is standardized as well to have a mean of zero and a standard deviation of one.

These two variables are added and then standardized again to construct the variable *Union Strength*. The *Strong Union* binary variable takes a value of one if the union is in the seventy-fifth percentile of *union Strength* and is equal to zero otherwise. *Renegotiate CBA* is a binary variable that measures whether the district's union was scheduled to renegotiate their CBA before the beginning of the 2020-2021 academic year.

The COVID-related outcome variable in this section represents the total number observed at the city level per capita. This number is multiplied by one hundred for

Table 1 — Summary Statistics: Cross-Sectional

Statistic	N	Mean	St. Dev.	Min	Max
School Openings					
Share Open	174	0.498	0.297	0	0.875
Teacher Union Strength					
Union Strength	174	0	1	−2.457	3.617
Index	174	0	1	−2.166	2.904
CBA Pages	174	0	1	−1.833	3.442
Strong Union	174	0.236	0.426	0	1
Renegotiate CBA	174	0.282	0.451	0	1
COVID Outcomes					
Cases (per capita)	174	13.983	4.973	1.516	30.058
Demographics					
Democrat Vote Share	174	0.561	0.119	0.333	0.866
Pop. Density (per 1k)	174	1.237	1.884	0.027	9.294
Median Income	174	9.310	3.309	3.711	23.252
% of Pop. 65+	174	0.186	0.057	0.073	0.551
White	174	0.853	0.140	0.325	1

ease of interoperability. In the 2020-2021 school year, the average school district saw approximately 14% of its population contract COVID.

The mean district vote share for the Democratic nominee for president in the 2020 election was 56%. The average school district has a population density of 1,237 people per square mile and a median household income of $93,100. The average school district has 18.6% of its population above the average retirement age with 83.6% of the districts' residents being white. There is substantial variation across each of these demographic variables.

Table 2 — Summary Statistics: Panel

Statistic	N	Mean	St. Dev.	Min	Max
School Openings					
Open	6,960	0.498	0.500	0	1
COVID Outcomes					
Cases (County)	6,960	150.979	177.664	1.857	790.714
Deaths (County)	6,960	1.939	2.480	0.000	10.286
Cases (City)	6,960	7.893	15.886	0.000	176.286
Deaths (City)	6,960	0.102	0.232	0.000	2.714
Cases (School)	5,922	0.522	1.119	0	16

Table 2 displays the statistics employed in the analyses which rely upon panel data. The dependent variable used in these cases is *Open* which is a binary variable indicating whether the school district offered in-person instruction that week. The COVID-related outcome variables in this section all represent the seven-day rolling averages for that geographic unit per week. Notably, the state government of Connecticut did not begin collecting and publishing data at the school district level until October 2020 which reduces the number of observations for this variable.

4 — Identification

4.1. Pages as a Proxy

One measure employed in this paper regarding teachers' unions' political power is the number of pages in their most recent collective bargaining agreement. This measure is appropriate in the context of the state of Connecticut where the law requires collective bargaining between unionized teachers and district school boards. These occur once every three to four years in the sample and are staggered by design to prevent each district from simultaneously negotiating its terms of employment.

A group of papers across published works in the Social Sciences use the number of pages within a document to proxy for different variables of interest. For example, Cochran III (2001) uses this measure to show that the volume of federally passed regulations increases in election years which have a complete turnover of the executive branch. De Rugy and Davies (2009) complement these findings by using a measure of regulation volume as a share of pages published which allows them to empirically account for the differences between administrations. Additionally, Coffey et al. (2012) examine the relationship between federal government activity and the performance of the Washington Redskins. They find a positive and robust relationship between the Redskins' winning percentage and bureaucratic output as measured by the number of pages published in the Federal Register.

Concerning teachers' unions, Hall et al. (2017) proxy for the restrictiveness of collective bargaining agreements with the number of pages per agreement – finding that collective bargaining strength is associated with lower high school math scores, but that the total effect is zero. Marianno et al. (2022) use the number of pages of the union's collective bargaining agreement to construct a measure of union strength in the context of analyzing reopening decisions during the COVID-19 pandemic.

4.2. CBA Text Analysis

Since there is no federal law either providing or prohibiting public sector employees from the right to bargain collectively, Connecticut's statutes guide school districts in the bargaining process with local teachers' unions. These statutes provide three main subjects of bargaining: mandatory, permissive, and illegal. Mandatory subjects of bargaining are those which relate to wages, hours, and conditions of employment such as salaries, leave provisions, and workload.

I chose to analyze the leave policies of each collective bargaining agreement to measure the expansiveness of each union's leave policy. This is done for purposes of more thorough identification as every district has a leave policy and the boundaries of its contents are clearly defined such that they do not naturally overlap with other sections. Wages and other conditions of employment often appear throughout the document in many different sections and are very laborious to properly identify as a result.

The inspiration and rationale for the selection of the topics identified within the leave policies come from Strunk and Reardon (2010) and McCannon et al. (2023). Strunk and Reardon create an advanced index that analyzes the degree to which the regulations within CBAs bind their members. One of the most commonly occurring measures they employ is the number of domains over which the union must consult with the administration. On the other hand, McCannon et al. measure the expansiveness of the topics covered within the contract. In the context of leave policies, each contract will contain information on sick leave and personal days, but expansive contracts will contain provisions covering family leave, military service, jury duty, etc.

Table 3 shows the terms used in the creation of my union strength index. *Bonuses* consist of topics that researchers have identified correlate positively with teacher union strength. Union and Entitlement-related topics capture the frequency with which the union is given discretionary authority. Leave, Religion, Professional, Mili-

Table 3 — Phrases Used in Construction of Union Strength Index

Bonuses		*Penalities*	
Union	Union, association, bargaining unit, president	**Penalty**	Penalty, penalties, failure, without pay
Parental Leave	Maternity, pregnancy, childbirth, child rearing, child-rearing paternity, parenthood, adoption	**Prohibit**	Shall not, prohibit, prohibited
Religion	Religion, religious leave, observance	**Late**	Tardiness, absenteeism
Professional	Professional, growth, sabbatical, career	**Authority**	Superintendent, the board
Military	Military, veterans, reserve, forces		
Unused	Accrued, unused, bank		
Entitlement	Entitled, shall, must, excused, with pay		
Vacation	Vacation, holiday		

tary, Unused and Vacation-related topics capture the expansiveness of the contract. On the other hand, *Penalties* consist of topics that are likely to correlate negatively with strength. Authority-related topics capture the frequency with which the union must defer to the Superintendent or school board for leave-related concerns. Penalties, Prohibitions, and phrases regarding being Late all represent constraints on union members' leave benefits.

$$Index_d = \frac{\frac{40}{52}\Sigma Bonus_d - \frac{12}{52}\Sigma Penalty_d}{\Sigma Sentences_d} \tag{1}$$

Equation 1 shows how the index is calculated. *Bonus* is equal to zero but takes a value of one each time a word or phrase within the left column of Table 3 appears with the district *d*'s CBA. The same is done for *Penalty*. I take the sum of each of these variables and then multiply it by the share of identified phrases for each category to equally weight bonuses and penalties. I then subtract the relative frequency of *Penalty* phrases from *Bonus* phrases and divide by the number of overall sentences in the leave policy to not penalize (reward) concise (discursive) CBAs.

4.3. CBA Renegotiations

Last, I identify school districts that renegotiated their CBA before the start of the 2020-2021 academic school year. As stated earlier, the law in the state of Connecticut requires collective bargaining between teacher's unions and district school boards. However, the timing of these renegotiations is exogenous to reopening decisions as they occur at pre-determined times. Because the state does not want to be in a position of having the employees of every district simultaneously negotiating their terms of employment, the timing of renegotiations occurs at fixed three to four-year intervals as determined by the founding year of the school district.

CBA negotiation timing has been identified as a legitimate source of exogenous variation for measuring the causal impacts of education-related outcomes. For example, Hoxby (1996) identifies the effect of teachers' unionization on district resources

and student learning outcomes by relying on exogenous differences in the timing of collective bargaining – showing that stronger unions reduce student performance through reduced competition and productivity. More recently, Biasi and Sarsons (2022) provides causal estimates of the effect of flexible pay for school teachers by leveraging differences in the timing of expiration of preexisting CBAs.

5 — Methods

5.1. Models for Cross-Sectional Data

Each of the empirical methods that I employ involve regression analysis using ordinary least squares (OLS). I have two main data sets that I analyze – one that is cross sectional and one that is panel. The estimating equations for the cross sectional models are as follows:

$$\text{Share Open}_d = \gamma_c + \delta_0(\text{Union Strength}_d) + \phi X_d + \epsilon_D \tag{2}$$

$$\begin{aligned}\text{Share Open}_d = \gamma_c + \delta_0(\text{Strong Union}_d) + \delta_1(\text{Negotiate}_d) + \\ \delta_2(\text{Strong Union}_d \times \text{Negotiate}_d) + \phi X_d + \epsilon_d\end{aligned} \tag{3}$$

where $d \in c$ as *d* represents each school district and *c* represents each county. *Share Open* and ϵ are $n \times 1$ vectors of the values of the outcome variable and the residuals, and X is an $d \times k$ matrix of *k* regressors.

Share Open in equations 2 and 3 represent the number of weeks of the school year that districts are open. *Union Strength* represents the standardized value of the sum of my two proxies for union strength which are the number of pages in a CBA and the index created by analyzing the expansiveness of the text in the leave policies in CBAs. *Strong Union* is a binary variable equal to one if the district's union is in the

top quartile of measured *Union Strength*. γ_c represents a county fixed effect while *X* represents a vector of control variables, namely the school district type (public school, charter, etc.).

5.2. Models for Spatial Analysis

Due to the geographic nature of the outcome variable, it is reasonable to suspect that spatial auto-correlation may be present. Spatial auto-correlation is formally defined as follows:

$$cov(y_i, y_j) = E(y_i, y_j) - E(y_i)E(y_j) \neq 0 \text{ for } i \neq j$$

where, y_i and y_j are observations of a variable at locations i and j across different districts. The subscripts i and j can refer to any combination of districts. Spatial auto-correlation can pose problems when using standard econometric techniques as regression parameter estimates will exhibit both bias and inconsistency in scenarios where the true data generating process (DGP) includes spatial dependence.

I employ spatial econometric techniques to account for not only the possibility of spatial dependence in the dependent variable, but also for situations in which there is spatial dependence in the independent variables and error terms. In order to begin this analysis, I construct a k-nearest neighbor weight matrix W by calculating the distance from each district's population centroid. Next, each centroid distance from spatial unit i to all units $j \neq i$ are ranked according to distance where $d_{ij(1)} \leq d_{ij(2)} \leq ...d_{ij(n-1)}$. This allows for the creation of the set $N_i(i) = \{j(1), ..., j(k)\}$ which contains the closest k units to i for each $k = 1, ..., n-1$.[4] Thus, the k-nearest neighbor weight matrix W has the takes the form:

$$W_{ij} = \begin{cases} 1 & \text{if } j \in N_k(i) \\ 0 & \text{if otherwise} \end{cases}$$

4. For simplicity, I ignore ties.

I calculate a spatial weight matrix using the five-nearest neighbors from each district's geographic centroid. This spatial weight matrix is used to help estimate three different types of spatial models I employ: the spatial Durbin model (SDM), SLX model and a spatial error model (SEM). These can be represented mathematically as follows:

$$\text{Share Open} = \rho W(\text{Share Open}) + X\beta\theta + \epsilon \quad \text{(SDM)}$$

$$\text{Share Open} = X\beta + WX\theta + \epsilon \quad \text{(SLX)}$$

$$\text{Share Open} = X\beta + u \quad \text{(SEM)}$$

$$u = \lambda W u + \epsilon$$

where W is an $d \times d$ spatial weight matrix, X is an $d \times k$ matrix of explanatory variables, β is a $k \times 1$ vector of regression coefficients, ϵ is an $d \times 1$ vector of independent and identically distributed random error terms. The SDM and SLX models contain θ parameters which represent spatially weighted explanatory variables and their respective coefficient estimates. The ρ and λ variables in the SDM and SEM models represent the degree of spatial auto-correlation present in the dependent variable and error term. Each is bound from negative one to one, where ρ or $\lambda = 1$ implies perfect spatial dependence.

5.3. Model for Panel Data

Given the unprecedentedly complicated nature of all that was occurring during the 2020-2021 school year coupled with daily COVID-19 cases data at a variety of geographic levels, I estimate a two-way fixed effects model in order to account for unobserved heterogeneity across both geographic units and time. The model is as follows:

$$\text{Open}_{dt} = \gamma_i + \lambda_t + \beta\text{Cases}_{it-1} + \epsilon_{it} \quad (4)$$

where $d \in i$ and $i \in \{\text{School, City, County}\}$. Thus, γ_i represents a school district, city or county fixed effect while λ_t represents a week fixed effect. *Open* is a binary variable indicting whether the school district was open that week and *Cases* represent the seven-day rolling average of new cases as the geographic level i during the prior week.[5]

6 — Results

6.1. Primary Analysis

I begin my analysis by plotting simple time series data in Figure 2. To do this, I compare the fraction of school districts that held in-person instruction for each week of the 2020-2021 academic school year to districts with strong teacher's unions (as measured by those in the top quartile of union strength) compared to other school districts.[6]

Figure 2 reveals that for every week of the academic school year from late August 2020 until late April 2021, school districts with stronger teacher's unions were less likely to offer in-person instruction. These results are particularly pronounced throughout the Fall semester where the districts with the strongest unions were only marginally more likely to have reopened in December than they were in August. The two school district types begin trending similarly to one another beginning in the Spring semester before converging at the beginning of May 2021.

I continue this analysis in Table 4 by examining the continuous measure of union strength. With no controls or fixed effects, model 1 of Table 4 reveals that a one standard deviation increase in teacher union strength reduces the probability of schools offering in-person instruction during the academic year by 4 percent. This result

5. Rather than use a probit or logit model given the binary nature of my dependent variable, I use OLS as it less likely to suffer from bias when using fixed-effects (Gomila, 2021).

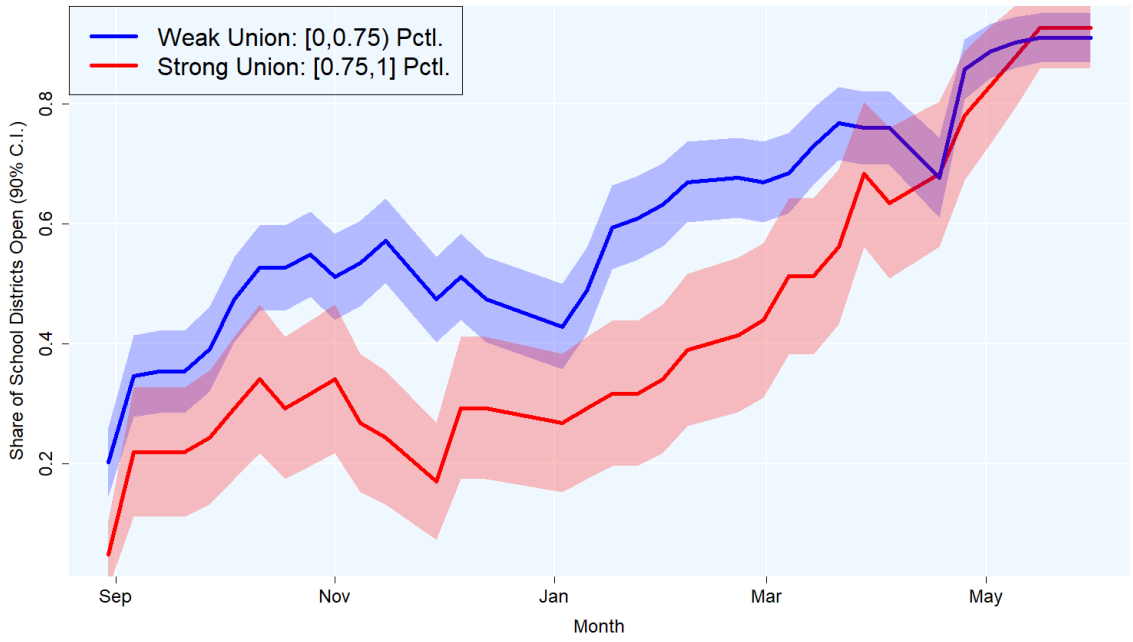
6. Weeks of the year where all school districts are closed such as Thanksgiving, Winter, and Spring break are omitted for presentational simplicity.

Table 4 — Union Strength & School Reopenings

Dependent Variable:	Share Open			
Model:	(1)	(2)	(3)	(4)
Variables				
Union Strength	-0.040*	-0.037*	-0.058***	
	(0.024)	(0.022)	(0.022)	
Strong Union				-0.136**
				(0.062)
Renegotiate CBA				-0.040
				(0.054)
Strong Union × Renegotiate CBA				-0.058
				(0.106)
Fixed-effects				
District Type		✓	✓	✓
County			✓	✓
Fit statistics				
R^2	0.018	0.092	0.208	0.124
Within R^2		0.015	0.034	0.049

Clustered (City) standard-errors in parentheses. n = 174
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*
The intercept is omitted from Model 1 for presentational simplicity.

Figure 2 — Teacher Union Strength & In-Person Schooling



is robust to controls for the type of school district (public schools, charter schools, technical schools) and county fixed effects. Model 3 shows that the effect increases to nearly 6 percent when comparing union strength across districts within the same county.

Model 4 of Table 4 examines the relationship between unions that are in the top quartile of union strength and whether the as-if random timing of their CBA renegotiation had any additive effect on the number of weeks of in-person instruction offered. While both the signs and the magnitudes of the coefficients testing for this hypothesis match my theoretical priors, the standard errors of these coefficients are sufficiently large enough to make the effect statistically indistinguishable from zero.

I explore the puzzling findings of the null result in Table 4 by including control variables which are important determinants of reopening decisions in other research. Table 5 shows these findings. Model 1 of this table shows that the effect of teacher

Table 5 — COVID Incidence, Partisanship & School Reopenings

Dependent Variable:	Share Open			
Model:	(1)	(2)	(3)	(4)
Variables				
Union Strength	-0.036	-0.029	-0.028	
	(0.024)	(0.025)	(0.025)	
Strong Union				-0.108
				(0.060)
Cases (per capita)	-0.020***	-0.023***	-0.021***	-0.021***
	(0.004)	(0.006)	(0.004)	(0.004)
Biden Vote Share		-0.481*	-0.529***	-0.616***
		(0.249)	(0.109)	(0.102)
Population Density		0.017	0.024	0.026
		(0.017)	(0.023)	(0.025)
Median Income			0.0005	0.0007
			(0.005)	(0.005)
65+ % of Pop.			0.462	0.514
			(0.595)	(0.586)
White			0.071	0.003
			(0.268)	(0.310)
Fixed-effects				
County	✓	✓	✓	✓
District Type	✓	✓	✓	✓
Fit statistics				
R^2	0.284	0.308	0.309	0.322
Within R^2	0.126	0.151	0.157	0.172

Clustered (City) standard-errors in parentheses. n = 174
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

union strength becomes statistically insignificant when controlling for the number of per capita COVID-19 cases at the city level. Models 2-4 continue to add control variables – revealing that the number of COVID-19 cases and the school district-level vote share for the Democratic presidential nominee in 2020 is a highly significant predictor of the number of weeks a school district offered in-person instruction. This later effect becomes particularly pronounced once accounts for income and race – suggesting an important interaction.

Figure 3 — Partisanship & In-Person Schooling

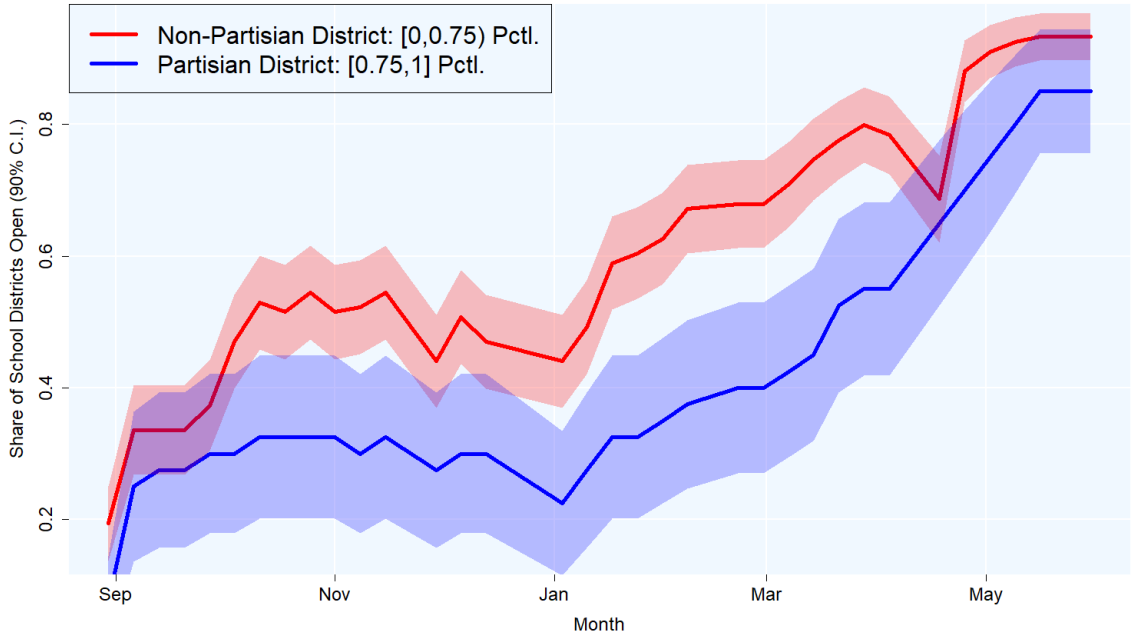


Figure 3 further explores the findings of Table 5 by plotting simple time series data which compares the fraction of school districts that held in-person instruction for districts with the most uniformly strong partisan support for Joe Biden compared to other school districts.[7] Once again, the effect remains that heavily partisan school districts remained significantly less likely to reopen. However, this time, the effects

7. Weeks of the year where all school districts are closed such as Thanksgiving, Winter, and Spring break are omitted for presentational simplicity.

persist longer and the differences are more pronounced.

6.2. Two-Way Fixed Effects Analysis

While Table 5 provides suggestive evidence that the local incidence of COVID-19 and partisan political attitudes were significant predictors of reopening decisions, I employ a two-way fixed effects model with weekly school district-level panel data to further examine the relationship between public health concerns and the likelihood of reopening schools. One major benefit of this kind of analysis is that two-way fixed effect models are far better equipped to account for unobservable factors that are specific to the school district, city, or county or vary over time.

Table 6 shows the results of this analysis. Model 1 uses both week and city fixed effects to analyze how within-school district-level variation in the local incidence of COVID-19 affected the likelihood of the school being open one week later. I find no evidence in support of this hypothesis in this model. However, this very well could be because this data begins at a later period than the other data sources – crucially beginning in October which is before the beginning of the second major wave of cases. Further, this variable only measures the number of confirmed cases of students and staff of the school district. These individuals are far less likely to be at high risk of hospitalization than the general population.

Model 2 of Table 6 analyzes the local incidence of COVID-19 at the city level. I document significant results. The coefficient from this model suggests that an increase of ten COVID-19 diagnoses per week reduces the likelihood of the school district offering in-person classes by 2 percent. Notably, no such effect is found at the county level. This is likely due to the relatively few counties in Connecticut. With only eight counties across the whole state, there are almost twenty-two school districts in each county. These results suggest that county-level analyses may be an inappropriate unit of analysis for answering this question.

Table 6 — Two-Way Fixed Effect Model: COVID Incidence and School Openings

Dependent Variable:	Open		
Model:	(1)	(2)	(3)
Variables			
Cases (School)$_{t-1}$	-0.000		
	(0.006)		
Cases (City)$_{t-1}$		-0.002**	
		(0.001)	
Cases (County)$_{t-1}$			0.000
			(0.001)
Fixed-effects			
School District	✓		
City		✓	
County			✓
Week	✓	✓	✓
Fit statistics			
Observations	5,051	5,936	6,082
R^2	0.640	0.578	0.312
Within R^2	0.001	0.001	0.000

*Clustered (School) standard-errors in parentheses in Model 1. Clustered (City) standard-errors in parentheses in Model 2. Clustered (County) standard-errors in parentheses in Model 3. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

6.3. Spatial Analysis

Models 1, 2 and 3 in Table 7 employ spatial regressions in order to address any spatial dependence which might be driving the results. Model 1 uses a spatial Durbin model (SDM) which tests for, and corrects, spatial relationships in the dependent variable. The value of ρ which is reported below this model represents the degree of the spatial dependence of the dependent variable. It is negative and statistically insignificant. Models 2 and 3 use a SLX regression and a spatial error model (SEM). These function similarly to the SDM, but instead focuses on the spatial spillovers onto the independent variables and error terms respectively. λ under Model 3 represents the degree of spatial dependence in the error term. It is negative and statistically insignificant.[8]

7 — Conclusion

This paper examines the relationship between teacher union strength and school reopening decisions. While I find evidence that school districts with stronger unions were significantly less likely to offer in-person instruction throughout the 2020-2021 academic school year, this effect disappears when accounting for the local incidence of COVID-19.

These findings stand in contrast with the consensus in the literature – that it was unions and political attitudes, not COVID-19, that prevented schools from reopening. While I find evidence for the latter, this paper rejects the former.

There are many reasons why these differences might emerge. One first reason may be the measurement of "reopenings". The majority of the research done thus far whose findings conflict with mine focus only on the initial decision to reopen in August and September whereas I analyze the entirety of the academic year. Second,

8. Each of the indirect effects (often referred to as the spatial lag coefficients) estimated from Models 1-3 are not reported in order to preserve space. Each are statistically insignificant.

Table 7 — Spacial Analysis: COVID Incidence and School Openings

Dependent Variable:	Share Open		
Model:	(1)	(2)	(3)
	SDM	SLX	SEM
Variables			
Strong Union	-0.132*	-0.132	-0.108
	(0.06)	(0.08)	(0.06)
Cases (per capita)	-0.012**	-0.003	-0.021***
	(0.004)	(0.012)	(0.004)
Biden Vote Share	-0.287*	0.065	-0.638***
	(0.168)	(0.24)	(0.097)
Population Density	0.03	0.03	0.026
	(0.029)	(0.029)	(0.025)
Median Income	-0.008	-0.009	0.001
	(0.005)	(0.006)	(0.005)
65+ % of Pop.	0.419	0.273	0.523
	(0.826)	(1.032)	(0.571)
White	0.002	0.002	0.003
	(0.437)	(0.546)	(0.302)
Fixed-effects			
District Type	✓	✓	✓
Fit statistics			
ρ	-0.113		
λ			-0.062
R^2		0.376	

*n = 174. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

many studies are reliant upon data at the county level when these decisions are being made at the school district level. I too find null results concerning county-level variation in the number of COVID-19 cases, but this is much more likely because there are nearly twenty-two school districts per county than it is representative of a true null effect. Last, much other research focuses on large school districts for which there is available data. While this likely helps the generalizability of their findings across states, it suffers from generalizability within state bias as rural districts are unobservable. This is likely an important factor to consider given the growing consensus in support of partisan differences across rural and urban communities.

I suspect that the results of this paper are generalizable given the relatively mild teacher union strength within the state (compared to others). This fact, coupled with the similarity of my findings with other recent research (Houston and Steinberg, 2022; Christian et al., 2022) underlines the importance of both more granular data and longer time horizons for analysis. This study helps reveal (with the benefit of hindsight) that the initial reopening decisions in the Fall of 2020 were likely endogenous concerning the wave of COVID-19 cases and deaths that followed.

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A — Additional Tables & Figures

Figure A1 — Number of Votes and Democratic Vote Share