Did Big Pharma Influence the Adoption of COVID Vaccine Mandates?

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Abstract

The paper examines whether pharmaceutical companies directly lobbied U.S. state lawmakers for their votes on COVID vaccine legislations. I find that state legislators who received campaign contributions from pharmaceutical companies are not more likely to vote in favor of those companies on the vaccine mandates. Prior field experiments have shown that campaign contributions buy access, and the U.S. pharmaceutical industry has directly influenced key state referenda on drug pricing and regulation reforms with its political contributions. While Democrats have mainly voted for vaccine mandates, it can be quite costly for Republicans to do the same. Journalists find that the industry remained largely in the background of the controversial vaccine mandate policies and relied primarily on third-party organizations to advance its agenda. The findings of this paper seem to provide evidence for this observation.

1 Introduction

Existing work that examines the influence of campaign contributions on roll call votes finds mixed results. Ansolabehere et al. (2003) find scant evidence that campaign contributions affect roll call voting at the federal level, while Bonica (2018) finds a positive relationship between campaign contributions and

roll call votes. By controlling for state lawmakers' characteristics and those of their electoral districts in a micro dataset, I study the issue by examining the relationship between pharmaceutical companies' campaign contributions and state legislators' votes on COVID vaccine legislations. While the lack of positive results in much of the existing work may be due to how costly it is to lobby lawmakers for roll call votes, the potential revenue from the COVID vaccines may provide enough incentive for pharmaceutical companies to do so. On the other hand, the strong politicization of COVID vaccines can further increase the cost of influencing lawmakers. I find no evidence supporting the argument that there is a positive relationship between campaign contributions and roll call votes.

In addition to providing new evidence on the effect of political contributions, understanding how political spending by pharmaceutical companies shapes health policy can also inform discussions on how to keep the influence of industry on U.S. health policy in check. Corporations are known to influence legislation with campaign contributions and lobbying in the U.S. This is especially true for the pharmaceutical industry. From 1999 to 2018, pharmaceutical companies in the country spent $4.7 billion on those activities. They target senior lawmakers in Congress involved in drafting health care laws and state committees that opposed or supported key referenda on drug pricing and regulation (Wouters, 2020).

State-level COVID vaccine legislation presents an opportunity to study the relationship at a different level of government. Merck had a huge influence on the adoption of the HPV vaccine mandates (Mello et al., 2012). COVID vaccine mandates can lead to more vaccine uptake (Karaivanov et al., 2022). As a result, pharmaceutical companies have an incentive to encourage the adoption of vaccine mandates and to oppose bans on vaccine mandates to increase their sales. With data from Vote Smart, the U.S. Census Bureau, the National Public Service for Legislative Tracking, and the National Institute on Money in State Politics, I construct a cross-sectional microdata set that has information on campaign contributions that state lawmakers received, their roll call votes on COVID vaccine legislations, and their individual and constituent

characteristics. Following Gokcekus et al. (2006), I control lawmakers' legislative preferences to study the relationship between pharmaceutical companies' campaign contributions and state legislators' votes on COVID vaccine bills.

I find no significant correlation between receiving contributions from pharmaceutical companies and voting for those companies. This shows that state lawmakers are not more likely to vote in favor of pharmaceutical companies if they receive contributions from those companies. Existing work on information lobbying finds that interest groups use a low amount of political contributions to buy access to lawmakers to lobby them later (Stratmann, 2017). The public discourse on the COVID vaccine mandates is heavily politicized. While it may be common for Democrats to vote for vaccine mandates, it can be extremely costly for Republicans to do the same. Fang (2023) documented how pharmaceutical companies paid third-party groups to advocate for them on vaccine mandates while remaining largely in the background. The insignificant results suggest that pharmaceutical companies likely did not use their lobbyists to change lawmakers' votes on the bills passed in those legislatures. Instead, those companies may have relied more on third-party organizations to push their agenda.

2 Background

2.1 The COVID Vaccine Mandates in the U.S.

In the US, only state governments have the power to issue vaccine mandates or bans. Bans or mandates can be issued by governors through executive orders. Public health officers, which are usually appointed by governors, also have the authority to issue mandates. State lawmakers can pass legislations to restrict or mandate vaccines as well. A list of bills in all states with such legislations can be found in Table 1.

For adults, there are two broad types of mandates: employer mandates (private or public) and proof of vaccination (regulations regarding a centralized system to show proof of vaccination). In November 2021, the administration

put a federal private employer mandate in place through OSHA. Described as a workaround, the order was withdrawn in February 2022.

Only Pfizer, Moderna, and Johnson&Johnson manufacture FDA-approved COVID vaccines. Since Moderna and its subsidiaries did not make contributions at the state level, I include only campaign contributions from Pfizer, Johnson&Johnson, and the Biotechnology Innovation Organization (BIO), a trade group for pharmaceutical companies.

Table 1: States and Bills

	Year passed	
	(1)	(2)
States&Bills	2021	2022
Alabama	SB267, SB9	
Arizona	SB1824	HB2498, SB1346
Arkansas	HB1547, SB615, SB739	
Connecticut		HB5047
Florida	HB1B, SB2006	
Georgia		SB345
Indiana	HB1405	HB1001
Iowa	HF889	
Kansas	HB2001, SB159	
Michigan	SB82	HB5783
Mississippi		HB1509
Missouri	HB271	HB1606
Montana	HB702	
Nebraska		LB906
New Hampshire	HB220	HB1455, HB1495, HB1604
North Dakota	HB1465, HB1511	
South Carolina		H3126, H5150
Tennessee	HB13, SB858, SB9014	SB1823, SB1982
Texas	SB968	
Utah	HB308, SB2004	HB63
West Virginia	HB335, HB4012	

2.2 Theoretical Framework

Ansolabehere et al. (2003) point out that the relatively small amount of campaign contributions may be used to buy access to lawmakers for information lobbying. Kalla and Broockman (2016) find senior lawmakers in the U.S. Congress are 3 to 4 times more likely to make themselves available to their donors with a field experiment. A large body of literature examines how campaign contributions are used to secure access for lobbying. According to the access theory, interest groups make a small amount of campaign contributions to buy access to politicians so that those interest groups can lobby them later. Lohmann (1995) theorize that interest groups pay a strictly positive monetary contribution to a policymaker who has conflicting interests to make their messages credible. Austen-Smith (1995) presents a mechanism in which interest groups make fewer campaign contributions to lawmakers with similar preferences for policy in the lobbying process.

Stratmann (2017) suggests that political contributions mainly influence the early stages of the legislative process rather than roll call votes in the final stage. Because of the publicity revolving around the process of roll call votes, publicly voting for special interest groups against the wishes of constituents can seriously harm lawmakers' chances of reelection. Yet, on certain issues, studies have found campaign contributions to be positively correlated with roll call votes. For instance, Gokcekus et al. (2006) find that federal lawmakers who received campaign contributions from the pharmaceutical industry tend to vote for the industry on the drug re-importation bill. Although most of the lobbying activities likely occur at the early stages of the legislative process, interest groups may also lobby lawmakers whom they have access to for their roll call votes. With hundreds of billions of dollars at stake, it is plausible that pharmaceutical companies may try to influence how state lawmakers vote.

Although Ansolabehere et al. (2003) rejects the idea that campaign contributions may affect lawmakers' roll call votes using data from the federal level, more recent work such as Mian et al. (2010) and Bonica (2018) does find a positive relationship between campaign contributions and roll call votes. Despite a relatively small body of literature examining the relationship at the

state level, there is still disagreement among existing work studying the issue. Cann (2007) find that elected judges tend to rule in favor of their donors, while Dow and Endersby (1994) show that lawmakers do not vote in favor of special interest groups that contribute more funding to them.

3 Data and Methodology

3.1 Data

The cross-sectional micro dataset contains information about each state legislator's vote on COVID vaccine bills, their campaign finances in their most recent election, and their individual and electoral district characteristics in 21 U.S. states. To construct the dataset, I obtain data from multiple different sources. Roth (2022) compiled a list of COVID vaccine legislations in all U.S. states. Legislations on COVID vaccine mandates are divided into two categories: employer mandates (private and state) and proof of vaccination by the author. Based on that list, I retrieve the voting records on those bills from the National Public Service for Legislative Tracking and Data API (Legiscan, 2022). The database has all legislators' voting records on bills in 50 U.S. state legislatures. Data on the campaign financing of lawmakers are retrieved from National Institute on Money in State Politics (2022). The non-profit organization maintains a database of campaign finance data at the state level compiled from candidates' campaign filing records. The data contains legislators' campaign finance information in their most recent election between 2017 and 2020 in 21 U.S. states.

Data on the most recent legislative elections are retrieved from Ballotpedia (2022). The online political encyclopedia covers federal, state, and local politics, elections, and public policy in the United States. For lawmakers' characteristics, I scrap data from Vote Smart (2022). The research organization collects and distributes information on candidates for public office in the United States. Data on the characteristics of electoral districts are retrieved from U.S. Census Bureau (2023). The dataset is composed using data from the American

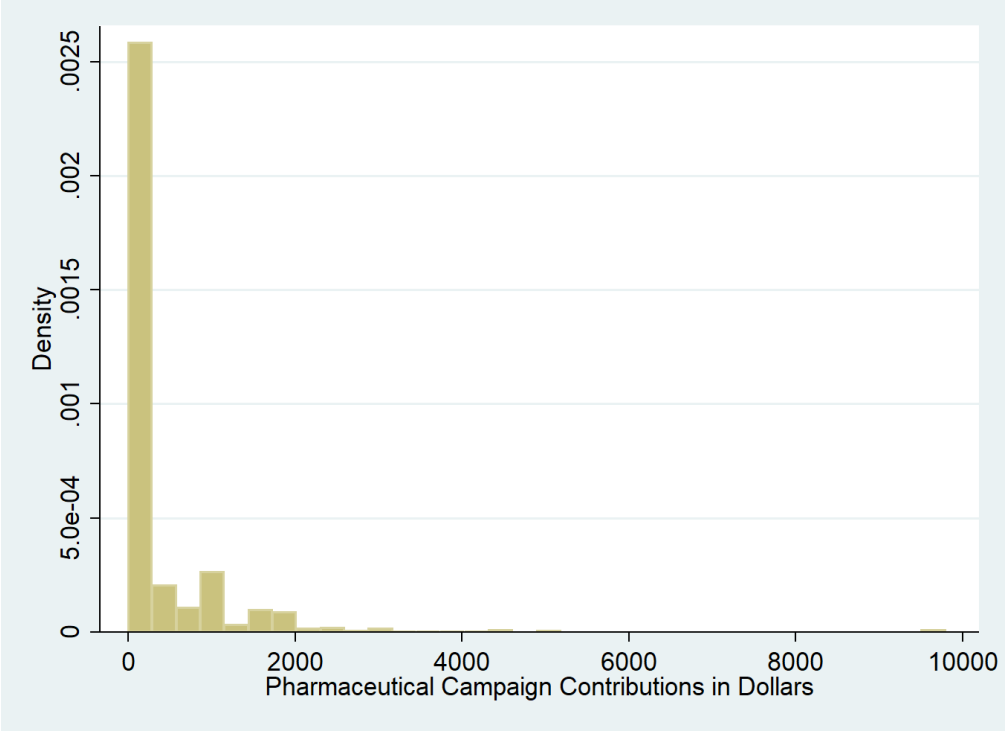
Community Survey. The response rate of the survey is about 80%.

I only include bills that were passed in the legislature. And those bills are mostly bans. Many COVID vaccine mandates or bans were issued via executive orders or public health orders. Some COVID vaccine legislation was killed in the committee or in one chamber of the legislature, while other COVID vaccine mandates or bans were shelved. Contributions made by C4 or C5 non-profit organizations, known as dark money, cannot be tracked. Fang (2021) reported that dark money was being funneled through the Biotechnology Innovation Group in the 2020 election cycle by Pfizer, Moderna, Johnson&Johnson, and other pharmaceutical companies.

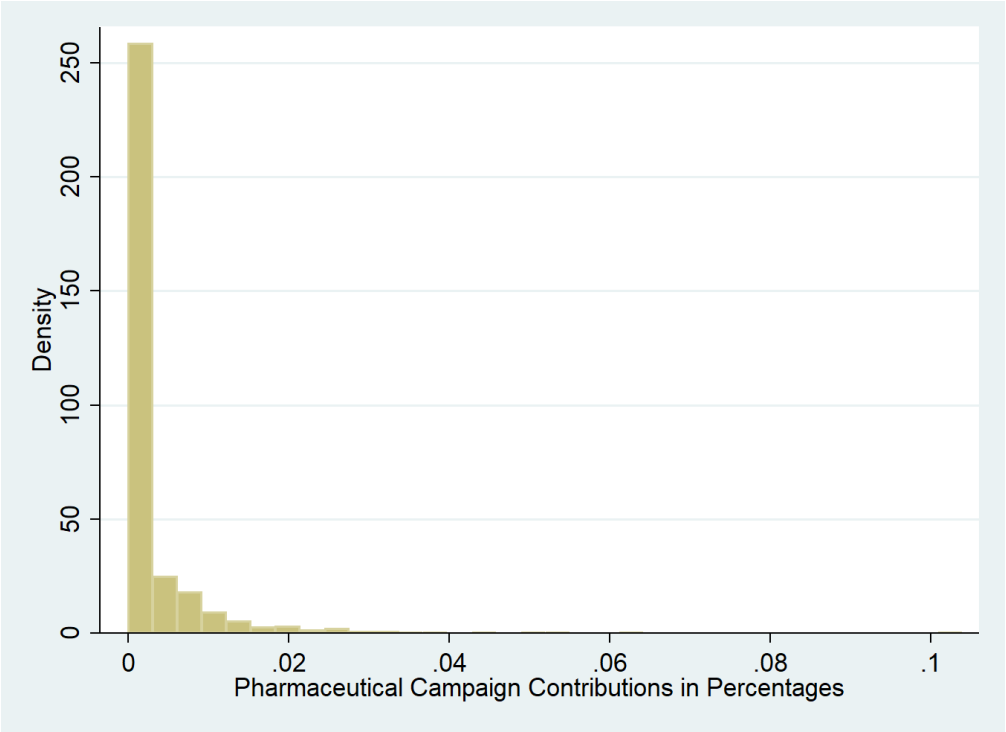
3.2 Summary Statistics

Table 2 summarizes the variables in the dataset. The state legislators in those 21 states are mostly Republicans and most lawmakers voted against pharmaceutical companies. A higher proportion of those who received campaign contributions from pharmaceutical companies voted in the companies' favor. All but one legislation are bans or restrictions on vaccine mandates. Most legislators were incumbents. Only the state houses of Arizona, New Hampshire, North Dakota, and West Virginia are made up of multiple-seat districts. The numbers of state representatives and senators who received contributions from the pharmaceutical companies were close.

Lawmakers who received campaign funds from pharmaceutical companies also received higher total contributions overall. Additionally, their opponents in the preceding election raised more money. This suggests that pharmaceutical companies likely bought access to lawmakers with relatively small contributions. Figure 1 shows the distribution of campaign contributions from pharmaceutical companies. While most lawmakers received no contributions from these companies, up to 10% of some lawmakers' total contributions came from them. Lastly, the characteristics of the legislators and their constituents are similar across both groups.



(a) Contributions in Dollars



(b) Contributions in Percentages

Figure 1: Distribution of Campaign Contributions from Pharmaceutical Companies

Table 2: Summary Statistics

Variables	(1) No pharma contribution	(2) Received pharma contribution	(3) Total
% voted against mandates	82.7	87.8	83.4
% of Republicans	70.9	80.8	73.7
% of state representatives	72.4	43.5	63.5
% of incumbents	74.8	87.3	78.3
% of male	77.1	77.8	77.3
% married	97.2	96.7	97.1
% with bachelor's degree or above	85.3	89.0	86.4
% with no committee assignment	25.1	30.4	26.6
% with no children	15.0	11.2	13.9
% in single-seat districts	94.2	92.9	93.8
% of male constituents	49.0	49.2	49.1
% of married household among constituents	49.7	51.5	50.2
% Constituents with (mean) bachelor's degree or above	29.3	30.2	29.5
Median age (mean) of constituents	39.6	39.5	39.6
Income of constituents (mean)	$81078	$84134	$81936
Labor force participation (mean) rate among constituents	61.2%	62.1%	61.5%
Unemployment rate (mean) among constituents	3.1%	2.9%	3.0%
Campaign contributions (Mean) from individuals	$45,648	$84,003	$56,413
Pharma (Mean) campaign contributions	$0	$1,196	$336
Total (Mean) contribution received	$147,869	$291,976	$188,315
Spending (Mean) by opponents	$85,445	$111,568	$ 92,776
Obs	**2,240**	**874**	**3,114**

3.3 Methodology

Denzau and Munger (1986) find that interest groups generally seek out legislators whose voters are indifferent to the policy that interest groups seek. Austen-Smith (1995) proposes that legislators will be willing to grant access to interest groups whose preferences over consequences are sufficiently close to theirs independent of financial incentives. Lohmann (1995) demonstrates a mechanism in which interest groups are forced to make a strictly positive contribution to buy access from legislators who have different policy preferences. Pharmaceutical companies may likely not need to buy access from lawmakers who want the same policy. The legislators who have the same policy preference as the pharmaceutical companies would have voted for mandates regardless of contributions. So not controlling for lawmakers' preferences can potentially bias the results.

To address the concern that lawmakers' legislative preferences may be correlated with contributions from pharmaceutical companies, I control the characteristics of lawmakers and those of their constituents. In addition to a legislator's ideology, which can be approximated by their political affiliation and personal characteristics, a lawmaker also needs to cater to the preferences of their constituents. As shown in the following equation,

$$Y_{isl} = \alpha_0 + \alpha_1 Contribution_{is} + \gamma X_{is} + State_s + \epsilon_{isl} \tag{1}$$

Subscripts i, s, and l represent the legislator, the state, and the legislation, respectively. Y_{isl} is equal to 1 if a legislator voted for the pharmaceutical companies (voting nay for a ban or voting yea for a mandate) on COVID vaccine legislations and 0 in other cases. $Contribution_{is}$ is a dummy variable that is equal to 1 if a state lawmaker received positive contributions from pharmaceutical companies and 0 otherwise. X_{is} is a vector of control variables. It includes the number of seats, average income, the percentage of people holding a bachelor's degree or higher, the percentage of married households, the percentage of males, the labor force participation rate, the unemployment rate,

and the median age in a district. It also includes proportions of individual contributions, total contributions received by the officeholder, total contributions received by opponents, the year when a bill is passed, the year of the preceding election, political affiliation, the gender and education level of lawmakers, their committee assignment, whether they have children, and the chamber of the legislature in which they serve. $State_s$ is the state-fixed effect. ϵ_{isl} is the error term.

4 Results

4.1 Main Results

I examine the effect of pharmaceutical companies' campaign contributions on lawmakers' roll call votes and report the results in Table 3. The sample in column 1 contains all legislations related to COVID vaccine mandates, while the samples in columns 2 and 3 contain only legislations related to employer mandates and proof of vaccination respectively. No significant results can be observed in any column.

The relatively small amount of contributions from pharmaceutical companies is not enough to buy lawmakers' votes. However, as shown in Kalla and Broockman (2016), the companies' contributions can certainly buy access. Journalists find that the pharmaceutical industry remained largely in the background on these controversial mandate policies, which faced opposition from a broad array of civil libertarians, labor unions, and community-based groups. Instead, the industry mobilized support for the mandates through third-party organizations to which it typically provided financial support. For instance, Pfizer quietly financed consumer, medical, and civil rights groups to create the appearance of broad support for the mandate (Fang, 2023). The industry likely noticed that showing support for vaccine mandates in roll call votes publicly is costly for Republican lawmakers. The lack of positive results suggests that pharmaceutical companies likely did not directly send their lobbyists after state lawmakers to affect their roll call votes.

Table 3: Main Results

Dependent variable: Votes on mandates			
Variables	(1) All bills	(2) Employer mandates	(3) Proof of vaccination
Received pharmaceutical contributions	-0.011 (0.012)	0.012 (0.016)	-0.030* (0.017)
Observations	3,114	1,937	1,757
R-squared	0.453	0.524	0.381
No. of States	21	18	19

Note: The dependent variable is equal to 1 if a lawmaker voted nay for a ban or yea for a mandate and 0 otherwise. The measure of pharmaceutical contributions is a dummy that is equal to 1 if a lawmaker received funds from those companies and 0 otherwise. Results in all columns control for political affiliation, chamber of the legislature sex, education level, marriage status, current role in the legislature, the number of children of a lawmaker, no. of seats, median income, education level, the proportion of males, the proportion of married households, the labor force participation rate, and the unemployment rate in a district, individual contributions, the year when a bill is passed, the total contribution received by the officeholder, election year, and the total spending by opponents. State-fixed effects are also included in all columns.
***p<0.01, ** p<0.05, * p<0.1

4.2 Robustness Checks

There are some identification concerns. OLS models may yield less accurate estimates than logit models. To control for district and lawmaker characteristics, I have to discard up to 50% of the observations. In this section, I will use the logit models, use the full sample, and try different continuous measures of contributions from pharmaceutical companies. The results can be found in Table 4.

In the second column, I run the regression with a logit model. In column 3, I included no district or lawmaker characteristics to make use of the full sample.

In column 4, I measure the contributions from pharmaceutical companies as percentages of total contributions. In the last column, pharmaceutical companies' contribution is measured in thousands of dollars.

As shown in column 2 of Table 4, I still find contributions from pharmaceutical companies to have no positive and significant relationship with state lawmakers' roll call votes with the logit model. The result remains unchanged when I drop all the district and lawmaker controls and use the full sample. Lastly, with different measures of campaign contributions in the last two columns, I still find no positive and significant results. In all, the results are robust to various specifications.

The lack of significant results may be due to the large number of small contributions from pharmaceutical companies. To explore this further, I analyze how lawmakers who received sizable contributions from pharmaceutical companies voted on vaccine mandates, as shown in Table 5. In the first column, I include only lawmakers who received at least $1500 from pharmaceutical companies, representing the 75th percentile of non-zero contributions. In the second column, I restrict the sample to lawmakers whose contributions from pharmaceutical companies account for at least 1% of their total campaign contributions, also representing the 75th percentile of non-zero contributions. Despite these restrictions, I still find no significant results in the first two columns.

In the last two columns, I code contributions from pharmaceutical companies as categorical variables. Based on the measure of campaign contributions from pharmaceutical companies, in dollars or as a percentage of the total contribution, I categorize the contributions as follows: 0 for no contributions, contributions between 0 and the 25th percentile ($500 or 0.3%) of nonzero pharmaceutical contributions are coded as 1 (low); contributions between the 25th and 75th percentiles ($1500 or 1%) are coded as 2 (medium); and contributions greater than the 75th percentile are coded as 3 (high). Despite this categorization, the results in the last two columns remain insignificant, except for the medium contribution in column 4. However, the negative and significant result disappears when using the Logit model in Table 11. These results suggest

that receiving a significantly larger amount of campaign contributions does not make a recipient more likely to vote in favor of those companies.

Table 4: Robustness Checks

Dependent variable: Votes on mandates					
	(1)	(2)	(3)	(4)	(5)
Variables	Baseline	Logit model	No covariates	Relative contribution	Contribution in thousands of $
Received pharmaceutical contributions	-0.011	0.041	0.005		
	(0.012)	(0.189)	(0.011)		
Pharmaceutical contribution in percentage				-0.122	
				(0.876)	
Pharmaceutical contributions in thousand dollars					-0.010
					(0.007)
Observations	3,114	3,105	6,209	3,114	3,114
R-squared	0.453		0.525	0.439	0.454

Note: The dependent variable is equal to 1 if a lawmaker voted nay for a ban or yea for a mandate and 0 otherwise. In columns 1 to 3, the measure of pharmaceutical contributions is a dummy that is equal to 1 if a lawmaker received funds from those companies and 0 otherwise. In columns 4 and 5, pharmaceutical contributions are measured in percentages and thousands of dollars respectively. Results in all columns except column 3 control for political affiliation, chamber of the legislature, sex, education level, marriage status, current role in the legislature, the number of children of a lawmaker, no. of seats, median income, education level, the proportion of males, the proportion of married households, the labor force participation rate, and the unemployment rate in a district, election year, the year when a bill is passed, individual contributions, and the total contribution received by the officeholder in the previous elections. State-fixed effects are also controlled in all columns.
***p<0.01, ** p<0.05, * p<0.1

Table 5: Lawmakers with Sizable Pharmaceutical Contributions

Dependent variable: Votes on mandates				
	Large pharmaceutical contribution		Categorical pharmaceutical contributions	
Variables	(1) Received > $1.5k from pharmaceutical companies	(2) > 1% campaign funds from pharmaceutical companies	(3) Converted from dollar contributions	(4) Converted from percentage contributions
Dollar pharmaceutical contributions	-0.004			
	(0.014)			
Percentage pharmaceutical contributions		-1.278		
		(1.978)		
Low (dollars)			0.007	
			(0.020)	
Medium (dollars)			-0.021	
			(0.015)	
High (dollars)			-0.010	
			(0.023)	
Low (percentages)				-0.002
				(0.021)
Medium (percentages)				-0.034**
				(0.016)
High (percentages)				0.018
				(0.021)
Observations	182	215	3,114	3,114
R-squared	0.500	0.581	0.454	0.454

Note: The dependent variable is equal to 1 if a lawmaker voted nay for a ban or yea for a mandate and 0 otherwise. The measure of pharmaceutical company contributions is in thousands of dollars in column 1 and in percentages in column 2. The sample in the first two columns includes only lawmakers who received pharmaceutical company contributions greater than the 75th percentile of nonzero contributions from pharmaceutical companies. In the last two columns, pharmaceutical company contributions are coded as categorical variables: 0 for no contributions, 1 (low) for contributions between 0 and the 25th percentile ($500 or 0.3%), 2 (medium) for contributions between the 25th and 75th percentiles ($1500 or 1%), and 3 (high) for contributions above the 75th percentile. Results in all columns control for the same covariates as in Table 3. State-fixed effects are also controlled in all columns. *** p<0.01, ** p<0.05, * p<0.1

5 The Heterogeneous Effects of Contributions

5.1 Political Affiliations and Chambers of Legislatures

The COVID vaccines and the COVID vaccine mandates have been highly politicized in the U.S. While President Trump took credit for the COVID vaccine rollout and rejected vaccine mandates, the Democrats first questioned the safety and efficacy of the vaccines before the election only to actively push for vaccine mandates when President Biden took office. It is rather obvious that the Democrats are largely and strongly for vaccine mandates. Therefore, according to the information lobbying model, pharmaceutical companies should not exert much effort to lobby Democrats who have similar preferences for policy. Splitting the sample by party affiliations allows me to examine the effects of pharmaceutical companies' contributions on lawmakers with different preferences. I split the full sample containing all bills by political affiliations, and report the results of the analysis in Table 6. As shown in columns 1 and 2 of Table 6, no positive and significant results can be observed in either column.

Since the introduction of term limits in state legislatures, Kousser (2005) have found that representatives of state houses tend to rely more on lobbyists for information compared to their state senate counterparts. According to Kousser (2005), the reason behind the phenomenon is the difference in term lengths between the two chambers. Generally, state senates have a 4-year term and state houses have a 2-year term. State houses are generally filled with newly elected lawmakers and state representatives tend to move into state senates as they become more experienced and hit their term limits. As a result, state representatives and their staff are usually less experienced than their senate counterparts in acquiring information for legislation. The result is state representatives rely on lobbyists more for information than senators. That means state representatives should be more responsive to lobbying than their senate counterparts who have more alternative channels to acquire information. In columns 3 and 4 of Table 6, I split the sample by the chamber of the legislature. I still observe no significant results in any of the columns.

Table 6: Political Affiliation and Chambers of the Legislature

Dependent variable: Votes on mandates				
	Party		Chamber	
	(1)	(2)	(3)	(4)
Variables	Democrat	Republican	House	Senate
Received pharmaceutical contributions	0.030	0.003	-0.012	-0.023
	(0.037)	(0.009)	(0.017)	(0.019)
Observations	816	2,299	1,978	1,140
R-squared	0.492	0.082	0.434	0.515

Note: The full sample includes all bills and is split by party lines and chamber of the legislature. The dependent variable is equal to 1 if a lawmaker voted nay for a ban or yea for a mandate and 0 otherwise. The measure of Big Pharma contributions is a dummy that is equal to 1 if a lawmaker received funds from those companies and 0 otherwise. Results in all columns control for the same covariates as in Table 3. State-fixed effects are also controlled in all columns.
*** p<0.01, ** p<0.05, * p<0.1

5.2 Chronic Conditions and Aging Society

Gallo Marin et al. (2021) find that preexisting comorbidities and old age are strongly correlated with the severity of COVID. The U.S. population is neither healthy nor young. That is especially true for the states with COVID vaccine legislations. See Table 7 for the percentage of the population with multiple chronic conditions (MCC)[1] and the percentage of the population aged 65 or above in those states. It is possible that lawmakers in states with a larger proportion of at-risk populations may be more interested in information about the vaccines' efficacy and respond more positively to pharmaceutical companies' pro-mandate messaging.

To determine if legislators are susceptible to pharmaceutical companies'

[1]An individual considered to have MCC if they reported having 2 or more of the 12 chronic conditions: arthritis, asthma, cancer, chronic obstructive pulmonary disease (COPD), depression, diabetes, heart disease, high blood pressure, high cholesterol, kidney disease, obesity, stroke

lobbying, I split the sample by the percentage of the population with chronic conditions and by the percentage of the population aged 65 or above. Information on chronic conditions comes from Newman et al. (2020). Data on the proportion of seniors is obtained from the Population Reference Bureau. I report the results in Table 8. The sample in column 1 is made up of states where less than 50.8% (50th percentile) of the population have MCC, and no significant effects can be observed. The result for the states where over 50.8% of the population have MCC is shown in column 2, I still observe no significant effects.

I then split the full sample by the median of the percentage of the population aged 65 or above (17.7%) and report the results in columns 3 and 4 respectively. I find no significant effects in either sample. Results in the table indicate no sign of pharmaceutical companies sending their lobbyists directly to lawmakers to change their votes.

Table 7: Chronic Conditions and Seniors

States	(1) % Population with multiple chronic conditions	(2) % Population aged 65 or cbove
Alabama	60.1	17.8
Arizona	50.3	18.5
Arkansas	60.5	17.7
Connecticut	47.7	18.2
Florida	50.4	21.3
Georgia	48	14.7
Indiana	55.7	16.5
Iowa	51.8	17.9
Kansas	50.8	16.8
Michigan	56.7	18.2
Mississippi	57.1	16.9
Missouri	52.9	17.7
Montana	48	19.7
Nebraska	50.1	16.5
New Hampshire	49.4	19.3
North Dakota	50.2	16.1
South Carolina	54.4	18.7
Tennessee	54.9	17.1
Texas	48.5	13.2
Utah	43.7	11.7
West Virginia	64.4	20.9

Table 8: Chronic Conditions and Old Age

Dependent variable: Votes on mandates				
	% Population with multiple chronic conditions		% Population aged 65 or above	
Variables	(1) $\leq 50th$ Percentile ($\leq 50.8\%$)	(2) $> 50th$ Percentile ($> 50.8\%$)	(3) $\leq 50th$ Percentile ($\leq 17.7\%$)	(4) $> 50th$ Percentile ($> 17.7\%$)
Received pharmaceutical contributions	-0.009	-0.015	-0.030*	0.021
	(0.019)	(0.016)	(0.016)	(0.019)
Observations	1,037	2,077	1,761	1,353
R-squared	0.599	0.360	0.409	0.539
No. of States	17	4	11	10

Note: The full sample includes all bills. The dependent variable is equal to 1 if a lawmaker voted nay for a ban or yea for a mandate and 0 otherwise. The measure of pharmaceutical contributions is a dummy that is equal to 1 if a lawmaker received funds from those companies and 0 otherwise. Results in all columns control for the same covariates as in Table 3. State-fixed effects are controlled in all columns.
*** p<0.01, ** p<0.05, * p<0.1

Lastly, I also examine how a larger proportion of unhealthy and senior populations, and more COVID deaths are related to lawmakers' votes on COVID-19 vaccine legislation. The data on the COVID death rate by states is retrieved from CDC (2023). As shown in Table 10 in the appendix, there is no significant relationship between a large proportion of residents with MCC and votes for mandates. A higher percentage of the senior population is positively and significantly related to votes for mandates. A one percentage point increase in the percentage of the population aged 65 or above in a state is associated with a 1.2 percentage point increase in a lawmaker's chance of voting for mandates. Furthermore, 1 additional death per 100,000 people in 2020 is associated with a 0.1 percentage point lower chance for lawmakers to vote for mandates. While having a senior population who are at a higher risk of dying from COVID may put pressure on lawmakers to vote for mandates, a higher death rate in 2020

can translate into fewer at-risk populations which allows lawmakers to be less concerned about mandates.

6 Conclusion

This paper examines the relationship between pharmaceutical companies' campaign contributions and U.S. state lawmakers' votes on COVID vaccine mandates. I find that receiving pharmaceutical companies' campaign contributions appears to have no relationship with state legislators voting for COVID vaccine mandates. Furthermore, even when restricting the sample to include only Republicans who control the legislatures or state representatives who rely more on lobbyists for information, I still find no significant effects. Lawmakers who received funding from pharmaceutical companies in states with a larger at-risk population are also not more likely to vote in pharmaceutical companies' favor. Since these companies only contributed a relatively small amount to lawmakers, pharmaceutical companies' political contributions were likely used to buy access to state lawmakers, as documented by existing literature. The politicization of vaccine mandates likely made it costly for Republicans to publicly vote for pharmaceutical companies and forced Democrats to do the opposite. Given this, the pharmaceutical industry likely did not exert much effort to directly lobby for state legislators' roll call votes. Instead, the industry stayed in the background and used third-party organizations to advance its agenda (Fang, 2023). The absence of a positive relationship serves as evidence supporting this theory. Lastly, despite the limitations of this paper, it appears that politicization can make roll call votes costly enough for interest groups to influence.

Mandating the new medical product may have unintended consequences. It may erode vaccine confidence and civil liberties (Bardosh et al., 2022a). We now know that COVID booster mandates can cause a net increase in hospitalization in healthy young adults (Bardosh et al., 2022b). It is not surprising that the J&J COVID vaccine was pulled off the market and that the mRNA vaccines may be associated with more harm than initially estimated at the time of emergency

authorization (Fraiman et al., 2022). The potentially serious consequences make it important to understand the extent of pharmaceutical companies' influence on the adoption of those mandates. My work adds to the large body of literature that seeks to understand how the industry operates in the political realm.

While this paper finds scant evidence of pharmaceutical companies directly influencing state lawmakers' roll call votes on COVID vaccine mandates with their lobbyists, those corporations may have engaged in other forms of influence campaigns. Perhaps the pharmaceutical companies engaged in a hybrid type of lobbying using multiple channels, including third-party organizations. The mostly Republican-controlled legislatures should have enough votes to pass bans on private employer mandates, which are likely to be the most effective policy at increasing vaccine uptake, none of the states passed such bills. It is possible that the industry focused primarily on defeating bans on employer mandates while allowing less restrictive bills to pass in the legislatures at the state level. More work should be done to study pharmaceutical companies' influence campaigns during the COVID era.

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Additional Results

Table 9: COVID Mortality by State

States	(1) Age-adjusted COVID death per 100,000
Alabama	152.8
Arizona	139.5
Arkansas	127.7
Connecticut	56.7
Florida	111.7
Georgia	135.9
Indiana	106.8
Iowa	75.9
Kansas	103.1
Michigan	107.1
Mississippi	146.3
Missouri	100.5
Montana	108.8
Nebraska	69
New Hampshire	60.2
North Dakota	70.9
South Carolina	71.2
Tennessee	142.5
Texas	151.4
Utah	78.2
West Virginia	146.8

Table 10: Old age, chronic diseases, and COVID deaths

Dependent variable: Votes on mandates			
Variables	(1) Chronic conditions	(2) Old age	(3) COVID deaths
% with MCC	-0.215		
	(0.136)		
% aged 65 or above		0.012***	
		(0.003)	
Age-adjusted deaths per 100,000			-0.001***
			(0.000)
Observations	3,114	3,114	3,114
R-squared	0.399	0.401	0.402

Note: The dependent variable is equal to 1 if a lawmaker voted nay for a ban or yea for a mandate and 0 otherwise. The measure of pharmaceutical contributions is a dummy that is equal to 1 if a lawmaker received funds from those companies and 0 otherwise. All columns contain 21 states. The control variables are the same as Table 3.
***p<0.01, ** p<0.05, * p<0.1

Table 11: Categorical Campaign Contributions with Logit Model

Variables	(1) Categorical variable (Dollars)	(2) Categorical variable (Percentage)
Low (dollars)	0.105	
	(0.295)	
Medium (dollars)	-0.177	
	(0.230)	
High (dollars)	0.249	
	(0.348)	
Low (percentages)		-0.022
		(0.319)
Medium (percentages)		-0.256
		(0.241)
Higj (percentages)		0.373
		(0.294)
Observations	3,105	3,105

Note: The dependent variable is equal to 1 if a lawmaker voted nay for a ban or yea for a mandate and 0 otherwise. Only the Logit model is used in this table. In both columns, pharmaceutical company contributions are coded as categorical variables: 0 for no contributions, 1 (low) for contributions between 0 and the 25th percentile ($500 or 0.3%), 2 (medium) for contributions between the 25th and 75th percentiles ($1500 or 1%), and 3 (high) for contributions above the 75th percentile. Results in all columns control for the same covariates as in Table 3. State-fixed effects are also controlled in all columns.