Did Big Pharma Influence the Adoption of COVID Vaccine Mandates?

Boyuan Wang

December 13, 2023

Abstract

This paper examines whether campaign contributions from pharmaceutical companies have an impact on the U.S. state lawmakers' votes on COVID vaccine legislation. I find state legislators tend to vote in the pharmaceutical companies' favor if they receive contributions from those companies. My findings are consistent with pharmaceutical companies using a small amount of campaign contributions to buy access to lawmakers in hopes of lobbying them on the issue later.

1 Introduction

Existing work examining the influence of campaign contributions mostly focused on elected federal officials. 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. This paper with a micro dataset on state lawmakers presents evidence supporting the argument that there's a positive relationship between campaign contribution and roll call votes. With an IV approach, I study the issue by examining the relationship between pharmaceutical companies' campaign contributions and state legislators' votes on COVID vaccine legislations.

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 National Public Service for Legislative Tracking, and the National Institute on Money in State Politics, I construct a cross-sectional micro dataset that has information on campaign contributions that state lawmakers received, their roll call votes on COVID vaccine legislations, and their individual characteristics. Following Chappell Jr (1981) and Ansolabehere et al. (2003), I use instrument variables that indicate the degree of electoral competition and the power of the legislators to study the relationship between pharmaceutical companies' campaign contributions and state legislators' votes on COVID vaccine bills.

I find a positive and significant correlation between receiving contributions from pharmaceutical companies and voting for those companies. This appears to show that state lawmakers tend to vote in favor of pharmaceutical companies if they receive contributions from those companies. Consistent with the theory of information lobbying and pharmaceutical companies' low amount of political contributions, those companies most likely bought access to lawmakers with campaign contributions to lobby them later. Republicans and state repre-

sentatives appear to be more responsive to the influence of pharmaceutical companies. Lastly, lawmakers in states with a larger share of the population who are vulnerable to COVID are likely to be more amenable to the messaging of pharmaceutical companies.

2 Background

2.1 The COVID Vaccine Mandates in the U.S.

In the U.S., only the 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 who 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, a federal private employer mandate was put in place by the administration 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 made no contributions at the state level, I include only the 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

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) do 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 the special

interest groups that contribute more funding to them.

Stratmann (2017) suggests that campaign contributions mostly influence the early stages of the legislative process instead of roll call votes at the final stage. Ansolabehere et al. (2003) points out that the relatively small amount of campaign contributions may be used to buy access to lawmakers for information lobbying. Lohmann (1995) presents a model in which interest groups pay a strictly positive monetary contribution to a policymaker who has conflicting interests to make their messages credible. Furthermore, Kalla and Broockman (2016) finds 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. In all, most experts seem to agree that interest groups make a small amount of campaign contributions to buy access to politicians so that those interest groups can lobby them at a later date.

3 Data and Methodology

3.1 Data

The cross-sectional micro dataset contains information about each state lawmaker's vote on COVID vaccine bills, their campaign finances in their most recent election, and other individual 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 lawmakers' campaign financing is 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 lawmakers' most recent elections, such as incumbency status and vote shares, are scrapped from Ballotpedia (2022). The online political encyclopedia covers federal, state, and local politics, elections, and public policy in the United States. For additional 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.

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 legislations on COVID vaccines were either 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. Although most legislators were incumbents, most of them did not run unopposed in the preceding elections. 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.

Those who received campaign funds from the pharmaceutical companies also received more total contributions. In addition, their opponents in the preceding election also raised more money. Taken together, those pharmaceu-

tical companies are likely to have bought access to lawmakers with a small amount of money. Lastly, the absolute value of vote shares is similar across both groups.

Table 2: Summary Statistics

Variables	(1) No pharma contribution	(2) Received pharma contribution	(3) Total
% voted against mandates	74.8	81.7	76.1
% of Republicans	63.7	76.3	66.1
% of state representatives	82.2	49.5	76.2
% of incumbents	70.3	89.3	73.8
% ran unopposed	20.7	21.1	20.8
% in single-seat districts	80.7	91.7	82.7
Campaign contributions (Mean) from individuals	$29,362	$70,606	$37,144
Pharma (Mean) campaign contributions	$0	$1,106	$209
Total (Mean) contribution received	$92,910	$249,566	$121,451
Spending (Mean) by opponents	$56,490	$92,528	$63,297
Vote share (Mean)	0.257	0.230	0.252
Obs	**5,035**	**1,171**	**6,206**

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. This means there may be a downward bias that can potentially bias the results.

To address the concern that lawmakers' legislative preferences may be correlated with contributions from pharmaceutical companies, I use an IV approach. Following Chappell Jr (1981), Welch (1982), and Ansolabehere et al. (2003), I choose instruments that indicate the degree of electoral competition. The idea is that a close race increases an incumbent's demand for PAC contributions, producing an exogenous shift in contributions through an increase in the propensity to "sell" services, including access. I use the absolute value of vote shares of the winning candidates minus 0.5, their incumbency status, and whether they ran unopposed in the preceding elections as instruments for campaign contributions from pharmaceutical companies.

An election outcome is known only probabilistically before the votes are counted. If an interest group wishes to exchange dollars for favors, the decisions on which candidates to support partly rely on which ones are probable winners. This is because those who are in a close race may lose, while candidates who are sure winners may not value their contributions. Contributions made based on the competitiveness of a race as indicated by the instrument variables generally should not be related to the legislative preferences of the lawmakers.

As shown in the equations below, equation 1 is the first stage of the $2SLS$ model, and equation 2 is the second stage.

$$Contribution_{is} = \beta_0 + \beta_1 Vote\_Share_{is} + \beta_2 Incumbent_{is} + \beta_3 Unopposed_{is} + \epsilon_{1is} \quad (1)$$

$$Y_{isl} = \alpha_0 + \alpha_1 Contribution_{is} + \gamma X_{is} + State_s + \epsilon_{2isl} \quad (2)$$

Subscripts i, s, and l represent the legislator, the state, and the legislation, respectively. $Vote\_Share_{is}$ refers to the absolute value of vote share that a winning candidate received minus 0.5 in the preceding election. $Incumbent_{is}$ is a dummy that is equal to 1 if a winning candidate was the incumbent in the preceding election. $Unopposed_{is}$ is a dummy that is equal to 1 if a winning candidate ran unopposed in the preceding election. 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 in a district, 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, and the chamber of the legislature that a lawmaker is in. $State_s$ is the state-fixed effect. ϵ_{1is} and ϵ_{2isl} are the error terms.

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. As predicted by the theory, the OLS model in column 1 has an insignificant result likely because of the downward bias, which comes from not adjusting for lawmakers' preferences.

I then split the full sample into two sub-samples (employer mandates and proof of vaccination) based on the content of the bills for the IV models.[1] In column 2, we can see that those who received pharmaceutical companies' campaign contributions are 23% more likely to vote in those companies' favor on COVID vaccine legislation and the result is significant. In columns 3 and 4, I still find positive and significant results. For legislation related to both employer mandates and proof of vaccination, state lawmakers are more likely to vote for pharmaceutical companies. Lastly, the results are larger in magnitude for employer mandates (33.1%) than proof of vaccination legislation (21.6%).

The relatively small amount of contributions from the pharmaceutical companies is not enough to buy lawmakers' votes. However, as shown in Kalla and Broockman (2016), the companies' contributions can certainly buy access. The significant and positive results from the IV model are the combined effects of buying access and lobbying. In other words, pharmaceutical companies bought access from state lawmakers like other special interest groups, yet only pharmaceutical companies lobby the lawmakers that they have access to on vaccine mandate legislation. Since the threat of being fired is stronger than the threat of being denied entry to non-essential businesses, it is plausible that pharmaceutical companies would lobby more intensively on employer mandates than proof of vaccination bills. So the stronger effect observed in employer mandate legislation may be a result of more intensive lobbying efforts exerted on those bills.

[1] See Table 8 in the appendix for first-stage results.

Table 3: Main Results

Dependent variable: Votes on mandates				
	OLS	IV		
Variables	(1) All bills	(2) All bills	(3) Employer mandates	(4) Proof of vaccination
Received pharmaceutical contributions	0.004 (0.011)	0.230*** (0.057)	0.331*** (0.071)	0.216*** (0.079)
Weak identification test		82.03	55.30	41.80
Sargan statistic		2.268	0.494	3.352
(P-value)		(0.322)	(0.781)	(0.187)
Observations	6,199	6,199	4,385	3,312
R-squared	0.525	0.491	0.552	0.392
No. of states	21	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. The instruments are the absolute value of vote shares of the winning candidates minus 0.5, their incumbency status, and whether they ran unopposed in the preceding elections. Results in all columns controlled for political affiliation, chamber of the legislature, the year when a bill is passed, no. of seats in a district, individual contributions, the total contribution received by the officeholder, election year, and the total spending by opponents. State-fixed effects are also included in all columns. The first stage results are in Table 8.
***p<0.01, ** p<0.05, * p<0.1

4.2 Robustness Checks

There are some identification concerns. The instruments may be invalid, and the error terms may be correlated at the individual level. In this section, I will include additional covariates, cluster the error by lawmakers, use alternative instruments, and try a continuous measure of contributions from pharmaceutical companies. The results can be found in Table 4.

The instruments in columns 1, 2, 4, and 5 are still the incumbency status, vote share, and whether the lawmaker ran unopposed. In the second column, I

include the following additional control variables: sex, education level, marriage status, current role in the legislature, and the number of children. The instrument in column 3 is the position that lawmakers held in the legislature before. The positions include floor leader, committee chair, committee vice chair, and committee member. This variable indicates the lawmaker's power, which can be an alternative instrument according to Ansolabehere et al. (2003). I cluster the errors by lawmakers in column 4. In the last column, I measure contributions from pharmaceutical companies in thousands of dollars.

As shown in column 2 of Table 4, I still find contributions from pharmaceutical companies to have a positive and significant relationship with state lawmakers' roll call votes after introducing additional controls. The result remains unchanged even with a different instrument in column 3. Clustering the errors by lawmakers still does not seriously affect the result in column 4. In column 5, a continuous measure of campaign contributions still does not change the result. In all, the results are robust to various specifications.[2]

[2]The first stage results can be found in Table 9

Table 4: Robustness Checks

Dependent variable: Votes on mandates					
	(1)	(2)	(3)	(4)	(5)
Variables	Baseline	Lawmaker characteristics	Alternative instrument	Robust errors	Continuous measure
Received pharmaceutical contributions	0.231***	0.248***	0.245***	0.242***	
	(0.057)	(0.069)	(0.077)	(0.070)	
Pharmaceutical contributions in thousand dollars					0.209***
					(0.052)
Weak identification test	81.85	45.42	131	47.74	62.90
Hansen J statistic	2.298	3.190		1.395	0.620
(P-value)	(0.317)	(0.203)		(0.498)	(0.431)
Observations	6,209	4,504	6,209	6,209	6,209
R-squared	0.491	0.473	0.486	0.049	0.449

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 4, 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 column 5, pharmaceutical contributions are measured in thousands of dollars. The instruments are the absolute value of vote shares of the winning candidates minus 0.5, their incumbency status, and whether they ran unopposed in the preceding elections in columns 1, 2, 4, and 5. The instrument in column 3 is the position held in the legislature. Results in all columns control for political affiliation, chamber of the legislature, election year, the year when a bill is passed, no. of seats in a district, individual contributions, and the total contribution received by the officeholder in the previous elections. State-fixed effects are also controlled in all columns. Column 2 also controls for sex, education level, marriage status, current role in the legislature, and the number of children. Errors are clustered by lawmakers in column 4. The first stage results are in Table 9.
***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 5. As shown in columns 1 and 2 of Table 5, positive and significant results can only be observed among the sample containing only Republicans. Although the pharmaceutical companies have bought access to lawmakers of both parties, there is not much need for them to lobby the Democrats who mostly prefer vaccine mandates. Tripathi et al. (2002) find lobbying firms target majority party members. Therefore, it also may be more beneficial for the pharmaceutical companies to lobby the Republicans who happen to control most of those state legislatures and may be somewhat undecided.[3]

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

[3]See the first-stage results in Table 10.

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 5, I split the sample by the chamber of the legislature. A positive and significant effect can only be seen among state house representatives. The results confirm the findings of Kousser (2005).

Table 5: 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	0.097	0.093***	0.396***	0.013
	(0.198)	(0.034)	(0.094)	(0.068)
Weak identification test	12.68	69.25	42.27	32.60
Sargan statistic	0.289	0.360	2.856	4.062
(P-value)	(0.865)	(0.835)	(0.240)	(0.131)
Observations	2,104	4,092	4,716	1,483
R-squared	0.422	0.035	0.466	0.507

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. The instruments are the absolute value of vote shares of the winning candidates minus 0.5, their incumbency status, and whether they ran unopposed in the preceding elections. Results in all columns controlled for the election year, the year when a bill is passed, no. of seats in a district, the total contribution received by the officeholder, individual contributions, and total spending by opponents. State-fixed effects are also controlled in all columns. The first stage results in Table 10.
*** 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 6 for the percentage of the population with multiple chronic conditions (MCC)[4] 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 more susceptible to pharmaceutical companies' 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 7. The sample in column 1 is made up of states where less than 56.7% (80th percentile) of the population have MCC, and lawmakers are 22% more likely to vote for pharmaceutical companies. The result for the states where over 56.7% of the population have MCC is shown in column 2, lawmakers in this sample are 36.1% more likely to vote for the pharmaceutical companies. Although I find pharmaceutical contributions have positive and significant effects on roll call votes in both samples, it is clear that the effect is much larger in column 2. The results confirm that lawmakers in states with more at-risk populations are more susceptible to pharmaceutical companies' lobbying.

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 only find significant results in states with a larger aged population. In column

[4]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

4, lawmakers are 33.4% more likely to vote for pharmaceutical companies. The results in columns 3 and 4 once again confirm that lawmakers in states with a larger at-risk population may respond more positively to the pro-mandate lobbying from pharmaceutical companies.[5]

Table 6: 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

[5]The first stage results can be seen in Table 11

Table 7: Chronic Conditions and Old Age

Dependent variable: Votes on mandates				
	% Population with multiple chronic conditions		% Population aged 65 or above	
Variables	(1) $\leq 80th$ Percentile ($\leq 56.7\%$)	(2) $> 80th$ Percentile ($> 56.7\%$)	(3) $\leq 50th$ Percentile ($\leq 17.7\%$)	(4) $> 50th$ Percentile ($> 17.7\%$)
Received pharmaceutical contributions	0.220***	0.361***	-0.013	0.334***
	(0.065)	(0.138)	(0.086)	(0.075)
Weak identification test	64.64	13.60	27.18	59.36
Sargan statistic	3.663	0.480	2.767	4.043
(P-value)	(0.160)	(0.787)	(0.251)	(0.132)
Observations	5,150	1,059	3,146	3,063
R-squared	0.498	0.398	0.387	0.579
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. The instruments are the absolute value of vote shares of the winning candidates minus 0.5, their incumbency status, and whether they ran unopposed in the preceding elections. Results in all columns controlled for the party, chamber, election year, the year when a bill is passed, no. of seats in a district, total contribution received by the officeholder, individual contributions, and total spending by opponents. State-fixed effects are controlled in all columns. The first stage results in Table 11.

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

6 Conclusion

This paper examines the relationship between pharmaceutical companies' campaign contributions and U.S. state lawmakers' votes on COVID vaccine mandates with an IV approach. I find that receiving pharmaceutical companies' campaign contributions appears to have a positive and significant relationship with state legislators voting for COVID vaccine mandates. Since those companies only contributed a relatively small amount to lawmakers, pharmaceutical companies' political contributions were likely used to buy access to

state lawmakers. The positive relationship and the relatively small amount of contributions suggest that those pharmaceutical companies may have used the access bought by their contributions to directly or indirectly lobby lawmakers on COVID vaccine legislations. Furthermore, lobbyists appear to primarily target Republicans who are the majority party in those states, and state representatives who rely more on lobbyists for information. Lastly, lawmakers in states with a larger at-risk population tend to vote in pharmaceutical companies' favor. Concerned with their at-risk constituents, lawmakers in those states may be more accepting of the pro-mandate messaging.

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 seeks to examine pharmaceutical companies' influence on state lawmakers via political contributions, there may be other forms of influence campaigns designed to achieve the same goal. For instance, Pfizer quietly financed consumer, medical, and civil rights groups to create the appearance of broad support for the mandate (Fang, 2023). Perhaps the pharmaceutical companies engaged in a hybrid type of lobbying using multiple channels. More work should be done to study pharmaceutical companies' influence campaigns during the COVID era.

References

Ansolabehere, S., De Figueiredo, J. M., and Snyder Jr, J. M. (2003). Why is there so little money in us politics? *Journal of Economic Perspectives*, 17(1):105–130.

Austen-Smith, D. (1995). Campaign contributions and access. *American Political Science Review*, 89(3):566–581.

Ballotpedia (2022). Ballotpedia — ballotpedia.org. https://ballotpedia.org/Main_Page. [Accessed 24-11-2022].

Bardosh, K., De Figueiredo, A., Gur-Arie, R., Jamrozik, E., Doidge, J., Lemmens, T., Keshavjee, S., Graham, J. E., and Baral, S. (2022a). The unintended consequences of covid-19 vaccine policy: why mandates, passports and restrictions may cause more harm than good. *BMJ Global Health*, 7(5):e008684.

Bardosh, K., Krug, A., Jamrozik, E., Lemmens, T., Keshavjee, S., Prasad, V., Makary, M. A., Baral, S., and Høeg, T. B. (2022b). Covid-19 vaccine boosters for young adults: a risk benefit assessment and ethical analysis of mandate policies at universities. *Journal of Medical Ethics*.

Bonica, A. (2018). Inferring roll-call scores from campaign contributions using supervised machine learning. *American Journal of Political Science*, 62(4):830–848.

Cann, D. M. (2007). Justice for sale? campaign contributions and judicial decisionmaking. *State Politics & Policy Quarterly*, 7(3):281–297.

Chappell Jr, H. W. (1981). Campaign contributions and voting on the cargo preference bill: A comparison of simultaneous models. *Public Choice*, 36(2):301–312.

Denzau, A. T. and Munger, M. C. (1986). Legislators and interest groups: How unorganized interests get represented. *American Political Science Review*, 80(1):89–106.

Dow, J. K. and Endersby, J. W. (1994). Campaign contributions and legislative voting in the california assembly. *American Politics Quarterly*, 22(3):334–353.

Fang, L. (2021). Vaccine makers funneled undisclosed campaign cash to democrats and republicans in 2020. *The Intercept*.

Fang, L. (2023). Pfizer Quietly Financed Groups Lobbying for COVID Vaccine Mandates — leefang.com. https://www.leefang.com/p/pfizer-quietly-financed-groups-lobbying. [Accessed 06-12-2023].

Fraiman, J., Erviti, J., Jones, M., Greenland, S., Whelan, P., Kaplan, R. M., and Doshi, P. (2022). Serious adverse events of special interest following mrna covid-19 vaccination in randomized trials in adults. *Vaccine*, 40(40):5798–5805.

Gallo Marin, B., Aghagoli, G., Lavine, K., Yang, L., Siff, E. J., Chiang, S. S., Salazar-Mather, T. P., Dumenco, L., Savaria, M. C., Aung, S. N., et al. (2021). Predictors of covid-19 severity: a literature review. *Reviews in Medical Virology*, 31(1):1–10.

Kalla, J. L. and Broockman, D. E. (2016). Campaign contributions facilitate access to congressional officials: A randomized field experiment. *American Journal of Political Science*, 60(3):545–558.

Karaivanov, A., Kim, D., Lu, S. E., and Shigeoka, H. (2022). Covid-19 vaccination mandates and vaccine uptake. *Nature Human Behaviour*, pages 1–10.

Kousser, T. (2005). *Term limits and the dismantling of state legislative professionalism*. Cambridge University Press.

Legiscan (2022). LegiScan | Bringing People To The Process — legiscan.com. https://legiscan.com/. [Accessed 01-05-2022].

Lohmann, S. (1995). Information, access, and contributions: A signaling model of lobbying. *Public Choice*, 85(3-4):267–284.

Mello, M. M., Abiola, S., and Colgrove, J. (2012). Pharmaceutical companies' role in state vaccination policymaking: the case of human papillomavirus vaccination. *American Journal of Public Health*, 102(5):893–898.

Mian, A., Sufi, A., and Trebbi, F. (2010). The political economy of the us mortgage default crisis. *American Economic Review*, 100(5):1967–1998.

National Institute on Money in State Politics (2022). Home - FollowThe-Money.org — followthemoney.org. https://www.followthemoney.org/. [Accessed 24-10-2022].

Newman, D., Tong, M., Levine, E., and Kishore, S. (2020). Prevalence of multiple chronic conditions by us state and territory, 2017. *PLoS One*, 15(5):e0232346.

Roth, E. (2022). State Efforts to Limit or Enforce COVID-19 Vaccine Mandates - NASHP — nashp.org. https://nashp.org/state-efforts-to-ban-or-enforce-covid-19-vaccine-mandates-and-passports/. [Accessed 01-06-2022].

Stratmann, T. (2017). Campaign finance: A review and an assessment of the state of the literature. *Forthcoming, Oxford Handbook of Public Choice, GMU Working Paper in Economics*, (17-15).

Tripathi, M., Ansolabehere, S., and Snyder, J. M. (2002). Are pac contributions and lobbying linked? new evidence from the 1995 lobby disclosure act. *Business and Politics*, 4(2):131–155.

Vote Smart (2022). Vote Smart | Facts For All — justfacts.votesmart.org. https://justfacts.votesmart.org/. [Accessed 24-11-2022].

Welch, W. P. (1982). Campaign contributions and legislative voting: Milk money and dairy price supports. *Western Political Quarterly*, 35(4):478–495.

Wouters, O. J. (2020). Lobbying expenditures and campaign contributions by the pharmaceutical and health product industry in the united states, 1999-2018. *JAMA Internal Medicine*, 180(5):688–697.

Appendix A First Stage Results

Table 8: First Stage Results (Main Results)

Variables	(1) All bills	(2) Employer mandates	(3) Proof of vaccination
Vote share	-0.072*	-0.125**	0.004
	(0.042)	(0.050)	(0.055)
Incumbency status	0.166***	0.154***	0.165***
	(0.011)	(0.012)	(0.015)
Unopposed	-0.015	-0.003	-0.018
	(0.018)	(0.021)	(0.025)
Campaign contributions	-0.000***	-0.000***	-0.000***
from individuals	(0.000)	(0.000)	(0.000)
Total contribution received	0.000***	0.001***	0.000***
	(0.000)	(0.000)	(0.000)
Spending by opponents	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)
Seats in a district	-0.011**	-0.010**	-0.011
	(0.005)	(0.005)	(0.009)
Year passed	-0.009	-0.011	0.006
	(0.013)	(0.014)	(0.041)
Election year	-0.018*	-0.011	-0.007
	(0.009)	(0.010)	(0.012)
Party = 2, Republican	0.066***	0.081***	0.045***
	(0.010)	(0.011)	(0.013)
Party = 3, Independent	-0.392**	-0.391*	-0.394
	(0.199)	(0.233)	(0.347)
Chamber = 2, Senate	0.205***	0.206***	0.198***
	(0.012)	(0.014)	(0.016)
Observations	6,199	4,385	3,312

Note: State-fixed effects included in the first stage are omitted
*** p<0.01, ** p<0.05, * p<0.1

Table 9: First Stage Results (Robustness Checks)

Variables	(1) Baseline	(2) Lawmaker characteristics	(3) Alternative instrument	(4) Robust errors	(5) Continuous measure
Vote share	-0.069	-0.033		-0.070	-0.070
	(0.042)	(0.054)		(0.069)	(0.069)
Unopposed	-0.016	-0.050**	-0.026**	-0.015	-0.015
	(0.018)	(0.023)	(0.013)	(0.032)	(0.032)
Incumbency status	0.166***	0.167***		0.165***	0.165***
	(0.011)	(0.015)		(0.014)	(0.014)
Prior role			-0.032***		
			(0.003)		
Spending by opponents	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Total contribution received	0.000***	0.000***	0.001***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Campaign contributions	-0.000***	-0.000***	-0.000***	-0.000**	-0.000**
from individuals	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Sex		-0.011			
		(0.014)			
Marital status		0.008			
		(0.018)			
Education level		0.000			
		(0.008)			
Current role		-0.010**			
		(0.004)			
No. of children		-0.002			
		(0.004)			
Seats in a district	-0.011**	-0.017**	-0.011**	-0.011**	-0.011**
	(0.005)	(0.007)	(0.005)	(0.004)	(0.004)
Year passed	-0.009	-0.013	-0.009	-0.009***	-0.009***
	(0.013)	(0.017)	(0.013)	(0.003)	(0.003)
Election year	-0.018**	-0.012	-0.005	-0.019	-0.019
	(0.009)	(0.011)	(0.009)	(0.017)	(0.017)
Party = 2, Republican	0.066***	0.067***	0.028***		
	(0.010)	(0.013)	(0.010)		
Party = 3, Independent	-0.391**	-0.441**	-0.388*		
	(0.199)	(0.215)	(0.201)		
Chamber = 2, Senate	0.204***	0.196***	0.175***		
	(0.012)	(0.015)	(0.012)		
Observations	6,199	4,385	3,312		

Note: State-fixed effects included in the first stage are omitted *** p<0.01, ** p<0.05, * p<0.1

Table 10: First Stage Results (Party and Chamber)

	Party		Chamber	
	(1)	(2)	(3)	(4)
Variables	Democrat	Republican	House	Senate
Vote share	-0.105*	-0.038	-0.065	0.108
	(0.060)	(0.058)	(0.044)	(0.107)
Incumbency status	0.102***	0.197***	0.121***	0.266***
	(0.017)	(0.014)	(0.011)	(0.027)
Unopposed	0.029	-0.025	-0.003	-0.115**
	(0.026)	(0.024)	(0.018)	(0.049)
Campaign contributions	0.000	-0.000***	-0.001***	-0.000**
from individuals	(0.000)	(0.000)	(0.000)	(0.000)
Total contribution received	0.000***	0.001***	0.001***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Spending by opponents	-0.000***	-0.000***	-0.000***	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)
Seats in a district	-0.011	-0.016***	-0.000	-0.479**
	(0.012)	(0.006)	(0.004)	(0.225)
Year passed	-0.006	-0.012	-0.006	0.000
	(0.019)	(0.017)	(0.013)	(0.036)
Election year	0.019	-0.024**	0.032	-0.053***
	(0.016)	(0.011)	(0.019)	(0.015)
Chamber = 2, Senate	0.189***	0.210***		
	(0.020)	(0.015)		
Party = 2, Republican			0.047***	0.095***
			(0.010)	(0.026)
Party = 3, Independent				-0.411
				(0.257)
Observations	2,104	4,092	4,716	1,483

Note: State-fixed effects included in the first stage are omitted *** p<0.01, ** p<0.05, * p<0.1

Table 11: First Stage Results (Chronic Conditions and Aging Society)

	% Population with chronic conditions		% Population aged 65 or above	
	(1)	(2)	(3)	(4)
Variables	$< 56.7\%$	$\geq 56.7\%$	$< 17.7\%$	$\geq 17.7\%$
Vote share	-0.108**	0.158	-0.030	-0.081*
	(0.046)	(0.115)	(0.083)	(0.046)
Incumbency status	0.161***	0.168***	0.162***	0.166***
	(0.012)	(0.027)	(0.018)	(0.012)
Unopposed	0.007	-0.113**	-0.025	-0.013
	(0.020)	(0.048)	(0.031)	(0.028)
Total contribution received	0.000***	0.001***	0.001***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Campaign contributions	-0.000***	-0.000	-0.000***	-0.000**
from individuals	(0.000)	(0.000)	(0.000)	(0.000)
Spending by opponents	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Seats in a district	-0.010**	0.001	0.132**	-0.012***
	(0.005)	(0.022)	(0.053)	(0.004)
Year passed	-0.009	0.356***	-0.008	-0.011
	(0.013)	(0.053)	(0.020)	(0.017)
Election year	0.004	-0.152***	-0.020	-0.003
	(0.010)	(0.024)	(0.013)	(0.013)
Party = 2, Republican	0.068***	0.063**	0.058***	0.072***
	(0.010)	(0.025)	(0.016)	(0.012)
Chamber = 2, Senate	0.219***	0.100***	0.208***	0.227***
	(0.014)	(0.031)	(0.020)	(0.016)
Observations	5,150	1,059	3,146	3,063
No. of States	17	4	11	10

Note: State-fixed effects included in the first stage are omitted *** p<0.01, ** p<0.05, * p<0.1