



School of Management, Economics, Law, Social Sciences,
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Bachelor's Thesis in Economics, specialization Data Handling and
Data Analytics

**Examining the Influence of Fossil Fuel Industry
Contributions on US Congressional Voting
Behaviour: A Data-Driven Analysis of Campaign
Financing and Environmental Voting**

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I confirm that this Bachelor's thesis is my own work and I have documented all sources and material used.

St. Gallen, 21.05.2024

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Abstract

Note:

1. **paragraph:** What is the motivation of your thesis? Why is it interesting from a scientific point of view? Which main problem do you like to solve?
2. **paragraph:** What is the purpose of the document? What is the main content, the main contribution?
3. **paragraph:** What is your methodology? How do you proceed?

Contents

1 Introduction	9
2 Money in Politics	11
2.1 Campaign Contributions	11
2.2 Correlation Contributions & Candidate's election sucess	14
2.3 Correlation Campaign Contributions & Votes in Contributor's favor .	14
2.4 Causal Effect of Campaign Contributions on Representatives' Voting Decisions.	15
3 Research Design	18
3.1 Roll Call Vote Specifications from Stratmann	18
3.2 Topic of Roll call Votes (Methane Pollution Safeguards)	19
3.3 Hypotheses	21
4 Data	23
4.1 Representative data	23
4.2 Rollcall data	23
4.3 Contribution data	25
4.3.1 Time Frame of Contributions	25
4.3.2 Contribution Data Sources and Processing	27
4.4 Merging	28
5 Econometric Models	30
5.1 Model specification	31
5.2 Linear Probability Model	33
5.3 Logit and Probit	34
6 Results	35
6.1 Hypothesis 1	35
6.2 Hypothesis 2	36
6.3 Hypothesis 3	37
6.4 Hypothesis 4	38

7 Discussion and Conclusion	40
List of Figures	43
List of Tables	44
Appendix A: Supplementary Material	45
Bibliography	46

1 Introduction

The United States has seen a dramatic increase in wealth and income gaps in recent decades, with the wealthy and powerful seeking to shape the political environment (Skocpol & Hertel-Fernandez, 2016). Additionally, the US bipartisan system has recently become more polarised (McCarty et al., 2006). The public’s perceptions mirror these trends: 84 percent of US residents think that money influences politics excessively and express a desire to see changes made to the campaign finance system to lessen the influence of wealthy donors (Bonica & Rosenthal, 2015) p.1.

The Koch brothers (David and Charles), are one of these influential donors, who have a multifaceted approach when it comes to their involvement in US politics. On the one hand, they shape the “mindset” of the US population through organised groups, think-tanks and networks of other mega-donors with similar political and social ideologies, such as the Koch Network (Hertel-Fernandez et al., 2018) p.1.

The Koch network is not just a[n]... undisciplined array of advocacy groups and political action committees to which the principals send checks. Instead, the network has by now evolved into a nationally federated, full-service, ideologically focused parallel to the Republican Party.

— Skocpol (Skocpol & Hertel-Fernandez, 2016) p.8

On the other hand, the Koch Industries, headed by Charles Koch, not only influence elections through their Network, but they donate insane sums of money to fund the electoral campaigns of Republican presidential and congressional candidates (Skocpol & Hertel-Fernandez, 2016). Especially over the past ten years, Koch Industries have increased their campaign contributions by at least 10% per election cycle, amounting to 28 Million USD in the 2022 election cycle, with approximately 90-97% of these congressional contributions going to Republican candidates (, n.d.-a).

Given these trends of campaign contributions in the US Congress, and especially the participation which wealthy (fossil fuel) donors like the Koch brothers

have in these elections, the question is why donors such as these contribute immense sums such as these to congressional elections? It is to assume that profit-maximizing firms such as the Koch Industries do not merely contribute millions of USD to congressional campaigns without considering their “bottom line” (Stratmann, 2017) p.13. Thus, the question is what campaign contributors are to receive in return for their donations.

Given Charles Koch’s position at the Industry and fossil fuel related conglomerate Koch Industries and David Koch’s history in climate change denial (Doreian & Mrvar, 2022) pp. 2-8, and their donor and advocacy roles in the United States, makes one wonder what the consequences of fossil fuel related campaign contributions to the US congress could mean for US environmental policies.

These questions will be analysed in this paper, i.e. examining the influence of energy (fossil fuel and environmental related) contributions on the voting behavior of US House members on methane pollution bills. The Analysis is based on the Paper of Thomas Stratmann (Stratmann, 2002), who exploits the time series nature of contribution and votes to approach a causal identification strategy to measure the effect of financial contributions on rollcall votes. Regarding campaign contribution, however, (Stratmann, 2002) uses the aggregate contributions for each election cycle, whereas in his 1995 paper (Stratmann, 1995), only the contributions leading up to the vote are included, regardless of election cycle. In this paper, both contribution data approaches will be included.

The chapter 2 of this paper will give a short literature review on the economics and political science perspectives on money in politics, with a focus on the causal relationship between campaign contributions and the representatives’ voting decisions. Chapter 3 presents the research design, details the reasoning behind analysing environmental legislation and the methane pollution rollcall votes in particular, and presents the hypotheses regarding the effect of contribution on voting decisions. Chapter 4 presents the data types and processing for the analysis, and chapter 5 presents the models used. Chapter 6 reports the results, chapter 7 provides the discussion of these, and chapter 8 concludes the paper.

2 Money in Politics

To understand the relationship between campaign contributions and representatives' voting decisions, the background for money in US politics needs to be introduced. Political Scientist Simon Weschle defines three types of money in politics, namely self-enrichment, campaign contribution and golden parachute jobs, where the first type happens when politicians are in office, and receive resources from special interest groups. Politicians receive campaign contributions during elections, to fund their campaigns. According to Weschle, the last type of money in politics is the golden parachute jobs, which are financially lucrative positions offered to ex-politicians (Weschle, 2022a).

2.1 Campaign Contributions

Although each of these types of money in politics has significant and different repercussions for democracy (Weschle, 2022a), campaign contributions in US politics are of particular significance for this paper. One of the reasons for this, is that there has been a stark increase in contributions to political campaigns over time (Stratmann, 2017) p.1 (Stratmann, 2005) p.141. The average contributions to members of congress have increased as well within the last 40 years. Since the 2024 election cycle is due in November 2024, the contributions there are not comparable to 2022 yet.

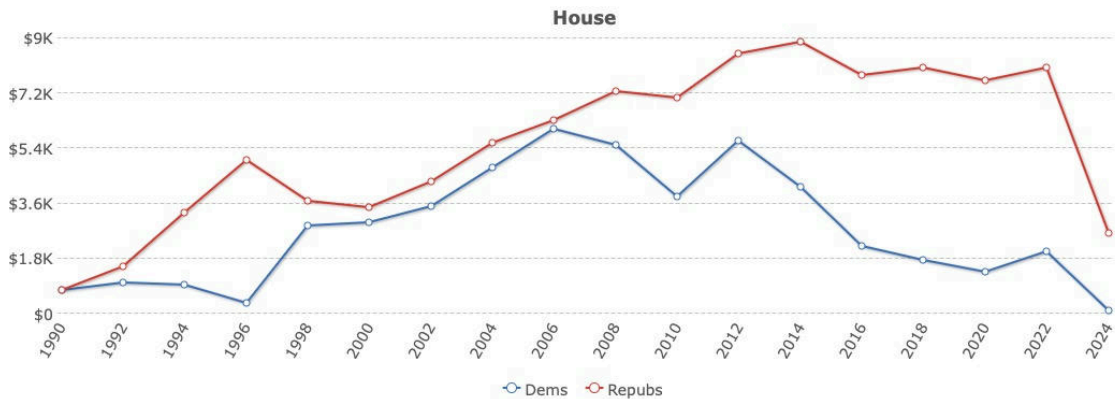


Figure 1: Average Contributions to House Members, 1990-2022

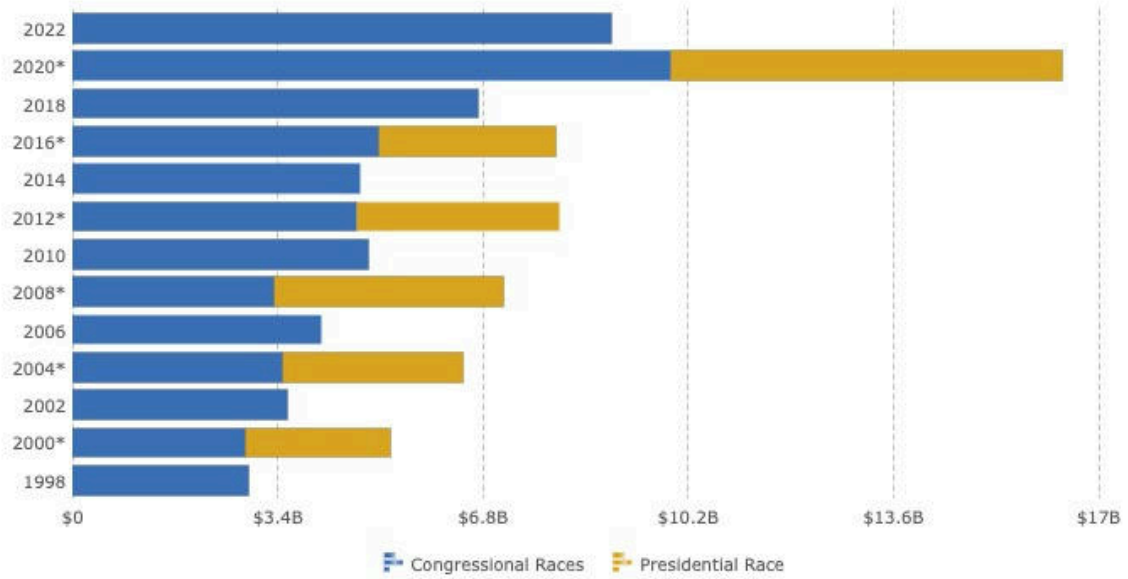


Figure 2: Total Cost of Election, where * stands for a Presidential Election Cycle, 1990-2022
(n.d.-a)

One of the main reasons for the noted increase in not only total campaign contributions over the last 30 years, but also the average campaign contributions per representative might be attributable to the change in legislature. In 2010, the US Supreme Court passed the landmark court case *Citizens United v. Federal Election Commission (FEC)*, which treated the question of whether Congress has the authority to limit independent expenditures by corporations. Campaign contributions are usually structured as individual and Political Action Committee (PAC) contributions in OpenSecrets data. Contributions over 200 USD by natural persons (or their family members) who work in the industry are individual contributions (Grier et al., 2023). whereby PACs are committees representing corporation or labor interests (n.d.-b). The *Citizens United v. FEC* case declared that natural and legal persons, i.e. persons and corporations have the same campaign spending rights when it comes to the US congress (, 2018) p.194. In essence, this case enabled independent expenditures which are election related to become unlimited (, 2010).

That campaign contributions have increased over the years, and one of the reasons for this increase, is clear. Still, the necessity of campaign contributions should still be clarified. US Citizens who would like to become members of the United States Congress, such as the House of Representatives, which is what this paper focuses on, need to become elected through a bi-yearly congressional election. To improve chances of election, these candidates get financial contributions, which they spend on advertisements, rallies and handouts to attract more votes (Weschle, 2022a) p.24.

Although it is clear that candidates need contributions to fund their campaigns, the question remains: why would corporations via PACs or individuals give money to candidates which these will not return? Stratmann makes the assumption that since corporations are inherently for-profit, they “don’t make contributions for reasons that do not benefit their bottom line”, meaning that companies’ campaign spending is strategic (Denzau & Munger, 1986; Stratmann, 2017; Weschle, 2022a) p.25. What these companies receive in return for their contribution, however, is unclear (Stratmann, 2017). Stratmann defines three types of goals for contributions, the first is access to the candidate, the second is to influence election and the third is to contribute to the candidate most likely to win (Stratmann, 2005) p.146 (Stratmann, 2017) p.13. Weschle determines that what campaign donors receive in return to contributing to candidates is either influence, meaning they change the opinion of the candidate by contributing to their campaign, or the support of a candidate that has your interest at heart. Specifically small scale contributors follow both methods (Weschle, 2022a) pp.26-28.

Besides the literature discussing the reasons for campaign spending, the question is also whether there is a positive correlation between candidates receiving contributions and receiving increased vote shares. If this were the case, then campaign spending would be more straightforward, since this would mean that successful election can be assumed.

2.2 Correlation Contributions & Candidate's election success

One would assume that receiving more campaign contributions would relate to a higher chance of getting elected, yet there is no clear correlation between campaign contributions and the vote shares which candidates receive (Stratmann, 2005; Weschle, 2022a) p.24. In fact, there are a host of factors that influence the amount of campaign contributions of politicians, which are often endogenously (?) estimated for vote shares (Weschle, 2022a) p.24.

Geographical factors play a role in contribution, for example. A contribution amount is worth more in some congressional districts than in others, since costs like rallying and advertising are priced differently (Stratmann, 2009). Similarly, contribution limits imposed on certain US states cap the contribution amount candidates may receive (Weschle, 2022a) p.25, and candidates from states with larger governments receive more contributions on average (Stratmann, 2005) p.148 (Bronars & John R. Lott, 1997). Factors which depend on the nature of the election also influence the level of contributions, since expected closeness of the election outcome also changes the average contribution amounts, i.e. incumbents who expect their position to be threatened will be incentivised to spend more (Weschle, 2022a), (Stratmann, 2017) p.8. p.25. The partisan “leaning” of the state also determines which candidates are up for race (Stratmann, 2017) p.9. PAC contributions in particular depend on the incumbency status of the candidate, since incumbents receive more contribution on average (Fouirnaies & Hall, 2014; Selling, 2023). When academic papers such as that of (Weschle, 2022a) include factors such as those above, increased campaign spending does relate to higher vote shares for representatives.

2.3 Correlation Campaign Contributions & Votes in Contributor's favor

In general, consensus that there is no link between PAC contributions and votes in that PACs favor (Selling, 2023) p.1 (Fellowes & Wolf, 2004) p.315, (Fiorina, 1999) p.216

- correlation between contributions and votes is given due to the support of similar interests, so we have simultaneous equation bias (Stratmann, 2002) p.1 (Burris, 2001; Chappell, 1982). (can be found in the section below)
- One major issue arises due to possible reverse causality, meaning that while contributions have an impact on roll call votes, it is also possible that legislators who cast roll call votes which are favorable to interest groups receive contributions from these groups." (Stratmann, 2017) p.14 (can be found in the section below)

2.4 Causal Effect of Campaign Contributions on Representatives' Voting Decisions.

Even if we have correlation between campaign contributions and the votes in the contributors interest, it is still important to determine from which side the causation runs. Do incumbents cater to wishes of special interest groups, because of their contribution or do they get contribution because their views coincide with the special interests groups (Stratmann, 2005) p.143 (Kau et al., 1982) p.275? Similarly, it is difficult to distinguish between two possible explanations for donations to politicians: either donors merely sympathise with and support politicians who share their views, or donations actually influence the politicians' decisions (i.e., donations actually buy votes) (Bronars & John R. Lott, 1997; Chappell, 1982) p.83.

Several researchers have tried to identify a causal relationship between voting and contributions and have not found effects, such as Bronars & Lott, which analysed how the voting behavior of politicians changed when they did not stand for re-election. Ideally, politicians should represent their ideology, even without facing threat of re-election, yet if their vote is "bought" then their contributions and voting behaviour changes, since the cost of shirking decreases (Bronars & John R. Lott, 1997) p.319. (Ansolabehere et al., 2003) analysed 40 empirical papers and concluded in a seminal paper that there is limited evidence indicating

interest group contributions have an impact on roll-call votes (Grier, Grier, & Mkrtchian, 2023).

Others, however, have found that contributions change voting behaviour: Stratmann analysed the timing of contributions, and instead of analysing how the contributions of the previous cycle relates to the voting behaviour of politicians, Stratmann took the contributions from current election cycles, since short term contributions are more relevant for voting behavior, according to him (Stratmann, 1995). Bertrand deduces that lobbying companies provide special interest groups access to politicians when contributing (as opposed to giving only issue specific information to congress members), and finds indirect evidence of this (Bertrand et al., 2014; Matter et al., 2019). Baldwin and Magee also find linkages of rollcall votes on specific trade agreement related bills and the contributions from businesses and labor groups (Baldwin & Magee, 2000). McAlexander, in his paper on the electoral gap in environmental voting shows that “Candidates that receive generous campaign contributions from the oil and gas industry increase their pro-environment voting at election time, because they understand that the public’s preference for environmental protection is stronger than that of the oil and gas industry” (McAlexander & Urpelainen, 2020). Also Mian et al. find that campaign contributions alter rollcall votes (Mian et al., 2010).

Given that some results find causal relationships between contributions and others find no effect, one can conclude that there is no academic consensus on this matter (Stratmann, 2017) p.13. Moreover, it is difficult to ascertain from which direction the causation runs, there has been little causal evidence to identify “the causal direction of donations on legislators’ voting decisions” (Matter, Roberti, & Slotwinski, 2019) p.6. Part of the reason there is no academic consensus on causal relationships is because of the nature of the studies, which are cross-sectional in design, where correlation between contributions and votes is given due to the support of similar interests, so we have simultaneous equation bias (Stratmann, 2002) p.1 (Burris, 2001; Chappell, 1982).

The studies which found causal links between campaign contributions and voting behaviour have a common denominator: research in particular fields or legislation. Baldwin and Magee, for example, (Baldwin & Magee, 2000) analysed trade agreement related bills, (Stratmann, 2002) analysed financial bills (Kang, 2015; Stratmann, 1995; 1995) and the timing of financial contributions, and found significant effects. Hence, one needs to analyse “specific votes and a rather narrow policy setting” (Kang, 2015; Stratmann, 1991) p.607 (Chappell, 1982).

Moreover, Stratmann criticises that most studies done in the field lack “a convincing identification strategy to estimate the causal effect of campaign contributions on legislative voting behavior. One major issue arises due to possible reverse causality, meaning that while contributions have an impact on roll call votes, it is also possible that legislators who cast roll call votes which are favorable to interest groups receive contributions from these groups.” (Stratmann, 2017) p.14

Common criticism in the field is attributed not only to studies whose analysis does not focus on a specific legislation or account for reverse causality, but also those who do not control for individual counties and geographical areas (Stratmann, 2005) p.142 (Grier, Grier, & Mkrtchian, 2023). Moreover, by looking at repeated votes and thus changes in voting behaviour, a link can be determined between contribution and voting (Stratmann, 2005) p.143-144 (Stratmann, 2002). Considering a closer time-frame for contribution has also proven to increase plausibility (Stratmann, 1995).

Given the extensive research done in money in politics, and moreover in the (causal) relationship between campaign contributions and rollcall voting behaviour, this paper will aim to take the above stated specifications to analyse a causal relationship between campaign contributions and rollcall votes in the environmental context.

3 Research Design

This section will deal with the reasoning behind the chosen votes (and contributions) for the analysis, and the hypothesis which are set up for the analysis.

3.1 Roll Call Vote Specifications from Stratmann

Thomas Stratmann (Stratmann, 2002), who in his 2002 paper follows a similar methodology to determine the causal relationship between campaign contributions and the representative's vote shares, defines the following rollcall votes preconditions for his research: the votes are not only repeated but also exhibit changes in voting behaviour (Kau, Keenan, & Rubin, 1982) p.276 (Stratmann, 2002). Moreover, the winners and losers of the votes need to be defined, the precise subject voted on should not be repeated again, this way patterns in contribution and voting behaviour can be deduced more easily. These conditions are met in this analysis. There are six roll call votes which are related to methane pollution safeguards (i.e. the methane emissions of fossil fuel companies), and these are not repeated to this date, since the vote relates to the acceptance or rejection of an increase in environmental regulation, the winners and losers of the votes are clearly defined.

There are conditions, however, which Stratmann sets up which are not met in this paper. On the one hand, he stipulates that the research should treat a topic where representatives “do not typically take clearly articulated positions in their voting campaigns” (Stratmann, 2002) p.4. This is not met here, since environmental positions are polarising, and most legislators have clear positions on environment, due to their party line, or also their personal conviction (McAlexander & Urpelainen, 2020). Stratmann also states that substantial amounts of representatives should receive campaign contributions from the relevant interest group, here pro- and anti environmental and fossil fuel related contributions. This is split in this paper, since a substantial amount of legislators receive more from fossil fuel industry, and the Energy and natural resources interest groups was the 9th biggest interest group contributor in 2022 with a total of 196 Billion USD contributed over the 2022 congressional election. The environmental contributions, on the other

hand, are a fraction of this (n.d.-c). Thus, it is more difficult to compare the contribution sizes of these interest groups. Lastly, Stratmann determines that there need to be changes in voting behaviours of the representatives, yet in this case, only 23 representatives out of 529 change their vote over time.

3.2 Topic of Roll call Votes (Methane Pollution Safeguards)

Although as shown in the section above, the rollcall bills do not fit the preconditions stipulated by Stratmann in (Stratmann, 2002), analysing environmental policy and the propensity for representatives to deviate based on contributions is still a relevant topic and has significant repercussions for democracy if a causal relationship does exist.

Although environmental subjects are polarising for the public and for representatives, which might indicate that representatives have less incentives to change their opinions, McAlexander (McAlexander & Urpelainen, 2020) has found that most environmental policies direct the cost of a sound environmental to industries, so the public has a generally more favorable environmental opinion than an average interest group, which indicates that if campaign contributions could change the voting behaviour of representatives, then representatives would prefer to take up positions that favour the interest groups more, i.e. less strong environmental positions (McAlexander & Urpelainen, 2020).

Moreover, the reason to choose these bills for the analysis can be attributed to the fact that, as stated above, the energy and natural resources interest groups are some of the biggest contributors to congressional elections (n.d.-c) and thus also have the biggest potential to be analysed, since these contributions are not only large in volume but also in distribution, as stated in the Introduction.

The six bills chosen for this paper are the following: The 2013, 113th congressional session Rollcall Vote 601 of Bill Number: H. R. 2728, the Protecting States' Rights to Promote American Energy Security Act, would preserve the Department of the Interior's ability to reduce methane emissions from oil and gas drilling operations on public lands. (, n.d.-b) The 2016, 114th congressional ses-

sion Roll Call 434 of Bill Number: H. R. 5538, the Department of the Interior, Environment, and Related Agencies Appropriations Act, 2017, would include a rider into the main bill to stop the EPA from enforcing its recently determined methane pollution regulations, which are the first-ever caps on methane emissions from new and altered sources in the oil and gas industry. (, n.d.-c) The 2017, 115th congressional session Roll Call 488 of Bill Number: H. R. 3354, would hinder the Environmental Protection Agency’s efforts to control methane emissions from newly created and altered sources inside the oil and gas industry. (, n.d.-d) The 2018, 115th congressional session Roll Call 346 Bill Number H. R. 6147, would hinder the Environmental Protection Agency’s (EPA) efforts to decrease methane emissions in the oil and gas industry from both new and modified sources from the oil and gas industry (, n.d.-e) The 2019, 116th congressional session Roll Call 385, Bill Number H.R. 3055, would hinder the Environmental Protection Agency’s (EPA) from implementing standards to reduce methane emissions from both new and modified sources from the oil and gas industry (, n.d.-f). The 2021, 117th congressional session, Roll Call 185 Senate Joint Resolution 14, (taken up by both the house and senate) would have rolled back on the EPA 2016 methane standards for both new and modified sources from the oil and gas industry (, n.d.-g).

The reasoning behind choosing these six bills is that they all amend the resources allocated to the Environmental Protection Agency (EPA) and the Department of Interior. Since the legislation enacted by Congress governs the executive wing and the EPA (McAlexander & Urpelainen, 2020) p.43, these rollcall votes are fundamental in gauging the environmental opinions of representatives. Moreover, the bills are quite similar in nature, since they not only all concern the same departments, but also precisely the methane pollutions and -emissions, not just any environmental pollution, and these bills specify the methane pollution generated through the oil and gas industries, and are thus industry specific.

	No Change in Voting	Change in Voting
Pro-Environmental Vote	259	8
Anti-Environmental Vote	278	23

Table 1: Representative’s Voting Positions

Although in (Stratmann, 2002)’s paper the two rollcall votes all pertained to the amendment of the same bill. This paper uses multiple, closely related, rollcall votes, and thus ensures that there is more variation in voting behaviour than there would be, if only two rollcall votes were available. Out of 568 representatives who voted on more than one of the six rollcall votes, only 23 representatives changed their voting behaviour, and of these 23 representatives, there were 31 vote changes in total, as seen in Table 1. Moreover, the fact that these rollcall votes are closely paced, i.e. 2013, 2016, 2017, 2018, 2019, 2021, means that there is a higher chance that representatives participate in more than one vote, unlike in (Stratmann, 2002)’s paper, where the two rollcall votes were in 1991 and 1998, which are 3 congressional sessions apart. Thus, the chance of a representative partaking in multiple votes decreased substantially.

3.3 Hypotheses

Given the topics of the rollcall votes, see Section 3.2, which are environmental in nature, and the fact that environmental issues are topics which are usually of public interest indicates that most representatives have predetermined environmental positions and are less likely to change these throughout their time in office (McAlexander & Urpelainen, 2020). This can also be seen in the data from the rollcall votes Table 1. Hence, this paper predicts that the effects of pro-environmental or anti-environmental contributions on the environmental voting behaviour of representatives will be minimal, if significant.

Given the differences in contribution sizes from the various interest groups, see Section 3.1, i.e. oil and gas (thus anti-environmental) individuals and interest groups contribute significantly more to congressional elections than pro-environmental individuals and interest groups, the second hypothesis states that changes from pro-env. to anti-env. votes will be more positively correlated with anti-environmental contributions, and the pro-env. contributions will be less significant and less “effective”, given their lessened propensity to contribute to representatives.

(Stratmann, 2002) shows that for junior representatives, the marginal effect of contribution was greater, whereas senior representatives were more steadfast in their positions. Similarly, this paper/model predicts that legislators in their early congressional terms are more likely to change their voting.

Lastly, since partisan affiliation and ideology is rather polarised in the United States (McCarty, Poole, & Rosenthal, 2006), and that usually, republicans receive higher campaign contributions on average, see Figure 1, the fourth hypothesis is that the effect of contributions on voting behaviour will be more significant for republican representatives than for democratic representatives.

4 Data

The empirical framework stipulated in Chapter 3 requires the comparison of voting behaviour of the US representatives and the campaign contributions which these received. Hence, the data for the analysis consists of three data types joined together: Data on the Representatives, their contribution data and the rollcall data. The following chapters consists of the description of the data types, where they were sourced, and the data processing for the analysis.

4.1 Representative data

To be able to conduct the analysis, a comprehensive dataset of all US representatives who participated in the relevant congressional sessions (113th-117th) was needed, which includes biographical information, to be able to control for age, gender, etc. in the analysis. Moreover, identification was needed, to be able to assign each rollcall vote and contribution definetly to a certain representative, and not have to deal with matching issues.

Given these requirements, the data on the US representatives was sourced from the github repository congress-legislators, which is created and managed by a shared commons, and includes detailed information for all historical and current US congressional members, including various IDs they have across US legislative data providing platforms. Since the above data is not ordered according to congressional sessions which each representative partook in, data from (, n.d.-h) was used match the data on current and historical legilsators with a list of the representatives participating in each seperate congress.

4.2 Rollcall data

As (Stratmann, 2002) stipulated in his paper, to be able to analyse changes in voting behaviour, the cross-sectionality of panel data needs to be exploited, and the votes need to be categorised clearly into winners and losers. This also means, that one needs to be able to deduce from the votes which candidates voted pro-one special interest group, and anti- the other one.

Due to this specification, the data from the League of Conservation Votes Scorecard was used throughout this paper. The website is predetermines which rollcall votes are pro-environmental and which are anti-environmental. One of the major downsides of using this data, however, was that the LCV Scorecard did not use IDs to prior to 2021, meaning that only in the last vote were IDs matched to each representative. Although approximately 60% of representatives present in the last rollcall vote, were also present in the votes prior and thus were able to be matched by IDs, about 40% of the representatives had to be matched by first and lastnames, parties and states, only, which caused merging errors, which will be detailed more in Section 4.4.

Considering these circumstances, utilizing one of the many other rollcall data providing websites, such as Govtrack US, Congress.gov and C-Span would have been more useful, since these match representatives with a unique identifier. This was not possible, however, because these websites do not publish all rollcall votes but only the most relevant, i.e. the votes which passed a bill. For this analysis, however, the environmentally related rollcall votes are to be used and these are often not published on the aforementioned websites. Thus, the LCV Scorecard Website was used to source rollcall data, despite their incomplete use of IDs for representatives.

Considering the circumstance that the 2021 votes had a different format than the 2013-2019 votes, the representative's names were often different, and thus could not be joined easily to create an aggregate rollcall dataframe.

```
fuzzy_match <- function(x, y, max_dist = 5) {  
  return(stringdist::stringdist(x, y) <= max_dist)  
}  
roll_call_full_<- fuzzy_full_join(  
  methane_116,  
  methane_117,  
  by = c("name", "Party", "District"),  
  match_fun = list(fuzzy_match, `==`, `==`)  
)
```


To overcome this, the R package `fuzzyjoin` (Robinson, 2020) was used. Using the functions `clean_strings` to remove special characters and `fuzzy_match` and `fuzzy_full_join` to join, a maximum distance between two values can be determined, here 5 characters. in the `fuzzy_full_join`, I defined that the names between the two dataframes can be matched if they are at most 5 characters distance from one another, while the variables `Party` and `District` need to be identical to match.

4.3 Contribution data

4.3.1 Time Frame of Contributions

As discussed in Chapter 1, Stratmann uses two different approaches to measuring the effect of campaign contributions on voting behaviour. In his (Stratmann, 1995) paper, Stratmann explores whether contributions closer to the vote are more important in determining voting behaviour than contributions of previous congressional elections. He concludes that current election contributions in his case of dairy legislation, are more determining for voting behaviour than that of the previous election. In the (Stratmann, 2002) paper, Stratmann uses the aggregate campaign contributions allocated to representatives in the election post and prior to the congressional session, i.e. contributions from the 1989-1990 and 1995-96 vote to explain the 1991 and 1998 vote and the contributions from the election happening parallel to the vote i.e. Stratmann uses the 1991-92 and 1997-98 contributions to gauge whether there are punishments or rewards for the representative's voting behaviors. In both cases, he finds positive correlation between contributions of current and prior elections from special interest groups and a vote in their favor, of which one can conclude, that multiple congressional election contributions should be taken into account for each vote.

To account for these differences in campaign contribution selection, I explored both options: On the one hand, I calculated the contribution variables based on the previous election cycle, based on several academic papers who take the same approach (Chappell, 1982; Kau, Keenan, & Rubin, 1982; Selling, 2023; Stratmann, 1991; 2002) to gauge whether aggregate contributions from election cycles may

influence the voting behaviour of representatives in the environmental context. On the other hand, I included only the campaign contributions from individuals and interest groups which supported a pro or anti environmental vote, which were given to representatives 6 months prior to the relevant vote. This means that I include not specific election periods, i.e. current or previous, but relevant contributions that roll in shortly before the vote. This is based on the hypothesis 4 stipulated in Section 3.3, that contributions are time related.

Vote Date	Cutoff Date	Cycle	Nr. of Contributions
June 25th 2021	Dec 25th 2020	2022	4965
		2020	34
June 20th 2019	Dec 19th 2018	2020	5191
		2018	30
Jul 18th, 2018	Jan 17th 2018	2018	7749
Sep 13th 2017	Feb 12th 2017	2018	7148
Jul 13th 2016	Jan 12th 2016	2018	1
		2016	7142
Nov 20th 2013	Mar 19th 2013	2014	7085

Table 2: Consolidated contribution data with vote and cutoff dates

When looking at what kinds of contributions are included in the six months prior, the following pattern emerges: since most votes are quite late in the respective congressional sessions, the contributions 6 months prior usually include contributions from the current congresses, and sometimes those of the previous one.

Discussing these two types of campaign contributions, i.e. aggregate contributions from the previous election, and the use of contributions from current elections shows that in these two papers, both the entire contributions of an industry to candidates in one election are given and that merely the time of relevance is different (Stratmann, 1995; 2002). Yet what these two papers, and many with similar methodology neglect to analyse is whether more timely contributions are more effective in affecting the voting behaviour of candidates. After all, most contributors who are profit-maximizing contribute strategically and in close temporal proximity to roll calls to maximize their influence on voting behaviour (Selling, 2023) and thus contribute closer to the vote, in order to assure that representatives

do not back out of their promises to support the special interest groups' causes (Stratmann, 1998). By including a more restricted time frame for contribution, such as six months prior to the vote, these trends can be captured (Grier, Grier, & Mkrtchian, 2023), without extending the time frame to such an extent that the contributions of the closely paced votes (SEP 13, 2017 and JUL 18, 2018) in the 115th congressional session overlap. Which is why, albeit analysing both strategies in this paper, for the main analysis, only the contributions within six months prior to the votes will be included.¹

4.3.2 Contribution Data Sources and Processing

Campaign contribution data is readily available through a multitude of open source platforms². Among those is the Center for Responsive Politics which provides contribution data through its Bulk Data³, which includes PAC contributions to US representative candidates and individual contributions to candidates, PACs, etc.

To clean the aggregate contribution data, the relevant contribution data was imported. The oil&gas-, methane-, natural gas-, coal-, environmental- and alternative energy contributions were imported for all incumbents, and then these were cleaned and categorized into pro-environmental and anti-environmental contributions, and joined with a list of all representatives per session.

Cleaning the bulk data for the timely contributions was more complex because of the size of the files and the comparatively small 8 GB RAM I had available. Given that the PAC and individual contribution text files had over 2 million rows and were over 15 GB large at times, made the importing let alone processing tedious, even when including built in (Wickham et al., 2019) tools and functions, such as piping and lazyloading. To resolve this, I wrote several shell scripts which check whether a cleaned file exists, and if not cleans the file anew. This saved

¹A comparison of both the aggregate and the timely contributions included in the models can be found in the appendix.

²such as Sunlightlabs: https://sunlightlabs.github.io/datacommons/bulk_data.html and the Database on Ideology, Money in Politics, and Elections (DIME), but which were not suitable for this analysis

³The bulkdata can be accessed through <https://www.opensecrets.org/open-data/bulk-data>

time and RAM space in two ways: On the one hand, cleaned files would not be re-cleaned uselessly, and on the other hand, shell scripting ensures a better utilization of RAM space when working with large files, such as these of individual and PAC campaign contributions.

After the pre-cleaning process through the scripts, only Individual and PAC contributions were kept which were allocated to incumbents. Using the OpenSecrets RealCodes⁴, only relevant pro-environmental and anti-environmental (fossil fuel) contributions were kept. Moreover, only non-negative contributions were kept.

4.4 Merging

To merge the three types of aforementioned data together, two types of merges (or joins, synonymous in R) were done. About 60% of the data was able to be merged together based on a set of Unique Identifiers, which was Bioguide ID for the rollcall data. Post primary merge, the rest of the data, which was not able to be merged was filtered out and merged based on the (Friedrichs et al., 2021) functions `fuzzy_match` and `fuzzy_join` functions as shown in the code block in Section 4.2. Finally, the two merged dataframes were concatenated.

Finally, only about 30 representatives were not able to be merged and thus removed. The reason for this is because these anomalies either joined or left congress halfway through the session or switched from the US house of representatives to the senate, and thus these members appeared in some dataframe, but not in the others, i.e. are marked as representatives but were not included in the vote and did not receive contribution, since they were not part of a regular election.

For the final dataframe used for analysis, the 731 representatives (over 113th-117th congresses) were further decreased, to only include representatives relevant to the analysis. This includes only representatives, who voted on more than one relevant bill. Without this specification, one couldn't analyse differences

⁴which can be found under https://www.opensecrets.org/downloads/crp/CRP_Categories.txt

in voting behaviour. Moreover, only Republicans and Democrats were included, since Independent and Libertarians are too few to be able to compare.

5 Econometric Models

In order to test the for the changes in voting behaviour due to campaign contributions, the model setup must allow for a dichotomous dependent variable, i.e. pro-environmental vote (1) or anti-environmental vote (0) and for the non-negativity of contributions (Chappell, 1982; Stratmann, 1991; 2002).

Two types of models that come into question for these are the Linear Probability Model (LPM) and the Logit, which are both frequently used in economic literature, but both come with their up- and downsides. The LPM is an ordinary least squared linear regression with binary dependent variables. The benefits of using a LPM to analyse the effect of campaign contributions on voting behaviour is the fact that the linear regression can be used to estimate the effects on the observed dependent variable, so coefficients are comparable over models and groups (Mood, 2009). One downside, however, is that there is a possibility for the predicted probability to be out of range, by being either higher than 1 or lower than 0.

In order to counter this, one can use the logistical regression or logit model, which also measures dichotomous dependent variables but the predicted probability will always stay within range of $(0, 1)$. Comparing models with various independent variables or significantly interpreting the results is challenging when using logistic regression since the distribution of the logistic regression is non-linear and thus changes in log-odds are not as intuitive to interpret as direct probabilities. Moreover, (Mood, 2009) explains that logistic effect measures can capture unobserved heterogeneity even in cases where there is no correlation between the omitted variables and the independent variables (Selling, 2023).

Although the linear regression sometimes predicts probabilities outside of range, LPMs usually fit about as well as logit models, even in cases of nonlinearities (Long, 1997; Selling, 2023), and their results are easier to predict than those of logit models (Mood, 2009), which is why the LPM will be used as a main model for this paper. To encompass the major downsides of the LPM, however, a Logit Model will be included as a robustness check.

5.1 Model specification

Measuring the relationship between campaign contributions from pro and anti-environmental sources and environmental voting behaviour is difficult, since many other factors are at play to determine voting behaviour (Selling, 2023). Because of this, this paper will include models which range from using the most generous conditions, such as using control variables and most strict, using individual fixed effects.

To control for confounding influence factors between a treatment and an outcome and approach a consistent causal interpretation (Hünernund & Louw, 1AD), the following control variables are used: the legislator's party and whether their party had House Majority during that term (McAlexander & Urpelainen, 2020; Stratmann, 2002), these control variables are used since party is a good determinant for a legislator's ideological leaning, and whether their party has the majority determines the power which the group has over the house of representatives.

To control for the junior/senior legislators stipulated in Section 3.3, I decided to add both the birthyear and seniority, which is number of terms in house the representative served, to control for the difference in age and experience which might distort the voting behaviour (Stratmann, 2002). By controlling for differences in geographical residence of the representatives, using state, geographical⁵ and the district level we remove possible differences in voting behaviour attributed to the location of representatives.

Based on roll-call records, the DW-Nominates are a widely used indicator of a representative's policy opinion in a multidimensional policy space, which serve as a strong predictor of the voting decisions of representatives (Matter, Roberti, & Slotwinski, 2019; Poole & Rosenthal, 1985). By including the absolute value of the first and second dimension of the DW-Nominate⁶ as control variables, we

⁵the variable Geographical has the 50 US states grouped into four categories: Northwest (NW), South (SO), West (WE), Midwest (MW), according to the United States Census Bureau under <https://www2.census.gov/geo/pdfs/reference/GARM/Ch6GARM.pdf>

⁶accessible under <https://voteview.com>

control for differences in ideology that might explain voting behaviour. Regarding the rollcall votes, the six rollcall votes included do not all pertain to the same bills, but I make the assumption that they are all the same bill considering they all touch upon the same topic and institutions, see Section 4.2, and thus I will not control for differences in bills (Grier, Grier, & Mkrtchian, 2023).

By including control variables, we are able to fix certain factors that we can measure and assume have confounding effects on the predicted probability. Using two-way fixed effects (FE) (Imai & Kim, 2019), however, we account for unobservable elements that remain constant across time, and thus remove time invariant confounding (Grier, Grier, & Mkrtchian, 2023). In this paper, three types of fixed effects are used: In the more generous version, I fix for the variables geographical region and year, since this measures only the change in contributions within a year and same geographical location.

In a stricter version, I fix for year and state. This provides more accurate results on the geographical level. By controlling for states, possible differences in state ties to the fossil fuel industries and severely environmentally affected states are not compared to one another, since these differences are important enough to influence both contributions and voting behaviour. By controlling for years, on the other hand, time-variant differences such as environmental perception or environmental disasters are not taken out of context and compared with years with little environmental happenings.

Lastly, in the strictest model, I fix for both legislators and years. The reason behind fixing for something as large as the representative, is because it gives the ability to control for omitted variables which are constant over time for each legislator such as the representative's background, which is complex and high dimensional and bound to affect the individuals voting behaviour (Huntington-Klein, n.d.; Stratmann, 2002). Not only am I thus able to address the omitted variable bias which I was not able to address through my control variables since they are difficult to measure (Grier, Grier, & Mkrtchian, 2023), such as the representative's eloquence and negotiation skills, proximity to the fossil fuel industry

and/or environmental industry, etc. but I am able to remove previous FEs, such as the state or geographical fixed effects, since these usually do not change within a representative over time.

5.2 Linear Probability Model

As mentioned in Section 5.1, the most generous model is the linear probability model shown in Equation 1.

$$\text{Vote}_{i,t} = \alpha + \beta_{1t}\text{Contributions}^{\text{pro-env}} + \beta_{2t}\text{Contributions}^{\text{anti-env}} + \gamma_i + \delta_t + x + \varepsilon \quad (1)$$

This model includes the entire sample of representatives who voted more than once on the set of the six roll call votes, it is non-discriminatory based on voting behaviour, where β are the explanatory variables of interest, Contributions from pro and anti-environmental sources, X is the matrix of control variables, δ_t are the time fixed effects and γ_i are the individual fixed effects, all of which are detailed in Section 5.1.

Using Equation 1 as a basis, I explored different variations of measuring the relationship between voting behaviour and contributions. One version is to isolate each vote, and include all relevant contributions from previous votes and those of the current vote. This way, the assumptions made in Section 4.3.1 are put to the test, and not only the short term contributions when an environmentally relevant vote is upcoming, but the previous contributions on similar topics are taken into consideration, to measure whether contributions are more long-term after all.

To address the hypotheses made in Section 3.3, the Equation 1 model was also used to measure the relationship which contributions have on voting in general, to see the “simple” relation between voting and contributions. In return, the LPM model was also applied to only those representatives who changed their voting over the course of the six rollcall votes. This way the causal identification strategy is approached, since only with variations in voting can these conclusions be drawn (Stratmann, 2002)

5.3 Logit and Probit

As robustness checks, the entire above process will be repeated with the logit and probit models, which, as mentioned in Section 5.1 have different uses than the LPM model.

$$P(y_{it} = 1|x, \beta_{1,2}, \gamma_i + \delta_t) = F(\beta_{1,2}'x_{it}, \gamma_i + \delta_t) \quad (2)$$

6 Results

6.1 Hypothesis 1

One of the hypothesis stated in Section 3.3 is that the effect of pro and anti environmental campaign contributions would be minimal, if significant. As visible from the regression outputs in the appendix, this was not the case. From using control variables to state and year fixed effects in the LPM with all representatives, the campaign contributions from environmental sources and non-environmental sources were highly significant.

For the most LPM shown in Equation 1 including control variables showed that when increasing the pro environmental contribution to representatives by one USD, the probability of the representative voting pro-environmentally increases by 0.00007214 percent on average, holding all else constant. In return, when increasing anti-environmental contribution by one USD, the probability of a representative voting pro environmentally decreases by an average of 0.000006 percent, holding all else constant. Both of these coefficients are significant on a 0 level. Given that the contributions from both anti and pro-environment are highly skewed, I applied a logistical transformation on the contribution variables, and found that although the adjusted R^2 increases from 0.91 to 0.92 and the effect of the anti-environmental contribution variable increases to -0.0121 holding all else constant and with the same significance level, the significance of the pro-environmental contribution variable is estimated to be an average of 0.011, holding all else constant, but the significance level of the estimator decreases.

When fixing the LPM model by US state and year, the adjusted R^2 stays at 0.91 and the contribution coefficients remain highly significant with a one USD increase in pro-environmental contribution increasing the probability of a pro-environmental vote by 0.0000698 percent and a one USD increase in anti-environmental contribution decreasing the probability of a pro-environmental vote by 0.0000048 percent. Only when applying legislator and year fixed effects does the significance of the pro-environmental contributions decrease to a 0.01 level, with

a one USD increase in pro-environmental contribution increasing the probability of a pro-environmental vote by 0.0000361 percent on average, holding all else constant. The anti-environmental contribution coefficient however is not significant at all, yet the predictors are very good in explaining variations in the dependent variable, with an adjusted R^2 of 0.953.

Although these adjusted R^2 values are very high and might raise suspicion of multicollinearity within the predictor variables, the VIF values of all variables are below 5, with most of them being between 1 and 1.25, and a correlation plot shows similar results, that no variables are suspiciously highly correlated with one another. This means that the high adjusted R^2 values are not due to multicollinearity, but rather due to the high explanatory power of the model, which can be attributed to the fact that most of the control variables are highly significant and have a high explanatory power on their own, such as the representative's party and DW-Nominate dimensions which are already very good predictors of the representatives voting decisions on their own. Hence, the first hypothesis from this paper can be rejected, since the effect of pro and anti environmental contributions on voting behaviour is not minimal, considering each effect is measured on a per USD scale and is also rather highly significant.

6.2 Hypothesis 2

In the second hypothesis, changes from pro to anti environmental votes are predicted to be more positively correlated with anti environmental contributions, and pro environmental contributions less effective. Considering, however, that only 23 representatives changed their votes over the course of the six rollcall votes, with only 31 vote changes in total, no conclusions can be drawn from this LPM model, and in return, no conclusions can be drawn about the propensity of contributions, whether pro or anti environmental in nature, to change the voting behaviour of representatives. Not only are the estimated models, see Appendix, estimating insignificant coefficients, but the adjusted R^2 is very low with 0.23, especially given the value of this metric in the previous models.

The only conclusion which can be drawn in respect to this hypothesis, is the fact that the effect of contributions was indeed not the same, when comparing pro environmental and anti environmental sources. The differences in pro-environmental and anti-environmental contributions is very large, see Section 4.3, in the first place. Moreover, the environmental contributions prove to be targeted towards democratic representatives, possibly due to the fact that the pro-environmental funds are limited in the first place, and thus the contributions should be more effective, rather than the anti-environmental contributions, which are more widely distributed, less differentiated and greater on average. This is also to be seen in the results of the LPM, which shows that if, not both contribution coefficients are highly significant, then usually only the pro-environmental contributions are significant, see the results from the LPM with legislator and year fixed effects, for example.

6.3 Hypothesis 3

The third hypothesis stated in Section 3.3 is that junior representatives are more likely to change their voting behaviour due to campaign contributions than senior representatives, given that they are not experienced enough to have stable opinions on the matter. To analyse this, I added the afore mentioned in Section 5.1 seniority and birthday (birthyear) control variables into the regressions. Since seniority details the number of terms the representative has partaken in and the birthyear represents the age of the legislator, I also checked that the correlation between the two variables would not be high enough to cause multicollinearity, which it was not, with a correlation of -0.57 , and a VIF of 1.27 and 1.28 respectively.

When looking at the LPM model with all representatives, the seniority variable was not significant, and the birthyear variable was significant at a 0.01 level, with a one year increase in birthyear increasing the probability of a pro-environmental vote by 0.007 percent on average, holding all else constant. The same trends were found when fixing the model by state and year, with the birthyear variable being significant at a 0.001 level and having an effect of 0.013 percent increase in pro-environmental voting for a one year increase in birthyear, and the seniority

variable being significant only at a 0.05 level with a one term increase in seniority increasing the environmental voting probability by 0.018 percent. When fixing the model by legislator and year (using plm instead of lm), the birthyear variable was not significant at all, and the seniority variable was significant at a 0.01 level, with a one term increase in seniority decreasing the probability of a pro-environmental vote by 0.0001 percent on average, holding all else constant. Similar results and significance for the birthday variable emerge when fixing the legislator, whereas the seniority variable is not significant at all.

Since only birthyear is mostly significant and seniority is not, one can conclude that younger representatives are more likely to vote pro environmentally in these votes holding all else constant, which compared to the results from the first hypothesis, the effect of a one year younger representative in voting pro environmentally is larger than that of one unit USD in pro environmental contributions. Whereas seniority affects the voting only when fixing for state and year, which means that the more experienced the representative is, the more prone they are to vote pro environmentally in these votes.

Still, although these results show the propensity of younger representatives to vote pro environmentally in these votes, this does not mean that young people are more prone to vote changes. To determine this, the the LPM model of only the representatives who changed their votes is taken into consideration, yet here neither birthyear nor seniority are significant, and thus no conclusions can be drawn in respect to the second hypothesis.

6.4 Hypothesis 4

In the fourth hypothesis, the effect of contributions on voting behaviour is stated to be more significant for republican representatives than for democratic representatives.

To check whether this might be the case I fixed not only year but also party in the two way fixed effects LPM and Logit/Probit models. The results show that when fixing for these two effects for the LPM of all representatives the results

are highly significant, as before. More interestingly, however, even when fixing party and year in the two subsamples, where only representatives are included who did (not) change their voting, the contribution coefficients are highly significant, which can not be said when including other two way fixed effects such as state and year, or legislator and year. This could be the case because on the one hand, party is a dummy variable, and all other fixed effects have more than 2 specifications, and are thus stricter models. Alternatively, since the predicted variable is a pro-environmental vote, which in nature is affected by ideology and politics, it is understandable as to why fixing for differences in party lines and ideology would be more significant than fixing for other variables.

7 Discussion and Conclusion

The main goals for the thesis was to explore the relationship of pro environmental and anti-environmental, specifically fossil-fuel, campaign contributions have on the voting behaviour of US. Representatives on the topic of methane pollution safeguard related rollcall votes. This paper finds that campaign contributions shape how the representatives votes on this particular matter. Elected officials are more likely to vote in agreement with the individual and PAC's contributions, if these interest groups contribute within six months of the vote.

Albeit including variables which track a representative's political ideology through rollcall votes (namely the DW-Nominate dimensions), and including legislator fixed effects to avoid omitted variable bias and thus including important metrics to measure causal relationships (Selling, 2023; Stratmann, 2002), no causal relationship between environmentally related campaign contributions and changes in environmental voting behaviour could be significantly estimated.

An explanations as to why no causal relationship can be concluded from this study, even though (Stratmann, 2002), whose methodology heavily influenced this paper, has found causality, is due to the small sample size of representatives which changed their votes over the course of the six votes, and the nature of the environmental topic, which is much more polarising and decisive among representative, and thus changes in voting behaviour are rare from the get-go. Moreover, whether his models were causal in the first place should be questioned in the first place, given that his assumptions for choosing the Glass-Steagall Act in the first place are shaky at times, such as that financial legislation is not of public interest and thus representatives have more voting leeway.

The implications of these results is that there is a clear relationship between anti(pro) environmental contributions and anti (pro) environmental voting behaviour of representatives and that dependent on the positions which representatives take, they have the possibility to earn their campaigns incredible amounts of donations, from the fossil fuel industry, for example. In a system where legislation should be made with the population in mind, the possibility of incumbents receiv-

ing campaign contributions has a bad aftertaste for the health of the american democracy (Weschle, 2022b). Moreover, given the steep rise in expenditures for congressional elections over the past 20 years, the effect which moneyed interest will have on votes will likely increase.

While this paper provides valuable insights, it has several limitations, which point to opportunities for future work.

Touched upon briefly in this paper, by regressing the pro enviornmental vote of representatives with the campaign contributions not only six months prior, but also the 6mo. prior to vote contributions of all similar votes before might show that representatives take contributions of previous similar votes as a baseline to determine their current votes.

As shown in results, methane related voting behaviour can be explained very well given the representative's party and DW-Nominate, meaning that the party line and ideology is a strong influencer for a legislators vote, and that most representatives tend to keep within those party lines. Thus, it would be interesting to analyse the campaign contributions not to individuals but parties themselves, and how this affects the party's votes on certain issues (Selling, 2023)

Another interesting topic for research would be to analyse changes in voting behaviour given by the nature of rollcall votes. Since these happen alphabetically, representatives whose names are further along the alphabet might be incentivised to deviate from party lines given a vote is already won/lost.

Using different sources of campaign contributions would also be an interesting approach. These include not individual and PAC contributions, but Super PAC contributions, which can be unlimited in size and cannot be directly allocated to a political candidate (Grier, Grier, & Mkrtchian, 2023).

Finally, another improvement to this paper would be to use more of the countless open source resources available to import campaign and representative data by using Application Platform Interfaces (API), which significantly ease the

data collection process. Resources such as the congress API⁷ or the tidycensus R package⁸.

⁷to be found at: <https://github.com/LibraryOfCongress/api.congress.gov/>

⁸documentation for which can be found at: <https://walker-data.com/tidycensus/>

List of Figures

Figure 1: Average Contributions to House Members, 1990-2022 11

Figure 2: Total Cost of Election, where * stands for a Presidential Election Cycle,
1990-2022 (n.d.-a) 12

List of Tables

Table 1: Representative's Voting Positions	20
Table 2: Consolidated contribution data with vote and cutoff dates	26

Appendix A: Supplementary Material

– Supplementary Material –

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