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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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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.

Contents

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 bipartisan 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.

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 illon USD in the 2022 election cycle, with approximately 90-97% of these congressional contributions going to Republican candidates (, n.d.).

Given the participation which wealthy (fossil fuel) donors like the 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 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. 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 Thomas Stratmann (Stratmann, 2002), who exploits the time series nature of campaign contributions and rollcall 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, 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.

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 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. Political Scientist Simon Weschle 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. 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) and the voting behaviour of politicians, campaign contributions in US politics are of particular significance for this paper. One reason 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 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.

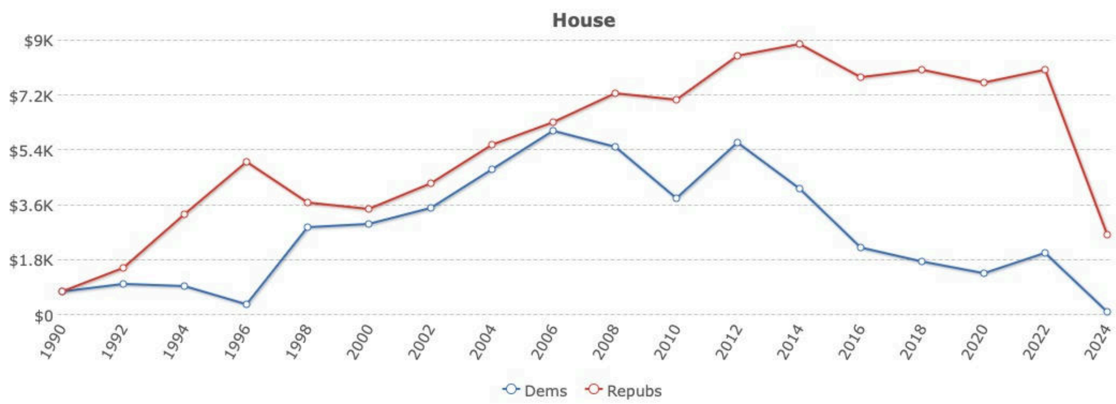

Figure 1: Average Contributions to House Members[1], 1990-2022

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

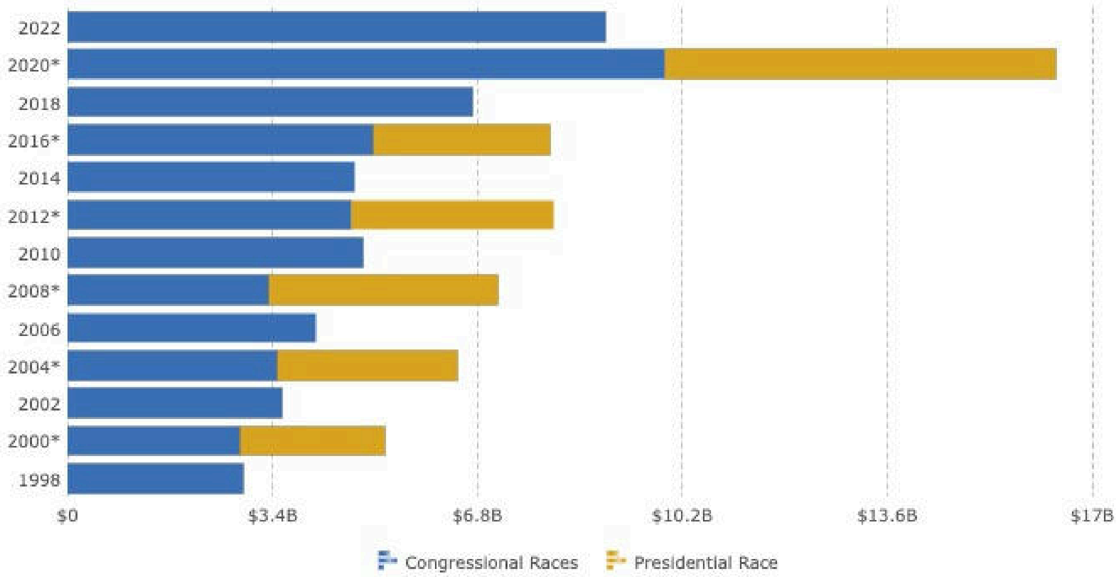

Figure 2: Total Cost of Election[2] (n.d.-a)

One of the main reasons for the noted increase in not only total costs of presidential and congressional elections over the last 30 years, but also the average campaign contribuions per representative, is attributable to the change in legislature. In 2010, the US Supreme Court decided 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 Comittee (PAC) contributions in the Center for Responsive Politics data[3]. Contributions over 200 USD by natural persons (or their family members) who work in the industry are individual contributions (Grier et al., 2023). PACs are comittees 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)

there are not comparable to 2022 yet

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

[3]to be found under https://www.opensecrets.org

p.194. In essence, this case enabled independent expenditures which are election related to become unlimited (, 2010).

Even if campaign contributions have risen over time, the reason as to why politicians receive these 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 handouts 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 (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, with specifically small scale contributors following both methods (Weschle, 2022a) pp.26-28.

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.

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 politicials 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 (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 competitiveness of the election outcome also changes the average contribution amounts, i.e. incumbents[4] who expect their position to be threatened will be incentivised to gather more donations (Weschle, 2022a), (Stratmann, 2017) p.8. 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 such as that of (Weschle, 2022a) include factors such as those listed above, increased campaign spending does relate to 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-

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

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 (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.

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 incentives 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, 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. 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 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 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. (McAlexander & Urpelainen, 2020).

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 (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 distinct rollcall votes and a rather restricted policy setting" (Kang, 2015; Stratmann, 1991) p.607 (Chappell, 1982).

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, which suggests that although contributions influence roll call votes in favor of interest groups, it's also feasible for legislators to accept 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 (Stratmann, 2005) p.142 (Grier, Grier, & Mkrtchian, 2023). Moreover, only 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 roll call votes and campaign contributions, and the hypothesis which are set up for the analysis.

3.1 Stratmann's (2002) Specifications

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 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 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 legilators receive contributions 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 million USD contributed over the 2022 congressional election. The environmental contributions, on the other hand, are a fraction of this (n.d.-c).

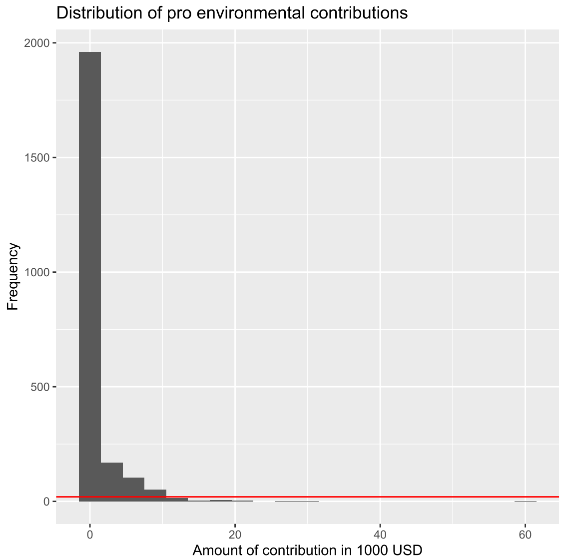

Figure 3: Distribution of pro environmental contributions with average anti environmental contribution per representative

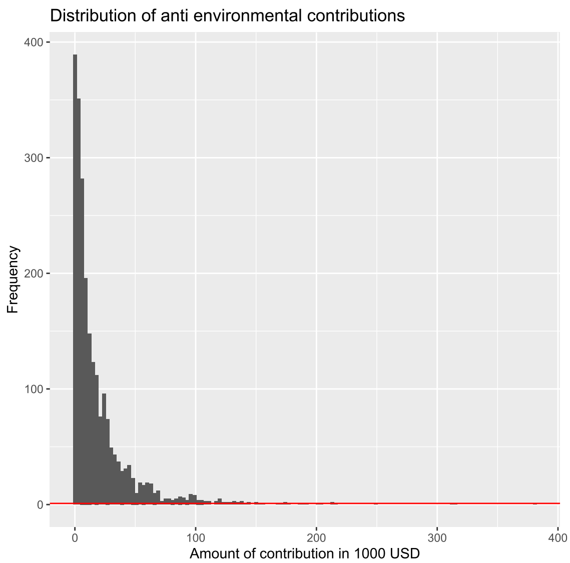

Figure 4: Distribution of anti environmental contributions with average anti environmental contribution per representative vote

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 changes in voting behaviours of the representatives, yet in this case, only 23 representatives out of 529 change their vote over time.

3.2 Methane Pollution Votes

Although as shown in the section above, the rollcall bills do not fit all of the preconditions stipulated by Stratmann (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.

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.

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.
H. R. 5538	434	114	2016	include a rider 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.
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
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
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
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

Table 1: the six Roll Call Votes on Methane Pollution Safeguards analysed in this paper

The six rollcall 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 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, generated through the oil and gas industries, and are thus industry specific.

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.

	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 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 2. 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 2. Hence, the first hypothesis is that the effects of pro-environmental or anti-environmental contributions on the enviornmental 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 the low propensity of pro-environmental groups and individuals to contribute to representatives.

In his paper, Stratmann shows that for junior representatives, the marginal effect of contribution was greater, whereas senior representatives were more steadfast in their positions (Stratmann, 2002) . 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 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 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 of the six votes. The following chapter consists of the 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. in the analysis. 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[5], 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[6] 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 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 (Stratmann, 2002). This

[5]https://github.com/unitedstates/congress-legislators
[6]https://bioguide.congress.gov

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[7] Scorecard was used throughout this paper. The website predetermines which roll-call votes are pro-environmental and which are anti-environmental. One of the major downsides of using this data, however, was that the LCV Scorecard does not include representatives' 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 rollcall votes which passed a bill. For this analysis, however, only the environmentally related rollcall votes are relevant 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.

[7] 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 (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 paralell to the vote i.e. Stratmann uses the 1991-92 and 1997-98 contributions to guage 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 these differences in campaign contribution selection, I explored both aforementioned 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 guage whether aggregate contributions from election cylces 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 3: Consolidated contribution data with vote and cutoff dates

In determining the Congresses from which contributions are included in the six months prior, the following pattern emerges, seen in Table 3: since most votes are taken quite late in the Congresses, the contributions for the six months prior usually include contributions from the current Congress, and only sometimes from the previous Congress.

A discussion of these two types of campaign contributions, i.e. aggregate contributions from the previous election and the use of contributions from the current election, shows that these two papers both give the total contributions of an industry to candidates in an election and that only 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 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.[8]

4.3.2 Contribution Data Sources and Processing

Campaign contribution data is readily available through a multitude of open source platforms[9]. Among those is the Center for Responsive Politics which provides contribution data in Bulk Data[10] form, 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 alter-

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

[9]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

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

native 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 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 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.

After the pre-cleaning process through the scripts, only Individual and PAC contributions were kept which were allocated to incumbents. Using the OpenSecrets RealCodes[11], only the non-negative contributions contributions from pro-environmental and anti-environmental (fossil fuel) sources 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 `fedmatch` (Friedrichs et al., 2021) package's functions `fuzzy_match` and `fuzzy_join` functions as shown in the code block 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 con-

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

gress 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 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-enviornmental 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 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 distribution of the logistic regression is non-linear and thus changes in log-ods are not as intuitive to interpret as direct probabilities. Moreover, Mood 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 (Mood, 2009; 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 LPM, Logit and Probit

Both the LPM and the conditional logit and -probit models 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 and Probit[12] serve as a robustness check, but all models have the same specifications and variables.

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

$$\begin{aligned} \text{Vote}_{\text{i,t}} = \alpha + \beta_1 \text{Contributions}^{\text{pro-env}}{}_{1,\text{t}} + \beta_2 \text{Contributions}^{\text{anti-env}}{}_{2,\text{t}} \\ + \gamma_i + \delta_t + \boldsymbol{X}' \zeta_{\text{i,t}} + \varepsilon_{\text{i,t}} \end{aligned} \tag{1}$$

The model shown in Equation 2 is both a conditional logit and -probit model by changing the underlying $F()$ from a logistic function to a standard normal cumulative distribution function.

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

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, where β are the coefficients of the variables of interest: Contributions from pro and anti-environmental sources, $\boldsymbol{x}$ is the vector 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 5.2.

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. This tests the 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.

[12] 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. 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.

To address the hypotheses made in Section 3.3, the Equation 1 was also used to measure the relationship which contributions have on voting in general, to the see the "simple" relation between voting and contributions. In return, all models were 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 conlcusions can be drawn (Stratmann, 2002).

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 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 (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[13], state

[13]As to be seen in Figure 6, 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.

and geographical[14] and the district level I 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-Nominate[15] 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.

In addition, I 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 that indicates whether representatives changed their votes across six specific votes. This helps determine whether vote-changing behavior affects the volume of campaign contributions they receive. Finally, I categorize contributions as either pro- or anti-environmental. By including separate dummy variables for each category, I assess whether the amount of contribution influences a representative's likelihood of voting pro-environmentally, or if simply receiving any contribution from these sources is enough to determine patterns in environmental voting.

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).

[14]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

[15]accessible under https://voteview.com

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 (FE) (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 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. 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 cultural and migration factors, 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 fixed effects. 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 within a representative over time. Therefore, to determine the impact of donations on voting changes, we only use the change in donations within a year and specific member, which allows us 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 environmental campaign contributions would be minimal, if significant. As visible form 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 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 contirubiont vairbale 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 state and year fixed effects does the anti-environmental dummy show statistical significance on a 0.05 level.

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)
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***	-0.123***	-0.144***	
	(0.029)	(0.029)	(0.028)	(0.029)	
2nd dimension DW Nominate	-0.070***	-0.070***	-0.074***	-0.057***	
	(0.021)	(0.021)	(0.022)	(0.021)	
GeographicalNE	0.073***		0.073***		
	(0.011)		(0.011)		
GeographicalSO	0.009		0.004		
	(0.009)		(0.009)		
GeographicalWE	0.019*		0.016		
	(0.011)		(0.011)		
Vote Number	0.0005***				
	(0.0002)				
Seniority	0.002	0.002	0.001	0.002*	0.017
	(0.001)	(0.001)	(0.001)	(0.001)	(0.044)
Anti-Env Contributions Amount	-0.001***	-0.001***		-0.0005***	-0.0002
	(0.0001)	(0.0001)		(0.0001)	(0.0002)
Pro-Env Contributions Amount	0.007***	0.007***		0.007***	0.004***
	(0.001)	(0.001)		(0.001)	(0.001)
Democratic Majority in House	0.024***				
	(0.009)				
Anti-Env Contribution Dummy	-0.021	-0.021	-0.028**	-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)	(0.008)	(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	0.063	0.869	0.006
Adjusted R^2	0.908	0.894	0.055	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)	11.570*** (df = 11; 1883)	1,432.629*** (df = 10; 2153)	3.657** (df = 3; 1679)
Note:					*p<0.1; **p<0.05; ***p<0.01

Figure 5: Main Models summarised[16]

[16] 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 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.

The results from the conditional logit 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 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 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. To analyse this, I added the afore mentioned in Section 5.2 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 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 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 enviornmentally 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 aremore 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 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 rollcall 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 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-Stagall 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 receiving 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.

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 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 API[17] or the tidycensus R package[18].

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

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

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

there are not comparable to 2022 yet

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

[21]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.

[22]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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Appendix A: Supplementary Material

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
Seniority	2,217	0.504	0.500	0	1
Pro Env Contributions Amount	2,314	5.546	4.205	1	18
Anti Env Contributions Amount	2,314	2.304	1.266	0.000	5.945
Democratic Majority in House	2,314	0.343	0.665	0.000	4.120
Pro-Env Contribution Dummy	2,314	0.321	0.467	0	1
Anti-Env Contribution Dummy	2,314	0.914	0.280	0	1
pro_env_dummy	2,314	0.307	0.461	0	1

Figure 6: the descriptive statistics of the main dataset used for the analysis[23]

[23]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				
	OLS		*panel linear*		
	(1)	(2)	(3)	(4)	(5)
district	0.001^{**}	0.001^{**}	0.001^{*}		
	(0.0004)	(0.0004)	(0.0004)		
partyR	-0.901^{***}	-0.902^{***}	-0.911^{***}	-0.896^{***}	
	(0.009)	(0.009)	(0.008)	(0.009)	
birthday	0.001^{*}	0.001^{**}	0.001^{*}	0.001^{***}	
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	
genderM	-0.025^{***}	-0.026^{***}	-0.025^{***}	-0.030^{***}	
	(0.009)	(0.009)	(0.009)	(0.009)	
nominate_dim1	-0.141^{***}	-0.142^{***}	-0.123^{***}	-0.144^{***}	
	(0.029)	(0.029)	(0.028)	(0.029)	
nominate_dim2	-0.070^{***}	-0.069^{***}	-0.074^{***}	-0.055^{***}	
	(0.021)	(0.021)	(0.022)	(0.021)	
GeographicalNE	0.073^{***}		0.073^{***}		
	(0.011)		(0.011)		
GeographicalSO	0.009		0.004		
	(0.009)		(0.009)		
GeographicalWE	0.019^{*}		0.016		
	(0.011)		(0.011)		
Instance	0.0005^{***}				
	(0.0002)				
seniority	0.002	0.002^{**}	0.001	0.002^{**}	0.010^{***}
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Contribution_minus	-0.0001^{***}	-0.0001^{***}		-0.00005^{***}	-0.00002
	(0.00001)	(0.00001)		(0.00001)	(0.00002)
Contribution_plus	0.001^{***}	0.001^{***}		0.001^{***}	0.0004^{***}
	(0.0001)	(0.0001)		(0.0001)	(0.0001)
Dmajority	0.024^{***}				
	(0.009)				
anti_env_dummy	-0.021	-0.023^{*}	-0.028^{**}	-0.027^{**}	
	(0.013)	(0.013)	(0.013)	(0.013)	
pro_env_dummy	-0.007	-0.007	0.007	-0.002	
	(0.009)	(0.009)	(0.008)	(0.009)	
Constant	-0.416				
	(0.782)				
Observations	1,901	1,901	1,901	2,217	2,217
R^2	0.909	0.895	0.906	0.870	0.019
Adjusted R^2	0.908	0.894	0.905	0.867	-0.291
Residual Std. Error	0.152 (df = 1884)				
F Statistic	$1,172.471^{***}$ (df = 16; 1884)	$1,465.286^{***}$ (df = 11; 1886)	$1,514.624^{***}$ (df = 12; 1883)	$1,445.498^{***}$ (df = 10; 2158)	10.686^{***} (df = 3; 1684)
Note:					*p<0.1; **p<0.05; ***p<0.01

Figure 7: the most important LPM models: c

	Vote		
	logistic		*OLS*
	(1)	(2)	(3)
district	0.007	0.004	0.001**
	(0.018)	(0.018)	(0.0004)
partyR	-8.436***	-8.464***	-0.901***
	(0.526)	(0.538)	(0.009)
Vote_change	0.401	0.510	
	(0.392)	(0.379)	
birthday	0.018	0.016	0.001*
	(0.019)	(0.018)	(0.0004)
genderM	-1.208**	-1.133**	-0.025***
	(0.497)	(0.497)	(0.009)
nominate_dim1	-2.705*	-2.699*	-0.141***
	(1.496)	(1.510)	(0.029)
nominate_dim2	-3.449***	-3.365***	-0.070***
	(1.102)	(1.126)	(0.021)
GeographicalNE	2.351***	2.314***	0.073***
	(0.560)	(0.562)	(0.011)
GeographicalSO	0.063	-0.009	0.009
	(0.489)	(0.480)	(0.009)
GeographicalWE	0.675	0.755	0.019*
	(0.561)	(0.553)	(0.011)
Instance	0.028***	0.030***	0.0005***
	(0.009)	(0.009)	(0.0002)
seniority	0.029	0.017	0.002
	(0.050)	(0.049)	(0.001)
Contribution_minus	-0.002**	-0.438***	-0.0001***
	(0.001)	(0.162)	(0.00001)
Contribution_plus	0.010***	0.534**	0.001***
	(0.004)	(0.234)	(0.0001)
Dmajority	1.622***	1.640***	0.024***
	(0.480)	(0.486)	(0.009)
anti_env_dummy	-0.725	0.886	-0.021
	(0.611)	(0.956)	(0.013)
pro_env_dummy	0.265	-0.944	-0.007
	(0.434)	(0.797)	(0.009)
Constant	-28.692	-24.353	-0.416
	(36.656)	(36.115)	(0.782)
Observations	1,901	1,901	1,901
R^2			0.909
Adjusted R^2			0.908
Log Likelihood	-155.789	-156.628	
Akaike Inf. Crit.	347.579	349.256	
Residual Std. Error			0.152 (df = 1884)
F Statistic			1,172.471*** (df = 16; 1884)

* ** ***

Figure 8: the two Logit models: (1) with only control variables and (2) legislator and year FEs

	Dependent variable:		
	Vote		
	(1)	(2)	(3)
district	0.001*	0.001**	0.0001
	(0.0004)	(0.0004)	(0.0004)
partyR	-0.911***	-0.901***	-0.911***
	(0.008)	(0.009)	(0.009)
Vote_change_dummy			0.176***
			(0.017)
birthday	0.001*	0.001*	0.0004
	(0.0004)	(0.0004)	(0.0004)
genderM	-0.025***	-0.025***	-0.026***
	(0.009)	(0.009)	(0.009)
nominate_dim1	-0.122***	-0.141***	-0.076***
	(0.028)	(0.029)	(0.029)
nominate_dim2	-0.075***	-0.070***	-0.106***
	(0.022)	(0.021)	(0.021)
GeographicalNE	0.074***	0.073***	0.060***
	(0.011)	(0.011)	(0.011)
GeographicalSO	0.004	0.009	-0.001
	(0.009)	(0.009)	(0.009)
GeographicalWE	0.016	0.019*	0.019*
	(0.011)	(0.011)	(0.011)
Instance	0.001***	0.0005***	0.001***
	(0.0002)	(0.0002)	(0.0002)
seniority	0.001	0.002	0.0003
	(0.001)	(0.001)	(0.001)
Contribution_minus		-0.0001***	
		(0.00001)	
Contribution_plus		0.001***	
		(0.0001)	
Dmajority	0.025***	0.024***	0.029***
	(0.009)	(0.009)	(0.009)
anti_env_dummy	-0.028**	-0.021	0.026
	(0.013)	(0.013)	(0.019)
pro_env_dummy	0.007	-0.007	-0.026
	(0.008)	(0.009)	(0.017)
Contribution_plus_log			0.014***
			(0.005)
Contribution_minus_log			-0.013***
			(0.003)
Constant	-0.351	-0.416	0.198
	(0.787)	(0.782)	(0.767)
Observations	1,901	1,901	1,901
R^2	0.907	0.909	0.913
Adjusted R^2	0.906	0.908	0.912
Residual Std. Error	0.153 (df = 1886)	0.152 (df = 1884)	0.148 (df = 1883)
F Statistic	1,313.433*** (df = 14; 1886)	1,172.471*** (df = 16; 1884)	1,157.610*** (df = 17; 1883)
Note:			*p<0.1; **p<0.05; ***p<0.01

Figure 9: the LPM models with only control variables

	Dependent variable:		
	Vote		
	panel linear	*OLS*	*panel linear*
	(1)	(2)	(3)
district	0.001^{**}	0.0001	0.001^{**}
	(0.0004)	(0.0004)	(0.0004)
partyR	-0.902^{***}	-0.911^{***}	
	(0.009)	(0.009)	
Vote_change_dummy		0.176^{***}	
		(0.017)	
birthday	0.001^{**}	0.0004	0.001^{*}
	(0.0004)	(0.0004)	(0.0004)
nominate_dim1	-0.142^{***}	-0.076^{***}	-0.141^{***}
	(0.029)	(0.029)	(0.029)
nominate_dim2	-0.069^{***}	-0.106^{***}	-0.070^{***}
	(0.021)	(0.021)	(0.021)
GeographicalNE		0.060^{***}	0.073^{***}
		(0.011)	(0.011)
GeographicalSO		-0.001	0.009
		(0.009)	(0.009)
GeographicalWE		0.019^{*}	0.019^{*}
		(0.011)	(0.011)
Instance		0.001^{***}	
		(0.0002)	
Instance4			0.010
			(0.012)
Instance6			0.035^{***}
			(0.012)
Instance7			0.025^{*}
			(0.013)
Instance51			0.024^{*}
			(0.012)
Instance52			0.033^{***}
			(0.012)
seniority	0.002^{**}	0.0003	0.002
	(0.001)	(0.001)	(0.001)
Contribution_minus	-0.0001^{***}		-0.0001^{***}
	(0.00001)		(0.00001)
Contribution_plus	0.001^{***}		0.001^{***}
	(0.0001)		(0.0001)
Dmajority		0.029^{***}	
		(0.009)	
genderM	-0.026^{***}	-0.026^{***}	-0.025^{***}
	(0.009)	(0.009)	(0.009)
pro_env_dummy	-0.007	-0.026	-0.007
	(0.009)	(0.017)	(0.009)
Contribution_plus_log		0.014^{***}	
		(0.005)	
Contribution_minus_log		-0.013^{***}	
		(0.003)	
anti_env_dummy	-0.023^{*}	0.026	-0.021
	(0.013)	(0.019)	(0.013)
Constant		0.198	
		(0.767)	
Observations	1,901	1,901	1,901
R^2	0.895	0.913	0.089
Adjusted R^2	0.894	0.912	0.080
Residual Std. Error		0.148 (df = 1883)	
F Statistic	$1,465.286^{***}$ (df = 11; 1886)	$1,157.610^{***}$ (df = 17; 1883)	10.226^{***} (df = 18; 1881)
Note:			*p<0.1; **p<0.05; ***p<0.01

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

	(1)	(2)
district	0.001*	0.001**
	(0.0004)	(0.0004)
birthday	0.001*	0.001*
	(0.0004)	(0.0004)
nominate_dim1	-0.123***	-0.141***
	(0.028)	(0.029)
nominate_dim2	-0.074***	-0.070***
	(0.022)	(0.021)
GeographicalNE	0.073***	0.073***
	(0.011)	(0.011)
GeographicalSO	0.004	0.009
	(0.009)	(0.009)
GeographicalWE	0.016	0.019*
	(0.011)	(0.011)
partyR	-0.911***	
	(0.008)	
Instance4		0.010
		(0.012)
Instance6		0.035***
		(0.012)
Instance7		0.025*
		(0.013)
Instance51		0.024*
		(0.012)
Instance52		0.033***
		(0.012)
seniority	0.001	0.002
	(0.001)	(0.001)
genderM	-0.025***	-0.025***
	(0.009)	(0.009)
Contribution_minus		-0.0001***
		(0.00001)
Contribution_plus		0.001***
		(0.0001)
pro_env_dummy	0.007	-0.007
	(0.008)	(0.009)
anti_env_dummy	-0.028**	-0.021
	(0.013)	(0.013)
Observations	1,901	1,901
R^2	0.906	0.089
Adjusted R^2	0.905	0.080

Figure 11: the LPM models with party and year FEs

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