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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

Author: Minna Emilia Hagen Heim

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Supervisor: Prof. Dr. Ulrich Matter

Abstract

Wealthy donors such as the Koch brothers of Koch Industries have contributed over 27 million USD to various congressional candidates in the 2022 election. This paper analyses whether such contributions from anti-environmental interest groups such as Koch Industries influence congressional voting on environmental issues. Building on the work of Stratmann (2002), it examines repeated roll call votes on methane pollution and the corresponding campaign contributions received by US representatives within six months of these votes. Using a causal identification strategy, the analysis attempts to determine the impact of pro- and anti-environmental contributions on voting behaviour and finds that pro-(anti-)environmental contributions have a positive (negative) effect on voting behaviour, although no causal relationship can be definitively established due to the small number of representatives who change their voting behaviour.

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[1] Since the 2024 election cylce is due in November 2024, the contributions

there are not comparable to 2022 yet

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[3]Although the Individual Fixed Effects model shows an adjusted R-squared of -0.311, estimated with the `plm` function,the linear probability model estimated with the `lm` function with the exact same specifications,coefficients, standard errors and p-values has a much higher adjusted R-squared of 0.95. The reason as to why I still included this model and not the other, is that the fixed effects coefficients for the lm would show up in the model summary, and thus the model would be too long to be included in the stargazer output.

[4]the variable Instance refers to the Votes. The Instances are 3, 4, 51, 52, 6 and 7, where 3 stands for the vote in the 113th congress, 51 stands for the first vote in the 115th congress, 52 for the second vote in the 115th congress, etc. The district variable refers to the district which the legislators represented. Sadly not all representatives had the district information.

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List of Abbreviations

DW-Nominate **– Dynamic Weighted Nominate.**

EPA **– Environmental Protection Agency.**

FEC **– Federal Election Commission.**

LCV **– League of Conservation Votes.**

LPM **– Linear Probability Model.**

PAC **– Political Action Committee.**

VIF **– Variance Inflation Factor.**

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), alongside the Two-Party system becoming 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).

But how do campaign donors influence politics? The prime example is the brothers David and Charles Koch, are one of the most 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).

On the other hand, the fossil fuel conglomerate Koch Industries, headed by Charles Koch, fund the electoral campaigns of Republican presidential and congressional candidates (Skocpol & Hertel-Fernandez, 2016) and have spent more than 123 million USD on elections. Especially over the past ten years, Koch Industries have increased their campaign contributions by at least 10% per election cycle, amounting to 28 millon USD in the 2022 election cycle, with approximately 90-97% of these congressional contributions going to Republican candidates[5].

Given the participation which wealthy fossil fuel donors like Koch brothers have in US elections, the question is why donors such as these contribute immense sums to congressional elections? Surely, profit-maximizing firms such as the Koch Industries do not merely contribute millions of USD to congressional campaigns without considering their return on investment (Stratmann, 2017). Thus, the question is what campaign contributors are to receive in return for their donations. Given Charles Koch's position at Koch Industry and fossil fuel related conglomerate Koch Industries and David Koch's history in climate change denial (Doreian

[5]found at: https://www.opensecrets.org/orgs/koch-industries/summary?id=d000000186}

& 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. The influence of fossil fuel and environmentally related contributions on the voting behavior of US House members on methane pollution bills will be analysed. The analysis is based on the paper of Stratmann (2002), who exploits the time series nature of campaign contributions and roll-call votes to approach a causal identification strategy to measure the effect of financial contributions on roll-call votes. Regarding campaign contribution, however, Stratmann (2002) uses the aggregate contributions for each election cycle, whereas in his 1995 paper, only the contributions leading up to the vote are included, regardless of election cylce (Stratmann, 1995). Although both contribution types are explored, this paper will focus on the latter contribution strategy.

Chapter 2 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 roll-call 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 and Chapter 7 provides the discusses the results and concludes the paper.

2 Money in Politics

To understand the relationship between campaign contributions and representatives' voting decisions, the concept for money in US politics needs to be introduced. Weschle (2022a) defines three types of money in politics, namely self-enrichment, campaign contribution and golden parachute jobs. The first type happens when politicians are in office, and receive resources from special interest groups. The second is when 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.

2.1 Campaign Contributions

Although each type of political funding has significant and distinct repercussions for democracy and the voting behavior of politicians (Weschle, 2022a), campaign contributions in U.S. politics are of particular importance for the analysis presented in this paper. One reason for this, is that there has been a stark increase in contributions to political campaigns over time (Stratmann, 2005, p.141; 2017, p.1) and understanding the reasons behind contributors donating this money to fund campaigns could help policy makers deal with this issue. The average contributions to members of congress have increased as well within the last 40 years.

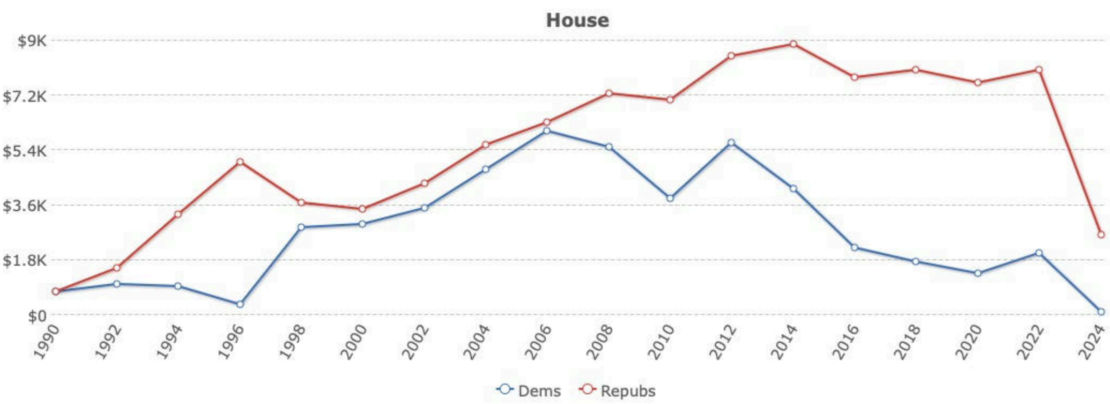

Figure 1: Average Contributions to House Members[6], 1990-2022, Source: (Center for Responsive Politics, 2024a)

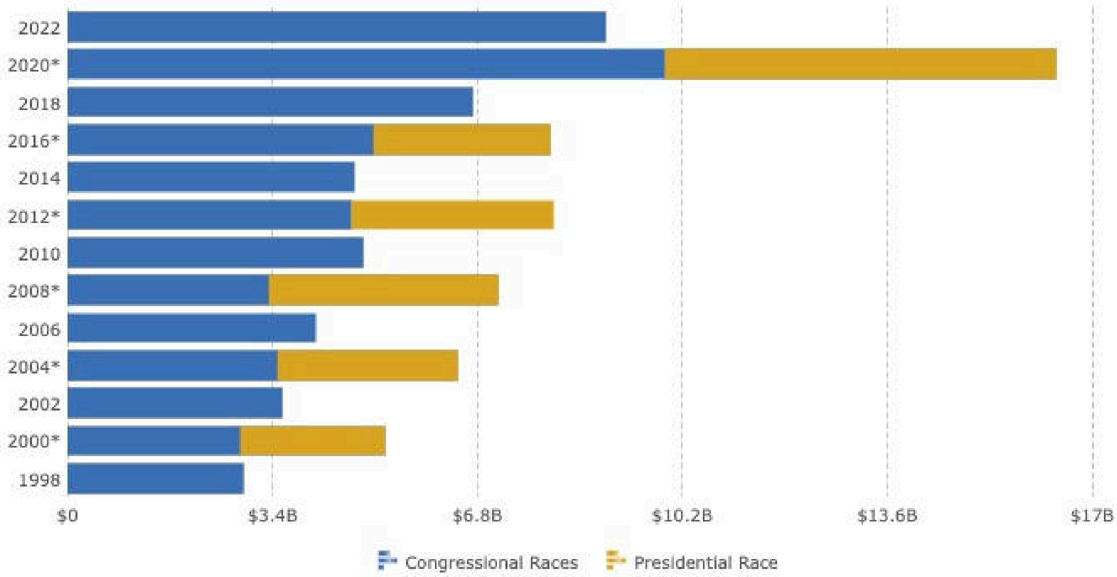

Figure 2: Total Cost of Election[7], Source: (Center for Responsive Politics, 2024b)

One of the primary reasons for the noted increase in both the total costs of presidential and congressional elections over the last 30 years, as well as the average campaign contributions per representative, is a significant change in legislation. In 2010, the U.S. Supreme Court ruled on the landmark case Citizens United v. Federal Election Commission (FEC). This decision addressed whether Congress could limit independent expenditures by corporations. Traditionally, campaign contributions are structured as individual and Political Action Committee (PAC) contributions, as shown in Center for Responsive Politics (2023) data. Individual contributions are those over 200 USD made by natural persons or their family members who are employed in the industry (Grier et al., 2023). PACs represent corporate or labor interests (Weschle, 2022b). The Citizens United v. FEC ruling affirmed that both natural and legal persons—individuals and corporations—possess equivalent rights to spend on U.S. congressional campaigns (Foreman, 2018,

[6] Since the 2024 election cylce is due in November 2024, the contributions

there are not comparable to 2022 yet

[7]where * stands for a Presidential Election Cycle, 1990-2022

p.194). This decision ultimately allowed for unlimited independent expenditures related to elections[8].

Even if campaign contributions have risen over time, the reason as to why politicians receive them should be clarified. US Citizens who would like to become members of the United States Congress, such as the House of Representatives, which is the chamber of congress which this analysis 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 flyers to attract more votes (Weschle, 2022a, p. 24).

Yet, why would corporations give money to candidates via PACs or individual contributions, which these will not return? Stratmann makes the assumption that since corporations are inherently for-profit, they do not donate to organisations without wanting to profit from doing so. Economists and political scientists hypothesise, that companies' campaign spending is strategic (Denzau & Munger, 1986; Stratmann, 2017; Weschle, 2022a, p. 25). What exactly these companies receive in return for their contribution, however, is unclear (Stratmann, 2017). Stratmann defines three motives 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; 2017, p. 13). Weschle (2022a) 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, with specifically small scale contributors following both methods.

Besides dicussing the reasons for campaign contributions, 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.

[8]United States Citizens United v. Federal Election Commission, January 21, 2010

2.2 Contributions and Candidates' election sucesses

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 politicians receive, which are often endogenous to a candidate's 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 (Bronars & Lott, 1997; Stratmann, 2005, p.148). Factors which depend on the nature of the election also influence the level of contributions, since expected competitiveness of the election outcome also changes the average contribution amounts, i.e. incumbents[9] who expect their position to be threatened will be incentivised to gather more donations[10] (Weschle, 2022a, p. 8), (Stratmann, 2017, p. 25). The partisan lean of a 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 like that of Weschle (2022b) examine factors such as those mentioned above, they find that increased campaign spending is associated with higher vote shares for representatives.

2.3 Campaign Contributions and Representatives' Voting Decisions.

When it comes to the relationship between campaign contributions from special interests and representative's voting decisions in that interest's favor, many re-

[9]A current office holder seeking re-election.

[10]Donations and contributions are used synonymously in this paper.

searchers see a correlation. Yet, the deduction of what that means for the relationship between campaign contributions and votes is difficult to make. 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 (Kau et al., 1982, p. 275; Stratmann, 2005, p. 143)? 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 & Lott, 1997; Chappell, 1982, p.83).

To overcome these challenges, causality must be established. Yet determining causality when there is a positive association between donations and roll-call votes is one of the most challenging issues in the literature on campaign finance. The idea that money may be exchanged for votes is contested by two competing causal theories. Firstly, donors often provide to organisations and individuals that are inclined to support their policy ideas (Burris, 2001). Secondly, it is possible that donations function more as rewards or punishments for previous roll-call votes than as catalysts for more voting (Stratmann, 1991). In the first case, the ideology of the lawmaker acts as a confusing factor, making the link between money and votes fictitious. The second situation involves the concept of reverse causality (Selling, 2023; Stratmann, 2017).

Given the importance of determining causal relationships for money in politics, several researchers have tried to identify such a relationship between voting and contributions and have not found effects, such as Bronars & Lott (1997), who 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 & Lott, 1997, p.319). Ansolabehere et al. 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 (Ansolabehere et al., 2003; Grier, Grier, & Mkrtchian, 2023).

Others, however, have found that contributions do 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 cylces, since short term contributions are more relevant for voting behavior, according to him (Stratmann, 1995). Betrand finds indirect evidence of lobbying companies providing special interest groups access to politicians when these groups contribute (as opposed to giving only issue specific information to congress members)(Bertrand et al., 2014; Matter et al., 2019). Baldwin & Magee (2000) also find linkages of roll-call votes on specific trade agreement related bills and the contributions from businesses and labor groups. McAlexander & Urpelainen (2020), in their paper on the electoral gap in evironmental voting determines that since the public's inclination for environmental protection is greater than the oil and gas sector's, candidates who get large campaign contributions from businesses tend to vote more in favour of the environment when elections come around.

Given that some results find causal relationships between contributions and others find no effect, most researchers can conclude that there is no academic consensus on this matter (Stratmann, 2017, p.13). 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 (Burris, 2001; Chappell, 1982; Stratmann, 2002, p.1).

The studies which found causal links between campaign contributions and voting behaviour have a common denominator: research in particular fields or legislation. Baldwin & Magee (2000), for example 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 distinct roll-call votes and a rather restricted policy setting (Chappell, 1982; Kang, 2015; Stratmann, 1991, p.607).

Moreover, Stratmann critisises that most studies done in the field lack a convincing identification strategy to determine the causal relationship between legislative voting behavior and campaign contributions. One significant problem is from the possibility of reverse causation, “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 legistlation or account for reverse causality, but also those who do not control for individual counties and geographical areas (Grier, Grier, & Mkrtchian, 2023; Stratmann, 2005, p.142). Moreover, only by looking at repeated votes and thus changes in voting behaviour, a link can be determined between contribution and voting (Stratmann, 2002; 2005, pp.143-144). Considering a closer time-frame for contribution has also proven to increase plausibility (Stratmann, 1995).

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

3 Research Design

This section will deal with the reasoning behind the chosen roll-call votes and campaign contributions, and the hypothesis which are set up for the analysis.

3.1 Stratmann's Specifications

Stratmann (2002) follows a similar methodology to determine the causal relationship between campaign contributions and the representative's vote shares, defines the following roll-call 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 clear stance in their election campaigns (Stratmann, 2002, p.4). This is not met here, since environmental positions are usually quite polarising, and most legislators have clear positions on environment, due to their party line and also their personal conviction (McAlexander & Urpelainen, 2020).

Stratmann argues that it is crucial for representatives to secure campaign contributions from pertinent interest groups, such as those advocating for and against environmental and fossil fuel interests. In this paper, a significant distinction is made because a large number of legislators receive contributions from the fossil fuel industry. Specifically, the Energy and Natural Resources interest groups, predominantly linked to fossil fuels, ranked as the ninth largest contributor in the

2022 congressional elections, donating a total of 196 million USD. In contrast, contributions from environmental groups were considerably smaller (Center for Responsive Politics, 2023).

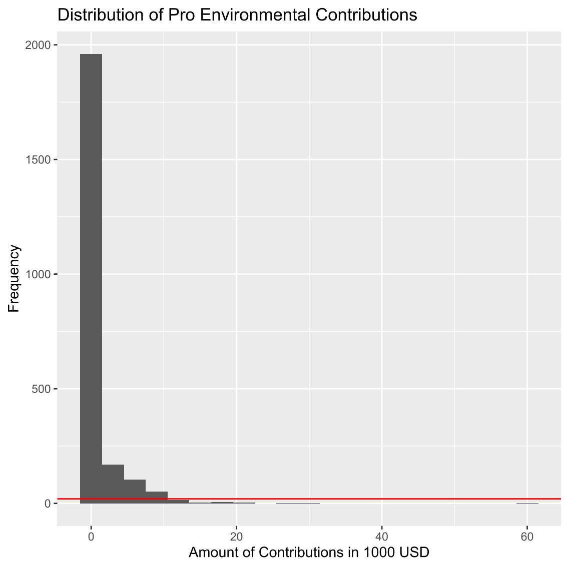

Figure 3: Histogram of pro-environmental contributions among representatives, Source: Own

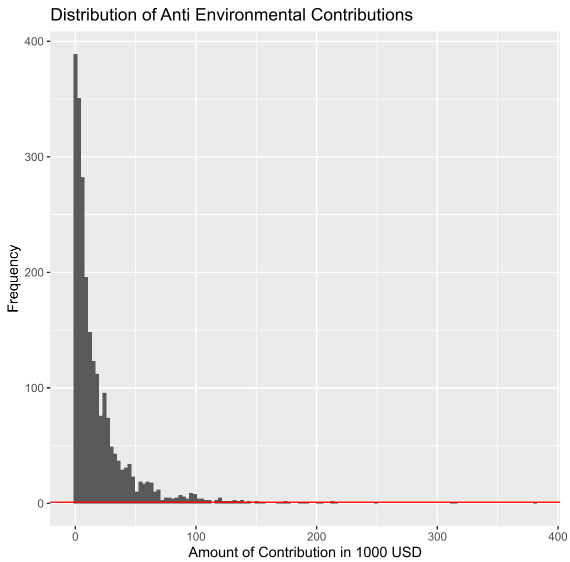

Figure 4: Histogram of anti-environmental contributions among representatives, Source: Own

Examining the figures above reveals distinct differences in the distribution of pro and anti-environmental campaign contributions. Pro-environmental contributions are generally smaller, while anti-environmental contributions tend to be larger and more spread out. This variance is also illustrated by the y-intercept line in the plots, which represents the average contribution to representatives from both groups.

Thus, it is more difficult to compare the contribution sizes of these interest groups. Lastly, Stratmann determines that there need to be a substantial amount of changes in voting behaviours of the representatives, yet in this case, only 23 representatives out of 529 change their vote over time, see Table 2.

3.2 Methane Pollution Votes

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

While environmental issues are polarizing for both the public and representatives, suggesting that representatives might have fewer incentives to change their positions McAlexander & Urpelainen (2020) found that most environmental policies shift the cost burden to industries. Consequently, the general public tends to hold a more favorable view of environmental issues compared to the average interest group. This discrepancy suggests that if campaign contributions were to influence voting behavior, representatives might be more inclined to adopt positions that align more closely with the interests of their contributors, often resulting in weaker environmental stances (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 (Center for Responsive Politics, 2023) 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 Chapter 1.

Legislation	Roll-Call Vote	Session	Year	Subject
H. R. 2728	601	113	2013	to preserve the Department of the Interior's ability to reduce methane emissions from oil and gas drilling operations on public lands[11].
H. R. 5538	434	114	2016	include a rider to stop the Environmental Protection Agency (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[12]
H. R. 3354	488	115	2017	would hinder the EPA's efforts to control methane emissions from newly created and altered sources inside the oil and gas industry[13]
H. R. 6147	346	115	2018	would hinder the EPA efforts to decrease methane emissions in the oil and gas industry from both new and modified sources from the oil and gas industry[14]
H. R. 3055	385	116	2019	would hinder the EPA from implementing standards to reduce methane emissions from both new and modified sources from the oil and gas industry[15]
S.J. Res. 14	185	117	2021	would have rolled back on the EPA 2016 methane standards for both new and modified sources from the oil and gas industry[16]

Table 1: The Six Roll-Call Votes on Methane Pollution Safeguards analysed in this paper

The six roll-call votes which will be analysed in this paper can be seen in Table 1. The reasoning behind choosing these six bills is that they all amend the resources allocated to the EPA and the Department of Interior. Since the legislation en-

[11]https://scorecard.lcv.org/roll-call-vote/2013-601-methane-emissions

[12]https://scorecard.lcv.org/roll-call-vote/2016-434-methane-pollution-safeguards

[13]https://scorecard.lcv.org/roll-call-vote/2017-488-methane-pollution-safeguards

[14]https://scorecard.lcv.org/roll-call-vote/2018-346-methane-pollution-safeguards-0

[15]https://scorecard.lcv.org/roll-call-vote/2019-385-methane-pollution-safeguards

[16]https://scorecard.lcv.org/roll-call-vote/2021-185-repealing-assault-methane-pollution-safeguards

acted by Congress governs the executive wing including the EPA (McAlexander & Urpelainen, 2020, p.43), these roll-call 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, generated through the oil and gas industries, and are thus industry specific.

Although in the Stratmann (2002) paper the two roll-call votes all pertained to the amendment of the same bill. This paper uses multiple, closely related, roll-call votes, and thus ensures that there is more variation in voting behaviour than there would be, if only two roll-call votes were available.

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

Table 2: Representative's Voting Positions

Out of 568 representatives who voted on more than one of the six roll-call votes, only 23 representatives changed their voting behaviour, and of these 23 representatives, there were 31 vote changes in total, as seen in Table 2. Moreover, the frequency of these successively scheduled votes—held in 2013, 2016, 2017, 2018, 2019, and 2021—increases the likelihood that representatives participate in multiple voting sessions, unlike in the Stratmann (2002) paper, where the two roll-call 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 roll-call 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 roll-call votes in Table 2. Therefore, the first hypothesis posits that if the coefficients are statistically significant, the impact of pro-environmental or anti-environmental contributions on the environmental voting behavior of representatives will be minimal.

Considering the differences in contributions among pro- and anti- environmental individuals and groups, as highlighted in Section 3.1, it's evident that anti-environmental entities, such as those in the oil and gas sector, financially support congressional elections more substantially than pro-environmental advocates. Consequently, the second hypothesis posits a stronger positive correlation between shifts from pro-environmental to anti-environmental voting patterns and anti-environmental contributions. In contrast, pro-environmental contributions, though less substantial, are hypothesized to have a reduced and less effective influence on voting behaviors, given the limited financial input from pro-environmental groups and individuals

In his paper, Stratmann (2002) demonstrates that junior representatives experience a greater marginal effect from contributions, whereas their senior counterparts maintain more steadfast positions. Similarly, the thrid hypothesis states that legislators in their early congressional terms are more susceptible to altering their environmental voting behaviors.

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 states that contributions on voting behaviour will be more effective 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 they received. Hence, the data for the analysis consists of three different types of data joined together: data on the representatives, their contribution data and the roll-call data of the six votes. The following chapter gives a short description of the data types, where they were sourced, and the data processing for the analysis.

4.1 Representative data

In order to conduct the analysis, a comprehensive dataset of all US representatives who attended the relevant congressional sessions (113th-117th), including biographical information to control for age, gender, etc. was used for the analysis[17]. Identification was also required in order to be able to unambiguously attribute each roll-call vote and each contribution to a particular representative and not have to deal with matching problems.

Given these requirements, the data on the US representatives was sourced from the github repository congress-legislators[18], 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 the Biographical Directory of the United States Congress[19] was used match the data on current and historical legilsators with a list of the representatives participating in each seperate congress.

4.2 Roll-call data

As Stratmann 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

[17]For reference, the biographical and financial data of US congressional members needs to be disclosed publicly, thus this is not classified information.

[18]https://github.com/unitedstates/congress-legislators

[19]https://bioguide.congress.gov

need to be categorised clearly into winners and losers (Stratmann, 2002). 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(LCV)[20] Scorecard was used throughout this paper. The website categorizes roll-call votes as either pro-environmental or anti-environmental. However, using this data presented challenges, primarily because the LCV Scorecard did not include representatives' IDs before 2021. About 60% of the representatives in the latest roll-call vote were also present in earlier votes and could be matched using their IDs. For the remaining 40%, matching had to rely solely on first names, last names, party affiliations, and state representations. This approach led to several merging errors, which will be detailed more in Section 4.4.

Considering these circumstances, utilizing one of the many other roll-call 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 roll-call votes but only the most relevant, i.e. the roll-call votes which passed a bill. For this analysis, however, only the environmentally related roll-call votes are relevant and these are often not published on the aforementioned websites. Thus, the LCV Scorecard Website was used to source roll-call 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 roll-call dataframe.

[20] https://scorecard.lcv.org

```r
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, `==`, `==`)
)
```

Listing 1: Excerpt of Code used

To overcome this, the R package `fuzzyjoin` Listing 1 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. In the `fuzzy_full_join` function, 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, play a larger role in determining 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 a positive correlation between contributions from special interest groups and a vote in their favor.

To account for the variability in campaign contribution selection, I employed two distinct approaches. Firstly, I calculated the contribution variables using data from the previous election cycle, following the methodology outlined in several academic studies, including (Chappell, 1982; Kau, Keenan, & Rubin, 1982; Selling, 2023; Stratmann, 1991; 2002). This approach evaluates whether aggregate contributions from past election cycles may influence representatives' voting behavior in environmental matters. Secondly, I focused exclusively on campaign contributions from individuals and interest groups that supported either pro-environmental or anti-environmental positions, received by representatives within the six months leading up to the relevant vote. Unlike the first approach, this method does not consider contributions from specific election periods, such as those during which the legislator was elected or those concurrent with the legislative session, but rather concentrates on contributions directly preceding the vote.

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 3: Consolidated contribution data with vote and cutoff dates

In analyzing the timing of contributions relative to congressional votes, a clear pattern emerges as detailed in Table 3. Since most votes occur late in the session, contributions from the six months preceding each vote mostly originate from the current Congress. Occasionally, they also include contributions from the previous Congress.

A discussion of these two types of campaign contributions-aggregate contributions from the previous election and the use of contributions from the current election-shows that these papers (Stratmann, 1995; 2002) both give the total contributions of an industry to candidates in an election and that only the time of relevance is different. 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 interst 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 (September 13, 2017 and July 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.[21]

4.3.2 Contribution Data Sources and Processing

Campaign contribution data is readily available through a multitude of open source platforms[22]. Among those is the Center for Responsive Politics which provides contribution data in Bulk Data[23] form, which includes PAC contributions to US representative candidates and individual contributions to candidates.

The oil&gas-, methane-, natural gas-, coal-, environmental- and alternative energy contributions were imported for all incumbents, and then cleaned and categorized into pro-environmental and anti-environmental contributions and joined with a list of all representatives per session[24].

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

[22] such 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

[23] The bulkdata can be accessed through https://www.opensecrets.org/open-data/bulk-data

[24] Cleaning the bulk data for the timely contributions was more complex due to 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

After the pre-cleaning process through the scripts, only Individual and PAC contributions were kept which were allocated to incumbents. Using the OpenSecrets RealCodes[25], only the non-negative contributions contributions from pro-environmental and anti-environmental (fossil fuel) donors 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 roll-call data. Post primary merge, the rest of the data, which was not able to be merged was filtered out and merged based on the `fedmatch` (Friedrichs et al., 2021) package's functions `fuzzy_match` and `fuzzy_join` functions as shown in Listing 1 in Section 4.2. Finally, the two merged dataframes were concatinated.

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 one congressional chamber to the next, and thus these members appeared in some dataframe, but not in the others, i.e. incumbents 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 representatives, who voted on more than one relevant bill. Without this specification, one couldn't analyse differences in

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the importing let alone processing tedious, even when including the state-of-the-art tidyverse (Wickham et al., 2019) package's 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 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.

[25]which can be found at https://www.opensecrets.org/downloads/crp/CRP_Categories.txt

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 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-enviornmental vote (0) and for the non-negativity of contributions (Chappell, 1982; Stratmann, 1991; 2002).

Two types of models are the linear probability model (LPM) and the logit, both of which are widely used in the economic literature, but both of which have some drawbacks. The LPM is an ordinary least squared multiple 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. One downside of the LPM, however, is the possibility for the predicted probability to be out of range, by being either higher than 1 or lower than 0 (Mood, 2009).

In order to counter this, one can use a nonlinear regression model, such as the logit regession 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 underlying cumulative distribution function of this model is a standard logistic districution. Thus, changes in log-odds are not as intuitive to interpret as direct probabilities in a linear regression. 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, the Logit Model will be included as a robustness check.

5.1 LPM and Logit

The specific versions of the LPM and logit model discussed above are shown in Equation 1 and Equation 2.

Both the LPM and the conditional logit model will be used for the analysis. As shown in Chapter 5 above, both are required to make sound analyses of the effect of contribution on voting behaviour. Thus, the LPM model is used as a main model, and the Logit[26] serves as a robustness check.

The model shown in Equation 1 is the Linear Probability model.

$$\text{Vote}_{\text{i,t}} = \alpha + \beta_1 X_{1,\text{t}} + \beta_2 X_{2,\text{t}} + \gamma_i + \delta_t + \boldsymbol{x}'\zeta_{\text{i,t}} + \varepsilon_{\text{i,t}} \tag{1}$$

The model shown in Equation 2 is a conditional logit.

$$P(\text{Vote}_{\text{i,t}} = 1|\boldsymbol{X}, \beta_{1,2}, \gamma_i) = F(\beta_{1,2}{'}\boldsymbol{x}_{\text{it}}, \gamma_i) \tag{2}$$

Let: X_1 be the pro-environmental contributions, and X_2 be the anti-environmental contribution, $\boldsymbol{x}$ be the vector of control variables, δ_t the the time fixed effect (FEs) and γ_i are the individual fixed effects, all of which are detailed in Section 5.2.

In their most basic specification, both Equation 1 and Equation 2 include 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. When moving from most generous to the strictest models, the main difference between the two models is that in the LPM model, both legislator and year fixed effects are used, whereas in the conditional logit model, specified by Stratmann (2002), only legislator fixed effects are used. As shown in Section 5.2 and Chapter 6, this is only the strictest specification.

Using these models as a base, I explored different ways of measuring the relationship between voting behaviour and contributions. One variation is to isolate each vote and include all relevant posts from previous votes and those from the current vote, see Figure 9 in the appendix for these results. This tests the

[26]Throughout my analysis, I replicated Stratmann's (2002) probit model, which includes only those representatives who changed their votes over time, and takes the changes in contribution level as explanatory variables, without control variables or fixed effects (FE)s. Given my small sample, however, the contribution change coefficients could not be estimated, which is why this model is not included in either the model specification nor the results.

assumptions made in Section 4.3.1, and takes into account not only the short term contributions when an environmental vote is coming up, but also the previous contributions on similar topics, to measure whether voting depends on contributions for previous relevant votes.

In one model specification, only representatives who maintained consistent environmental voting behavior across the six roll-call votes were included. This approach allows for an analysis of whether the presence or amount of contributions influences legislators, even when no changes in voting behavior occur—essentially, assessing whether interest groups contribute regardless of voting changes. Conversely, all models were applied solely to representatives who altered their voting throughout the six roll-call votes. This method facilitates a causal identification strategy, enabling conclusions to be drawn only when there are variations in voting behavior (Stratmann, 2002), see Figure 8 for these results.

5.2 Model specification

Using the models shown in Section 5.1, this paper will analyse the relationship of votes and campaign contributions ranging from using the most generous model specifications, such as using control variables, to the strictes, using individual fixed effects.

To control for confounding influence factors between a treatment and an outcome and approach a consistent causal interpretation (Hünermund & Louw, 2020), 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 in the house 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 (Selling, 2023; Stratmann, 2002). By controlling for differences in geographical residence of the representatives, using `district`[27], `state` and `geographical`[28] and the district level I remove possible differences in voting behaviour attributed to the location of representatives.

Based on roll-call records, the Dynamic Weighted (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-Nominate[29] as control variables, I control for differences in ideology that might explain voting behaviour. It is easier to prove causality when a variable for legislator ideology is included, as this eliminates the variation in roll-call voting that might be attributed to the lawmaker's ideological inclination (Selling, 2023). Furthermore, according to Roscoe & Jenkins (2005), adding an ideology variable to the equation is the only practical approach to account for the influence of friendly donating.

I also control for the `gender` of the legislator, as the gender pay gap tends to apply not only to income but also to campaign contributions. Furthermore, to account for voting consistency, I introduce another dummy variable indicating whether the legislator changed their vote on six specific votes. This helps to determine whether vote-changing behaviour affects the volume of campaign contributions they receive. Finally, I define dummy variables which indicate whether representatives received pro- or anti-environmental contributions in the time-period before the votes. This allows me to measure the extensive margin of contribution, i.e. how the fact that a representative received a contribution relates

[27]As to be seen in Figure 7, about 300 rows lack the variable district, since this information was only available selectively in the abovementioned data sources. After careful consideration, I decided to include the variable regardless, since it is significant and improves the model, albeit observations with NA-values for district not being included for three of the models shown in Figure 5.

[28]the 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

[29]accessible at https://voteview.com

to their voting behaviour. By including these dummy variables and the amount of the donation, I also measure the intensive margin. In this way, I can analyse whether the actual amount of the contribution changes the voting behaviour of a representative who has received a contribution (dummy = 1).

Regarding roll-call votes, the six roll-call votes included do not amend the same bills, but I assume that they are all the same bill as they all relate to the same subject and institutions, see Section 4.2, and therefore I will not control for differences in bills (Grier, Grier, & Mkrtchian, 2023).

By including the aforementioned control variables, I am able to fix certain factors that I can measure and assume have confounding effects on the predicted probability. Were I to leave the regressions as is, then there could still be potential omitted variable bias in my analysis. Yet, I am bound to miss either variables that I did not know affect my results, or variables that I cannot measure. Unobservables, or the inability to include in a model every variable that influences a result, are the root cause of the issues. The variance in the dependent variable resulting from unobserved or omitted variables is known as unobserved heterogeneity (Mood, 2009).

Using two-way fixed effects (Imai & Kim, 2019), one can account for unobservable elements that remain constant across time and another unit (such as party or state), and thus remove unit and time invariant confounding (Grier, Grier, & Mkrtchian, 2023). In this paper, four types of two way FEs 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. By fixing for the geographical region of a state and not the actual state, I am controlling for some differences within the US, such as culture and migration, but not making the model so strict as to account for all differences in states. By controlling for years, on the other hand, time-variant differences such as environmental perception or enviornmental disasters are not taken out of context and compared with years with little environmental happenings.

In a stricter version, I fix for year and state. This provides more accurate results on the geographical level. As mentioned above in Section 2.2, differences in states and their election such as the size of government or the competitiveness of the election influence the amount of contributions which incumbents receive. By controlling for states, not only the differences in elections and contributions are fixed, but differences in economic conditions, population sizes and 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.

The third type of fixed effects employed are the party and year FEs. This way, I can adjust for the the influence that political party orientation might have on the results, along with the same temporal factors as before. This may capture differences in policies, ideologies, or priorities that vary systematically between parties (Selling, 2023).

Lastly, in the strictest model, I fix for both legislators and years. The reason behind fixing for something as small as a single 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, 2021; Stratmann, 2002). Not only am I thus able to address the omitted variable bias which I was not able to address through my previous two-way fixed effects, 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 for a representative over time. Therefore, to determine the impact of donations on voting changes, I only use the change in donations within a year and specific member, which allows me to predict the impact of donations most accurately (Grier, Grier, & Mkrtchian, 2023).

6 Results

6.1 Effectiveness of Contributions

One of the hypothesis stated in Section 3.3 is that the effect of pro and anti-environmentalcampaign contributions,if statistically significant, would be minimal. 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 generous LPM shown in Equation 1 including control variables showed that when increasing the pro-environmental contribution to representatives by 1000 USD, the probability of the representative voting pro-environmentally increases by 0.007214 percent on average, ceteris paribus. In return, when increasing anti-environmental contribution by 1000 USD, the probability of a representative voting pro-environmentally decreases by an average of 0.0006 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 ceteris paribus and with the same significance level, the sigifnicance of the pro-environmental contribution variaable is est. to be an average of 0.011, ceteris paribus, but the significance level of the estimator decreases.

When including the dummy variables of pro- or anti- environmental contributions leading up the each vote, the results show no significance in the most general linear regression with control variables. Only when including party and state and year fixed effects does the anti-environmental dummy show statistical significance on a 0.05 level. For the state and year fixed effects model, the interpretation is as follows: A representative receiving anti-environmental contributions decreases their probability of voting pro-environmentally by 2.6 percent, and for each additional 1000 USD, the proabability of a pro-environmental vote decreases further by 0.05 percent, ceteris paribus.

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 1000 USD increase in pro-environmental contribution increasing the probability of a pro-environmental vote by 0.00698 percent and a 1000 USD increase in anti-environmental contribution decreasing the probability of a pro-environmental vote by 0.00048 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 1000 USD increase in pro-environmental contribution increasing the probability of a pro-environmental vote by 0.00361 percent on average, ceteris paribus. 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.

	Dependent variable:				
	Vote				
	OLS	*panel linear*			
	(1)	(2)	(3)	(4)	(5)
Anti-Env Contributions Amount	-0.001***	-0.001***	-0.001***	-0.0005***	-0.0002
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)
Pro-Env Contributions Amount	0.007***	0.007***	0.007***	0.007***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Anti-Env Contribution Dummy	-0.021	-0.021	-0.021	-0.026**	
	(0.013)	(0.013)	(0.013)	(0.013)	
Pro-Env Contribution Dummy	-0.007	-0.007	-0.007	-0.0005	
	(0.009)	(0.009)	(0.009)	(0.009)	
District	0.001**	0.001**	0.001**		
	(0.0004)	(0.0004)	(0.0004)		
PartyR	-0.901***	-0.901***		-0.895***	
	(0.009)	(0.009)		(0.009)	
Birthyear	0.001*	0.001*	0.001*	0.001***	
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	
GenderM	-0.025***	-0.025***	-0.025***	-0.029***	
	(0.009)	(0.009)	(0.009)	(0.009)	
1st dimension DW Nominate	-0.141***	-0.141***	-0.141***	-0.144***	
	(0.029)	(0.029)	(0.029)	(0.029)	
2nd dimension DW Nominate	-0.070***	-0.070***	-0.070***	-0.057***	
	(0.021)	(0.021)	(0.021)	(0.021)	
GeographicalNE	0.073***		0.073***		
	(0.011)		(0.011)		
GeographicalSO	0.009		0.009		
	(0.009)		(0.009)		
GeographicalWE	0.019*		0.019*		
	(0.011)		(0.011)		
Vote Number	0.0005***				
	(0.0002)				
Seniority	0.002	0.002	0.002	0.002*	0.017
	(0.001)	(0.001)	(0.001)	(0.001)	(0.044)
Democratic Majority in House	0.024***				
	(0.009)				
Constant	-0.416				
	(0.782)				
Year Fixed effects	No	Yes	Yes	Yes	Yes
Geographical Fixed Effects	No	Yes	No	No	No
Party Fixed effects	No	No	Yes	No	No
State Fixed effects	No	No	No	Yes	No
Individual Fixed effects	No	No	No	No	Yes
Observations	1,901	1,901	1,901	2,217	2,217
R^2	0.909	0.895	0.081	0.869	0.006
Adjusted R^2	0.908	0.894	0.072	0.866	-0.311
Residual Std. Error	0.152 (df = 1884)				
F Statistic	1,172.471*** (df = 16; 1884)	1,454.509*** (df = 11; 1881)	12.778*** (df = 13; 1881)	1,432.629*** (df = 10; 2153)	3.657** (df = 3; 1679)
Note:					*p<0.1; **p<0.05; ***p<0.01

Figure 5: Main Linear Probability Models summarised[30]

[30]Although the Individual Fixed Effects model shows an adjusted R-squared of -0.311, estimated with the `plm` function,the linear probability model estimated with the `lm` function with the exact same specifications,coefficients, standard errors and p-values has a much higher adjusted R-squared of 0.95. The reason as to why I still included this model and not the other, is that the fixed effects coefficients for the lm would show up in the model summary, and thus the model would be too long to be included in the stargazer output.

As shown in Section 3.1, the average pro-environmental contributions for the representatives within six months prior to the enviornmental vote was approximately 1,000 USD whereas the anti-environmental contributions averaged out to 19,800 USD. Putting this into the context of the results shown in Figure 5, where a 1000 USD pro-environmental contributions increases environmental voting by 0.7 percent and anti-environmental contributions decreasing it by 0.06 percent, the impact of anti-environmental contributions is likely more effective due to their higher average amount—approximately 19,800 USD compared to 1,000 USD for pro-environmental contributions. Therefore, anti-environmental contributions appear to have a stronger effect on environmental voting, reflecting the disparity in average contribution amounts.

Although these adjusted R^2 values are very high and might raise suspicion of multicoloinearity within the predictor variables, the Variance Inflation Factor (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 multicolinearity, 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 1000 USD scale and is also rather highly significant.

	Dependent variable:			
	Vote	Vote		
	logistic	*conditional logistic*		
	(1)	(2)	(3)	(4)
Anti-Env Contributions Amount	-0.022***	-0.020***	-0.016**	-0.021***
	(0.008)	(0.008)	(0.008)	(0.008)
Pro-Env Contributions Amount	0.106***	0.102***	0.088**	0.103***
	(0.035)	(0.034)	(0.039)	(0.034)
Anti-Env Contribution Dummy	-0.705	-0.591	-0.739	-0.595
	(0.611)	(0.587)	(0.578)	(0.589)
Pro-Env Contribution Dummy	0.264	-0.047	0.382	-0.049
	(0.432)	(0.406)	(0.400)	(0.407)
District	0.010	0.010	0.012	0.010
	(0.018)	(0.017)	(0.023)	(0.017)
PartyR	-8.399***	-8.050***	-23.804	
	(0.522)	(0.476)	(1,183.464)	
GenderM	-1.209**	-1.139**	-1.416**	-1.141**
	(0.494)	(0.469)	(0.610)	(0.469)
1st dimension DW Nominate	-3.161**	-2.698*	-3.395**	-2.708*
	(1.436)	(1.396)	(1.587)	(1.398)
2nd dimension DW Nominate	-3.267***	-3.004***	-1.924	-3.002***
	(1.089)	(1.023)	(1.201)	(1.024)
GeographicalNE	2.454***			2.432***
	(0.550)			(0.547)
GeographicalSO	0.144			0.116
	(0.483)			(0.484)
GeographicalWE	0.695			0.667
	(0.566)			(0.568)
Vote Number	0.028***	0.013*	0.031***	0.013*
	(0.009)	(0.008)	(0.008)	(0.008)
Seniority	0.047	0.070	0.006	0.070
	(0.047)	(0.045)	(0.043)	(0.045)
Democratic Majority in House	1.570***		1.742***	
	(0.474)		(0.391)	
Birthyear	0.023	0.039**	0.027*	0.039**
	(0.018)	(0.017)	(0.016)	(0.017)
Constant	-39.065			
	(35.163)			
Geographical Fixed Effects	No	Yes	No	No
State Fixed effects	No	No	Yes	No
Party Fixed effects	No	No	No	Yes
Observations	1,901	1,901	1,901	1,901
R^2		0.660	0.574	0.061
Max. Possible R^2		0.711	0.614	0.205
Log Likelihood	-156.347	-154.227	-95.343	-157.637
Akaike Inf. Crit.	346.694			
Wald Test		360.520*** (df = 12)	62.390*** (df = 13)	93.070*** (df = 14)
LR Test		2,053.508*** (df = 12)	1,620.253*** (df = 13)	119.769*** (df = 14)
Score (Logrank) Test		1,684.575*** (df = 12)	1,380.764*** (df = 13)	158.630*** (df = 14)
Note:				*p<0.1; **p<0.05; ***p<0.01

Figure 6: Main Conditional Logit Models summarised

The results from the conditional logit, see Figure 8, used as a robustness check show similar trends as the linear probability models above. When regressing Vote against the contribution and control variables, we see that the coefficient for contributions are log-odds. In other words, for a 1000 USD increase in the anti (pro) environmental, the expected change in log odds is $-2.135\text{e-}05$ (9.944e-05), ceteris paribus. These results are a bit less significant than these of the LPM, since anti-environmental contributions are significant on a 0.05 and pro-environmental on a 0.01 level, when only including control variables. When fixing for state and years, the estimate coefficients for pro environemtnal contributions are 0.502 and -0.47 for the anti enviornmental contributions, ceteris paribus, where both coefficients are significant on a 0.1 level. When fixing legislator and year, however, neither contribution variable is significant.

6.2 Contribution and Vote Changes

In the second hypothesis, changes from pro to anti-environmental votes are predicted to be more positively correlated with anti-environmental contribuions, and pro-environmental contributions less effective. Considering, however, that only 23 representatives changed their votes over the course of the six roll-call 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 torwards 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 Seniority on Vote Changes

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, as shown by Stratmann (2002). To address this, I incorporated the previously mentioned seniority and birth year control variables into the regression models, as outlined in Section 5.2. 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 multicolinearity, 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-environemtnal 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 birthyear 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 1000 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 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 third hypothesis.

6.4 Partisan Contributions

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 roll-call votes. Moreover, this paper contributes to the extensive academic literature on this topic, by analysing the effect of environemtally related campaign contributions on the representative's voting on methane pollution safeguards, a topic on which there are few studies. By using not only Stratmann's logit and probit models and aggregate election but also a linear probability model with time-related contribution, I am further extending this area of research. 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 roll-call 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.

Several reasons preclude establishing a causal relationship in this study, despite its methodology being heavily influenced by Stratmann (2002), who identified causality in his work. One significant limitation is the small sample size of representatives who altered their votes over the six roll-call votes, see Table 2. Additionally, the inherently polarizing and decisive nature of environmental issues among representatives means that changes in voting behavior are inherently rare. Moreover, the causality of the models used by Stratmann (2002) warrants scrutiny, especially given his questionable assumptions in selecting the Glass-Steagall Act for analysis—such as the presumption that financial legislation does not engage public interest, thereby affording representatives greater freedom in their voting decisions.

The implications of these results are 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 receiving campaign contributions has a bad aftertaste for the health of the American democracy (Weschle, 2022c). 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.First, more robustness checks should be included. By including more relevant models and relevant variables, such as each state's gdp per capita related to the fossil fuel industry, results could be concluded with more certainty. 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 six months 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 Chapter 6, 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 roll-call 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 interesting approach 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 API[31] or the tidycensus R package[32].

[31]to be found at: https://github.com/LibraryOfCongress/api.congress.gov/

[32]documentation for which can be found at: https://walker-data.com/tidycensus/

Appendix A: Supplementary Material

A1. Code

The Data, Code, Analysis and Plots used to construct this paper can be found on my github profile: https://github.com/minnaheim/contribution_vote_data. This paper was written using typst, based on the template from the Technical University of Munich: https://github.com/ls1intum/thesis-template-typst.

A2. Additional Models

Descriptive statistics

Statistic	N	Mean	St. Dev.	Min	Max
District	1,984	9.191	9.803	0	53
Vote Change	2,314	0.062	0.342	0	4
Birthyear	2,314	1,958.587	11.147	1,929	1,989
1st dimension DW Nominate	2,314	0.439	0.137	0.110	0.848
2nd dimension DW Nominate	2,314	0.215	0.167	0.000	0.957
Vote Number	2,314	21.617	22.326	3	52
Vote Dummy	2,217	0.504	0.500	0	1
Seniority	2,314	5.546	4.205	1	18
Pro Env Contributions Amount	2,314	19.800	29.876	0.000	380.725
Anti Env Contributions Amount	2,314	0.991	2.877	0.000	60.550
Democratic Majority in House	2,314	0.321	0.467	0	1
Pro-Env Contribution Dummy	2,314	0.914	0.280	0	1
Anti-Env Contribution Dummy	2,314	0.307	0.461	0	1

Figure 7: the descriptive statistics of the main dataset used for the analysis[33]

[33]the variable Instance refers to the Votes. The Instances are 3, 4, 51, 52, 6 and 7, where 3 stands for the vote in the 113th congress, 51 stands for the first vote in the 115th congress, 52 for the second vote in the 115th congress, etc. The district variable refers to the district which the legislators represented. Sadly not all representatives had the district information.

	Dependent variable:			
	Vote	Vote	Vote	
	panel	*conditional*	*panel*	
	linear	*logistic*	*linear*	
	(1)	(2)	(3)	(4)
Anti-Env Contributions Amount	-0.001^{***}	-0.021^{***}	-0.001^{***}	-0.0001
	(0.0001)	(0.008)	(0.0001)	(0.0001)
Pro-Env Contributions Amount	0.007^{***}	0.103^{***}	0.007^{***}	0.001
	(0.001)	(0.034)	(0.001)	(0.001)
Pro-Env Contribution Dummy	-0.007	-0.049	-0.007	0.004
	(0.009)	(0.407)	(0.009)	(0.005)
Anti-Env Contribution Dummy	-0.021	-0.595	-0.021	-0.011
	(0.013)	(0.589)	(0.013)	(0.008)
Vote Number		0.013^{*}		
		(0.008)		
District	0.001^{**}	0.010	0.001^{**}	0.001^{***}
	(0.0004)	(0.017)	(0.0004)	(0.0002)
Birthyear	0.001^{*}	0.039^{**}	0.001^{*}	-0.0002
	(0.0004)	(0.017)	(0.0004)	(0.0002)
1st dimension DW Nominate	-0.141^{***}	-2.708^{*}	-0.141^{***}	-0.076^{***}
	(0.029)	(1.398)	(0.029)	(0.017)
2nd dimension DW Nominate	-0.070^{***}	-3.002^{***}	-0.070^{***}	-0.037^{***}
	(0.021)	(1.024)	(0.021)	(0.013)
GeographicalNE	0.073^{***}	2.432^{***}	0.073^{***}	0.039^{***}
	(0.011)	(0.547)	(0.011)	(0.007)
GeographicalSO	0.009	0.116	0.009	0.013^{**}
	(0.009)	(0.484)	(0.009)	(0.005)
GeographicalWE	0.019^{*}	0.667	0.019^{*}	0.006
	(0.011)	(0.568)	(0.011)	(0.006)
Seniority	0.002	0.070	0.002	-0.002^{***}
	(0.001)	(0.045)	(0.001)	(0.001)
GenderM	-0.025^{***}	-1.141^{**}	-0.025^{***}	0.001
	(0.009)	(0.469)	(0.009)	(0.005)
Observations	1,901	1,901	1,901	1,813
R^2	0.081	0.061	0.081	0.062
Adjusted R^2	0.072		0.072	0.052
Max. Possible R^2		0.205		
Log Likelihood		-157.637		
F Statistic	12.778^{***} (df = 13; 1881)		12.778^{***} (df = 13; 1881)	9.076^{***} (df = 13; 1793)
Wald Test		93.070^{***} (df = 14)		
LR Test		119.769^{***} (df = 14)		
Score (Logrank) Test		158.630^{***} (df = 14)		
Note:				*p<0.1; **p<0.05; ***p<0.01

Figure 8: All party FE models, with all representatives, only those who changed their votes and all those who didn't

	Dependent variable:				
	Vote in 114th Congress	1st Vote in 115th congress	2nd Vote in 115ths congress	Vote 116th congress	Vote 117th congress
	(1)	(2)	(3)	(4)	(5)
Anti-Env Contributions for Vote 3	0.001	0.001	-0.0004	-0.002***	-0.002***
	(0.0005)	(0.001)	(0.001)	(0.001)	(0.001)
Pro-Env Contributions for Vote 3	-0.001	-0.008	-0.001	-0.005	-0.001
	(0.004)	(0.006)	(0.007)	(0.005)	(0.005)
Anti-Env Contributions for Vote 4	0.0001	-0.0004	0.00003	-0.0001	-0.003***
	(0.0004)	(0.001)	(0.001)	(0.001)	(0.001)
Pro-Env Contributions for Vote 4	0.001	-0.010*	0.004	0.007*	-0.020***
	(0.005)	(0.005)	(0.006)	(0.004)	(0.004)
Anti-Env Contributions for Vote 51		0.001	0.006***	0.005***	0.006***
		(0.001)	(0.002)	(0.001)	(0.001)
Pro-Env Contributions for Vote 51		0.002	0.009	0.001	-0.0003
		(0.005)	(0.006)	(0.006)	(0.006)
Anti-Env Contributions for Vote 52			-0.004**	-0.003**	-0.002*
			(0.002)	(0.001)	(0.001)
Pro-Env Contributions for Vote 52			-0.014***	-0.003	0.0003
			(0.003)	(0.005)	(0.005)
Anti-Env Contributions for Vote 6				0.0003	0.002***
				(0.001)	(0.001)
Pro-Env Contributions for Vote 6				-0.002	-0.014*
				(0.011)	(0.008)
Anti-Env Contributions for Vote 7					-0.001
					(0.001)
Pro-Env Contributions for Vote 7					0.017*
					(0.009)
PartyR		0.936***	0.905***	0.979***	0.955***
		(0.028)	(0.033)	(0.022)	(0.023)
1st dimension DW Nominate	-0.048	-0.079	-0.061	-0.011	0.035
	(0.069)	(0.091)	(0.110)	(0.075)	(0.079)
2nd dimension DW Nominate	0.170***	0.110*	0.064	0.026	0.081
	(0.052)	(0.065)	(0.078)	(0.056)	(0.055)
GenderM	0.031	0.007	0.017	0.024	0.004
	(0.021)	(0.025)	(0.030)	(0.020)	(0.019)
Pro-Env Contribution Dummy	-0.016	0.017	0.012	0.010	-0.018
	(0.022)	(0.026)	(0.030)	(0.036)	(0.033)
Anti-Env Contribution Dummy	0.048	0.052	-0.036	0.007	0.009
	(0.030)	(0.036)	(0.047)	(0.030)	(0.027)
Observations	332	281	268	224	179
R^2	0.067	0.917	0.891	0.968	0.976
Adjusted R^2	-0.119	0.869	0.824	0.943	0.954
F Statistic	2.201** (df = 9; 276)	163.850*** (df = 12; 178)	96.517*** (df = 14; 165)	235.046*** (df = 16; 126)	211.775*** (df = 18; 93)
Note:					*p<0.1; **p<0.05; ***p<0.01

Figure 9: the LPM models of each vote, with all relevant contributions leading up to the vote.

	Dependent variable:	
	Vote	
	OLS	*logistic*
	(1)	(2)
Log. Anti-Env Contributions Amount	-0.015***	-0.532***
	(0.004)	(0.185)
Log. Pro-Env Contributions Amount	0.027***	0.839**
	(0.009)	(0.334)
Anti-Env Contribution Dummy	0.003	0.190
	(0.016)	(0.747)
Pro-Env Contribution Dummy	-0.015	-0.319
	(0.012)	(0.569)
District	0.001**	0.007
	(0.0004)	(0.017)
PartyR	-0.898***	-8.385***
	(0.009)	(0.530)
Birthyear	0.001*	0.022
	(0.0004)	(0.018)
GenderM	-0.023**	-1.138**
	(0.009)	(0.494)
1st dimension DW Nominate	-0.141***	-3.339**
	(0.029)	(1.454)
2nd dimension DW Nominate	-0.072***	-3.150***
	(0.021)	(1.112)
GeographicalNE	0.071***	2.460***
	(0.011)	(0.553)
GeographicalSO	0.006	0.127
	(0.009)	(0.477)
GeographicalWE	0.018	0.804
	(0.011)	(0.561)
Vote Number	0.001***	0.029***
	(0.0002)	(0.009)
Seniority	0.001	0.039
	(0.001)	(0.047)
Democratic Majority in House	0.023***	1.569***
	(0.009)	(0.476)
Constant	-0.434	-36.504
	(0.785)	(34.885)
Observations	1,901	1,901
R^2	0.908	
Adjusted R^2	0.907	
Log Likelihood		-157.266
Akaike Inf. Crit.		348.533
Residual Std. Error	0.152 (df = 1884)	
F Statistic	1,162.325*** (df = 16; 1884)	
Note:	*p<0.1; **p<0.05; ***p<0.01	

Figure 10: the LPM models with geographical and year fixed effects

A3. Declaration of Aids

Type of Aid	Use of Aid
Github Copilot	Used for coding repeatitive things in R
DeepL Write	Applied over entire thesis to improve spelling and wording
ChatGPT	Applied over entire thesis to improve wording
Quillbot	Applied over entire thesis to paraphrase text from sources

A4. Declaration of Authorship

I hereby declare,

- that I have written this thesis independently
- that I have written the thesis using only the aids specified in the index;
- that all parts of the thesis produced with the help of aids have been precisely declared;
- that I have mentioned all sources used and cited them correctly according to established aca- demic citation rules;
- that I have acquired all immaterial rights to any materials I may have used, such as images or graphics, or that these materials were created by me;
- that the topic, the thesis or parts of it have not already been the object of any work or examina- tion of another course, unless this has been expressly agreed with the faculty member in ad- vance and is stated as such in the thesis;
- that I am aware of the legal provisions regarding the publication and dissemination of parts or the entire thesis and that I comply with them accordingly;
- that I am aware that my thesis can be electronically checked for plagiarism and for third-party authorship of human or technical origin and that I hereby grant the University of St.Gallen the copyright according to the Examination Regulations as far as it is necessary for the administra- tive actions;
- that I am aware that the University will prosecute a violation of this Declaration of Authorship and that disciplinary as well as criminal consequences

may result, which may lead to expul- sion from the University or to the withdrawal of my title.

By submitting this thesis, I confirm through my conclusive action that I am submitting the Declaration of Authorship, that I have read and understood it, and that it is true.

21.05.2024

Minna Emilia Hagen Heim

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