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PAC Aggregations and US Congress:
A Quantitative Analysis from a Different Scale

Abstract

This paper addresses the malleability of party control in the US Congress by finding linearly dependent trends between different aggregations of Political Action Committee donations and US Congress party representation since the election cycle of 2000. Using linear models, I fitted aggregated donation data from OpenSecrets and party representation data in Congress. And with figures, I offer possible explanations behind the uncovered phenomena. Through these experiments, I found that large sums of money almost always had a high correlation with US Congress party representation and that the House of Representatives' party representation in particular had a significant correlation with the top countries' PAC donations.

Keywords: Political Action Committee, PAC, Political Spending, Political Donations, OpenSecrets, Political Interest

1. Introduction

The 2016 and 2020 US presidential elections have been surrounded with their fair share of conspiracy theories and political uncertainty. Particularly the possibility of interference from foreign powers in the 2016 elections left many Americans less and less willing to trust in the country's democracy. Therefore, in this report, I will explore the stability of the US democracy by comparing Political Action Committee contributions with US Congress party distribution over time.

Political Action Committees, or PACs for short, are committees created to raise and spend money for the purpose of supporting candidates in political campaigns. While people still view PACs as a personal way of supporting candidates, previous research has indicated that organizational PACs strategically use donations to further their own company interests (Calcagno and Jackson 2021). Often by contributing to campaign funds, organizational PACs "buy" votes for certain policies from senators, almost directly influencing the passing of legislation (Brooks, Cameron, and Carter 1998). Though many such reports have been published, the scale of their research is often limited to a handful of PACs and their donations to specific senators about specific policies. This research aims to expand that scale by testing the correlation between US government party distribution for both Senate and House of Representatives and different groups of PACs. The 2 groups I will be testing are PACs grouped by country and by industry. As a control, I will use the aggregation of leadership PACs to find a baseline for PAC aggregations and their correlation with US Congress representation for both Senate and House of Representatives.

With R and data from OpenSecrets which is taken and organized directly from the Federal Election Commission (Miller 2021), I will examine the connection between donations of different aggregations of PACs and US Congress representation over time since the 2000s. Using simple linear models (Chambers 1992), the null hypothesis (H_0) is:

There is no statistically significant linear relationship between the donation distribution of one kind of PAC and the party distribution of senate/house of representatives in Congress.

And the alternative hypothesis (H_A) is:

There is a statistically significant linear relationship between the donation distribution of one kind of PAC and the party distribution of senate/house of representatives in Congress.

2. Methods

2.1 Data Collection and Cleaning

The primary data source for this project is OpenSecrets.org, which aggregates data about federal campaign contributions from the Federal Election Commission. It is a 501(c)3 tax-exempt, charitable organization that has no affiliation with any of the organizations mentioned in the data it provides. On OpenSecrets, I web-scraped PAC-related data between the election cycles of 2000 and 2020 inclusive. The 3 separate categories are Foreign-Connected PACs, Leadership PACs, and PACs aggregated by Industry. Please see Appendix A for more information on the R scripts used to web-scrape the data.

Foreign-Connected PACs[1]:

These PACs are created as part of the American division of overseas companies. Though the policy that only American citizens or green card holders can donate still stands, foreign-connected PACs do give an outlet for foreign companies to contribute to US campaigns.

On OpenSecrets, each election cycle contains data for each individual PAC, including the company affiliate, country of origin, parent company, and donation amount for republicans, democrats, and in total.

Table 1: Summary Statistics of Foreign PACs Aggregated by Country

Variable	N	Mean	SD	Range
Donation to Democrats	240	319811.44	514887.92	2968712 (0-2968712)
Donation to Republicans	240	460607.02	710396.54	3673092 (0-3673092)

Source: OpenSecrets.org

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[1] OpenSecrets,
https://www.opensecrets.org/political-action-committees-pacs/industry-breakdown/2020

I aggregated this data in 2 similar ways: 1) I combined the donation amounts based on election cycle alone for the general trend of foreign donations and converted each year's democratic and republican donations into percentages out of the total amount of donations; 2) I grouped the data based on election cycle and country of origin and similarly converted party donations into percentages.

Leadership PACs[2]:

While normal PACs are self-organized committees or affiliated with companies, leadership PACs are committees specifically affiliated with a politician, often used to donate to other candidates. This not only boosts their clout among candidates of their party, but it also strengthens the interconnectivity of the political party circle as a whole. Because of the purpose of leadership PACs, the distribution of donation is very polarized.

On OpenSecrets, each election cycle contains data for each individual PAC, including the PAC name, affiliate, and donation amount for republicans, democrats, and in total.

Table 2: Summary Statistics of Leadership PACs

Variable	N	Mean	SD	Range
Donation to Democrats	15033	43023.97	118611.21	2356046 (-21500-2334546)
Donation to Republicans	15033	63169.95	159454.05	2456500 (-6500-2450000)

Source: OpenSecrets.org

As I was only trying to find the general trend, I aggregated this data by election cycle and converted each year's democratic and republican donations into percentages of total donations of that cycle.

PACs Aggregated by Industry[3]:

[2] OpenSecrets,
https://www.opensecrets.org/political-action-committees-pacs/industry-detail/Q03/2020
[3] OpenSecrets,
https://www.opensecrets.org/political-action-committees-pacs/industry-breakdown/2020

OpenSecrets provides a hierarchical coding system that tags each PAC as 1 of 142 different industries, thereby lending insight into industry-level trends in PAC donations. The data provided on the website displays industry name, total donation, and donation for democrats and republicans separately.

Table 3: Alphabetically Ordered Sample of PAC Data Industry Breakdown for the 2020 Election Cycle

Industry Name	Total for all parties	Democrats	Republicans
Abortion Policy/Anti-Abortion	$659,086	$5,000	$654,086
Abortion Policy/Pro-Abortion Rights	$1,429,895	$1,407,585	$0
Accountants	$8,088,600	$3,756,600	$4,329,500
Advertising & public relations services	$16,000	$11,000	$5,000

Source: OpenSecrets.org

Since this industry breakdown included all PACs, I could not just aggregate it by election. Therefore, I grouped the donation amounts by both election cycle and industry name.

Party Division in US Congress[4]:

For data on the senate and house distribution over the election cycles in the 2000s, I chose to web-scrape that data from a Wikipedia article about Party Divisions of United States Congresses. which includes information about the number of seats held by democrats and republicans in each election cycle. For cycles where seats shifted mid-term, I simply used the initial number of seats held.

2.2 Tests and Assumptions

In order to compare the correlation between different continuous variables, I decided to use Linear Models (Chambers 1992) to measure linear dependency between 2 variables at a time.

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[4] https://en.wikipedia.org/wiki/Party_divisions_of_United_States_Congresses

Therefore, I fitted linear models and tested correlation for 8 different pairs of variables, each with a unique combination between a congress branch as the outcome variable and a PAC category as the predictor variable.

Table 4: Combinations of Linear Models Between PAC Category and Congress Distribution

PAC Category (predictor variable)	Congress (outcome variable)
Leadership PAC donation over the 2000s	House of Representatives party distribution over the 2000s
Foreign-Connected PAC donation over the 2000s	House of Representatives party distribution over the 2000s
Top 5 PAC Industries by donation over the 2000s	House of Representatives party distribution over the 2000s
Top 5 foreign PAC Countries by donation over the 2000s	House of Representatives party distribution over the 2000s
Leadership PAC donation over the 2000s	Senate party distribution over the 2000s
Foreign-Connected PAC donation over the 2000s	Senate party distribution over the 2000s
Top 5 PAC Industries by donation over the 2000s	Senate party distribution over the 2000s
Top 5 foreign PAC Countries by donation over the 2000s	Senate party distribution over the 2000s

The assumptions of Linear Models are 1) the data is numeric, 2) the relationship is linear, 3) the data is normally distributed, 4) the variance of both variables is similar, and 5) the 2 variables are independent from each other. The data fits assumption 1 as the dataset is continuous and assumption 2 is shown by graphing aggregated foreign PACs, industry PACs, and leadership PACs each with House and Senate party representation. These graphs are found in Appendix C.

Because of the aggregation of data by election cycle since the 2000s, there is little data to assume normal distribution and variance similarity. Additionally, the independence of variables will be the point of testing for these linear models.

2.3 Evaluation of Linear Model Results

The significance level is set at $\alpha = .05$ with the alternative hypothesis being that there is a statistically significant linear dependency between the donation distribution of one kind of PAC and the party distribution of a branch of Congress in the 2000s. Results will be displayed through tables created from the R package sjPlot (Lüdecke 2018).

Additionally, in order to gauge the degree to which variables are linearly dependent, I will calculate the average absolute value of the estimates of each linear model. Since estimates could be both positive and negative, finding the average of the coefficient estimates' absolute values would provide a metric that could represent the relative linear dependency of models.

2.4 Graphical Analysis

For a more comprehensive understanding of the connection between variables, scatter plots and line graphs from the R package ggplot2 (Wickham 2016) will be used simultaneously with the Linear Model results to interpret the data.

3. Results

The sampled data was processed into a percentage distribution between Democratic and Republican donations. Visualization code for all figures can be found in Appendix D.

3.1 Tables

Table 5: Comparison between linear models fit on house and senate distribution as a function of leadership and foreign PAC donation distribution aggregated by election cycle.

Predictors	House of Representatives Party Distribution (%)		Senate Party Distribution (%)	
	Estimates	*p*	*Estimates*	*p*
(Intercept)	0.27	**0.006**	0.33	**0.002**
Leadership PACs	-0.19	0.591	-0.30	0.379
Foreign PACs	0.73	0.070	0.72	0.071
Average Absolute	0.46		0.51	
Observations	11		11	
R^2 / R^2 adjusted	0.563 / 0.453		0.476 / 0.345	

Source: OpenSecrets

Table 5 shows the linear model fits of large scale aggregations of PAC donation data. 2 models were used. One for each assembly of Congress as the outcome variable. I grouped leadership and foreign donations by year and summed the donations for each party for each year. To avoid external factors that influence the amount of money, I transformed the party donations into percentages of total donations in that year. These percentages are used to fit the linear model with the distributions of House of Representatives and Senate.

Table 6: Top 5 Industries with highest total donations aggregated by election cycle and fitted to predict the party distribution of different branches of US Congress

Predictors (Industries)	Total Donations since the 2000s (Not adjusted for inflation)	House of Representatives Party Distribution (%) Estimates	p	Senate Party Distribution (%) Estimates	p
(Intercept)		-0.24	0.616	-0.13	0.826
Finance, Insurance & Real Estate	$ 731,213,704	0.75	0.138	-0.10	0.862
Ideological/Single-Issue	$ 711,203,260	0.36	0.434	-0.91	0.160
Labor	$ 632,544,037	0.44	0.425	0.83	0.268
Health	$ 494,250,740	0.18	0.771	0.16	0.837
Leadership PACs	$ 479,314,831	-0.53	0.265	0.69	0.268
Average Absolute		0.45		0.54	
Observations		11		11	
R^2 / R^2 adjusted		0.836 / 0.672		0.648 / 0.297	

Source: OpenSecrets

Table 6 shows the linear model fits of the aggregation of PACs from the 5 highest donating industries. 5 industries were chosen because, after aggregating the data by year, only 11 observations are left. Therefore, to preserve a high degree of freedom whilst understanding the correlation between money from different industries, the top 5 highest donating industries were chosen. Note here that OpenSecrets does list Leadership PACs as an industry to better categorize them.

Table 7: Top 5 Countries with highest total donations aggregated by election cycle and fitted to predict the party distribution of different branches of US Congress

Predictors (Countries)	Total Donations since the 2000s (Not adjusted for inflation)	House of Representatives Party Distribution (%)		Senate Party Distribution (%)	
		Estimates	*p*	*Estimates*	*p*
(Intercept)		0.23	0.067	0.19	0.302
UK	$ 51,978,515	0.59	0.065	0.87	0.101
Switzerland	$ 30,610,851	-1.29	**0.036**	0.14	0.864
Germany	$ 24,927,823	1.54	**0.019**	-0.10	0.900
Japan	$ 13,208,936	0.39	**0.027**	0.10	0.669
Ireland	$ 11,389,764	-0.59	**0.030**	-0.27	0.449
Average Absolute		0.88		0.30	
Observations		11		11	
R^2 / R^2 adjusted		0.903 / 0.807		0.648 / 0.296	

Source: OpenSecrets

Table 7 shows the linear model fits of the aggregation of PACs from the 5 highest donating countries. Similar to Table 6, I only used the top 5 to preserve the degree of freedom.

3.2 Figures

While tables do offer valuable information about model performance and linear dependency between different aggregations of PACs and different branches of Congress, figures can provide a more visual understanding of the nature of the relationship between PAC donations and Congress representation.

Figure 1: Line graph representing the aggregation of all Foreign PAC donations compared to Congress representation from House of Representatives and Senate over the 2000s
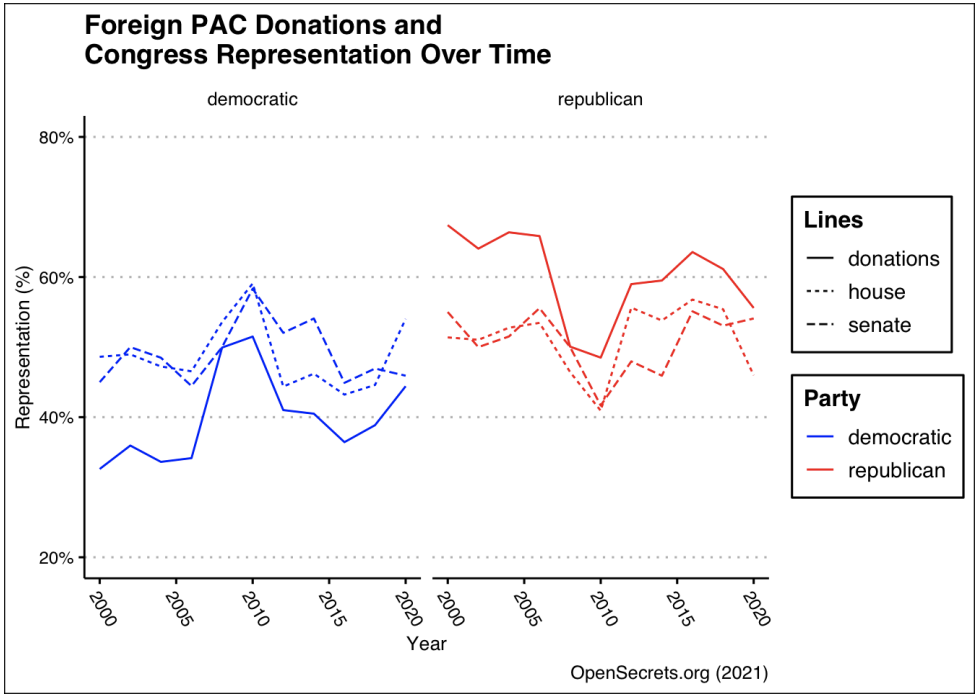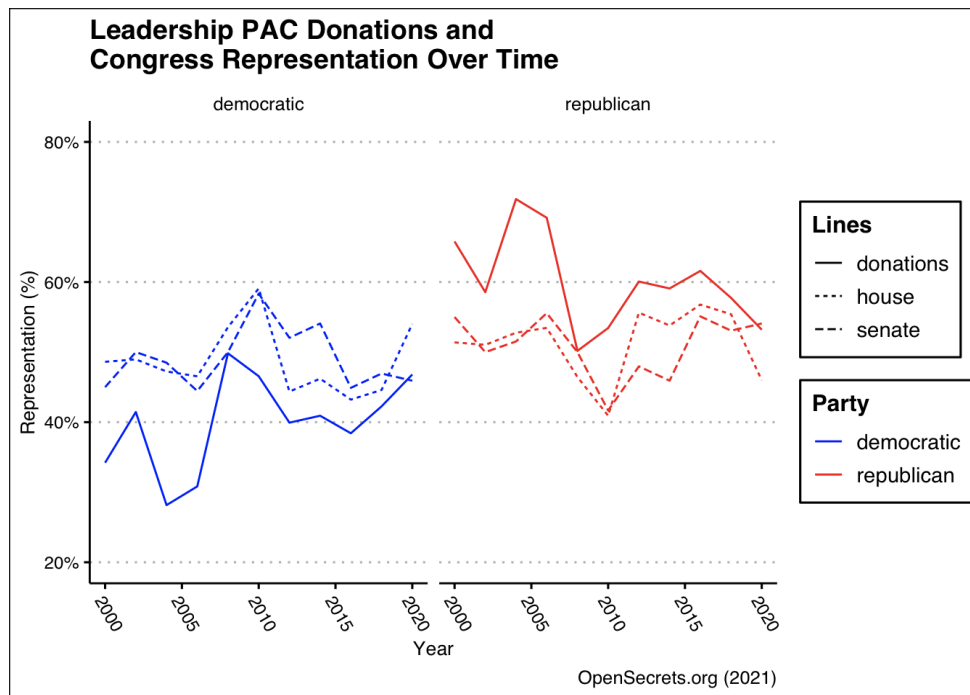

Figure 2: Line graph representing the aggregation of all Leadership PAC donations compared to Congress representation from House of Representatives and Senate over the 2000s

Leadership PAC Donations and Congress Representation Over Time

OpenSecrets.org (2021)

Figures 1 and 2 not only show the relationship over time between foreign and leadership donations to parties and party representation in Congress, but they also reveal an important note about how I approached the problem of differing scales. The complementary relationship between democratic and republican representation is due to my conversion of seats held and donations received by parties into percentages. This allows direct comparison of variables that are not on the same numerical scale. For instance, donations (in US dollars) are usually not comparable with seats held in the Senate due to scale. However, after conversion, the two variables can be compared in terms of percentage per party.

Conversion into percentage between two parties does come with one major benefit when it comes to graphing. In figures below, you will see only the percentage change for one party. Though this decision may seem odd, it does not cause any loss of information because the percentages are always complementary. Any relationship shown in the figures will be reflected for the other party.

Figure 3: Line graph of aggregation of PACs from the 5 highest donating countries compared to Congress representation from House of Representatives and Senate over the 2000s

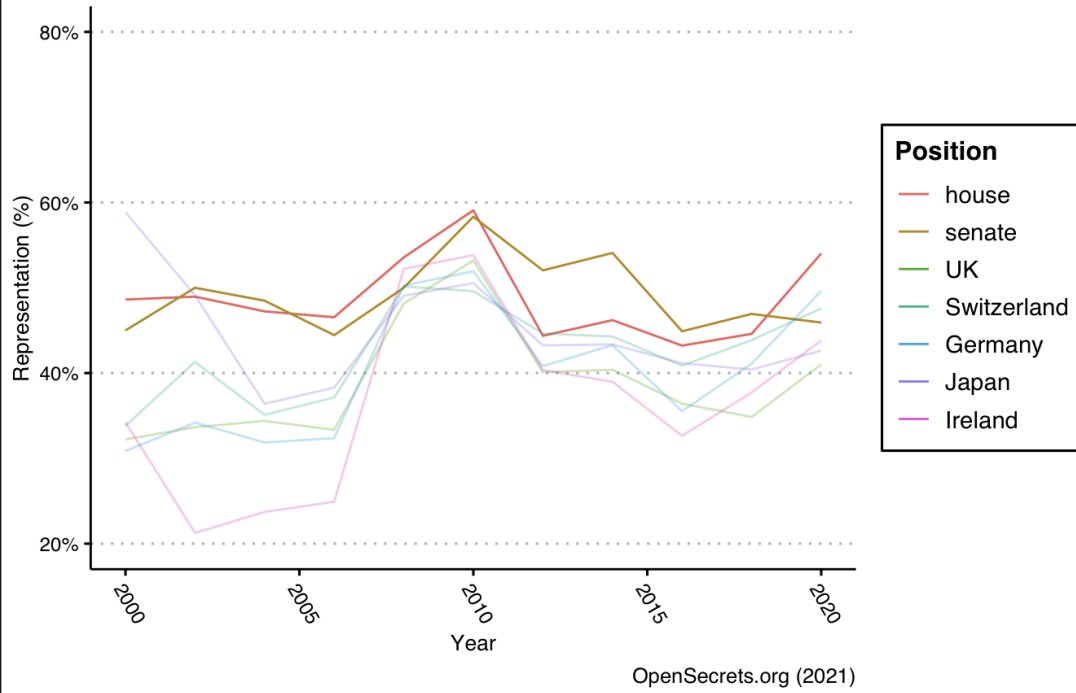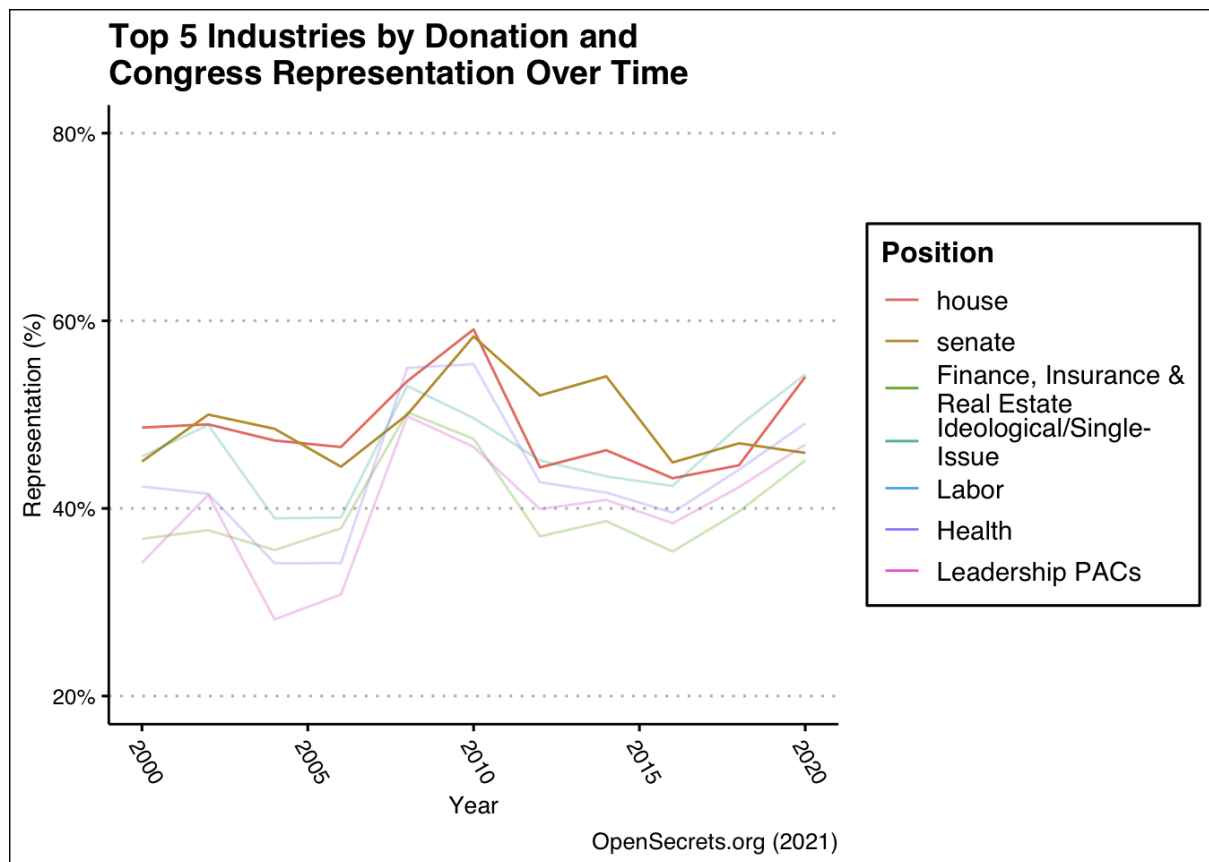**Top 5 Foreign Donation Countries and Congress Representation Over Time**

Representation (%)

Position
- house
- senate
- UK
- Switzerland
- Germany
- Japan
- Ireland

Year

OpenSecrets.org (2021)

Figure 4: Line graph of aggregation of PACs from the 5 highest donating industries compared to Congress representation from House of Representatives and Senate over the 2000s

Figures 3 and 4 as mentioned before only show the change in representation from the democratic party. Each line represents either a percentage aggregation of donation or Congress representation. The lines representing House of Representatives and Senate representation over time have been highlighted from the rest of the lines for convenience.

4. Discussion

Before discussing my interpretations of the results, I will establish 3 assumptions I will refer to in the following sections, which are based on previous research.

Firstly:

PACs have a preference of candidates, meaning PACs donate to candidates according to similar political views or interests (Poole, Romer, and Rosenthal 2021).

Secondly:

Corporations can utilize their PACs to donate with the intention of furthering company interests (Brooks, Cameron, and Carter 1998).

Thirdly:

Government officials, that is members of both Senate and House of Representatives, have an interest in gaining the favor of PACs due to personal and political interest (Calcagno and Jackson 2021).

The following discussion will be written based on these assumptions and will build upon them with the results.

4.1 Aggregated PAC Donation and Representation

As seen in Figures 1 and 2, aggregated PAC donation percentage split by party provides a close parallel with trends of party representation in Congress. What is interesting to note here is that the donation line of Figure 1 seems to more closely resemble the house and senate lines than that of Figure 2.

This difference in parallel could in part be due to the amount of donations. Since the donation line in Figure 1 represents the aggregation of all foreign PACs, it outweighs the amount of donations received in only the leadership PACs. And since government officials have the motive of maximizing authority and personal wealth sometimes even over holding their seats (Calcagno and Jackson 2021), the difference in scale of donation amounts would make a difference.

Further insight in the relationship between donation amount and seat representation could be found in Figures 3 and 4. Figure 3 shows side-by-side the donation and seat representation of PACs and Congress. While all the lines in the figure follow similar trends, it is clearly visible that the line

for donations from Japan and Ireland PACs conform less to the overall trend, at least initially. The same idea could be seen in Figure 4 where the industry of "Leadership PACs" seems to be the most fluctuating line in the initial year of the 2000s. The categories pointed out are all also the lowest among their top 5's in donation sum.

This understanding that a large sum of money could influence the seats and party representation in the government then raises some concerns worth discussing. If donating is a way to influence campaigns and elections through PACs, is donating not also a form of voting?

As stated in my second assumption, corporations do use their PACs to choose candidates to donate to. Therefore, corporation PACs often donate large sums of money to candidates. Table 6 shows that PACs from the top 5 industries have all donated well into the 9-figures to political parties and campaigns. While "Leadership PACs" and "Ideological/Single-Issue" are inherently political, a very business-focused industry like "Finance, Insurance & Real Estate" having the highest donations since the 2000s does show that corporations are actively contributing to government politics through PACs.

4.2 Foreign Donations and Branches of Congress

The main purpose of this research was examining different aggregations of PAC donations and its connection with party representation for different branches of Congress. An relevant finding was the relationship between PAC donations from the top donating countries and the representation in the House of Representatives.

While previous research has shown that the Senate is more influenced by company favors (Brooks, Cameron, and Carter 1998), the results from my linear model suggest that the House of Representatives is more susceptible to foreign donations. Table 7 shows the top 5 donating countries and their coefficient estimates when used to linearly predict the party representation in the House of Representatives. The estimates for Switzerland, Germany, Japan, and Ireland all had a p-value of below the significance level at 0.05, so their estimates reject the null hypothesis for linear dependency.

Additionally, the estimates for predicting the representation for the House have a higher average absolute value than those for predicting Senate representation with House's at 0.88 while Senate's only at 0.30. The higher the average absolute value is for coefficient estimates, the more influential each estimate is because it shows that the estimates are farther away from 0. The resulting linear model also had an R^2 value of 0.903, which demonstrates high correlation. This further supports

the idea that the House of Representatives are more influenced by foreign donations because it shows that the difference in party donation percentage results in more drastic party representation percentage changes in the House.

4.3 Foreign and Industry leading PAC Aggregations

After understanding the role that money plays in campaign success and seat representation, there are then further topics worth researching as an extension of this idea. Notably, one phenomenon that the results have touched on is the relative difference in monetary influence between PACs of foreign countries and PACs by industry.

Comparing the linear model fits for the House of Representatives' party distribution in Tables 6 and 7, the sum of the top 5 industry aggregated PAC donations since the 2000s are more than 10 times that of country aggregated PAC donations. However, while many countries in Table 7 reject the null hypothesis for linear dependency with the House's party distribution, the same cannot be said for the industries in Table 6. Not only that, similar to the section above, the House's model in Table 7 had a much higher average absolute value at 0.88 than the model in Table 6 at 0.45. The deviating coefficients show that the House's party representation is more swayed by each dollar of PAC donation from foreign countries than from industries.

The disparity in influence from donations of different PAC sources and aggregations is yet another point of concern and is worth doing further research into.

5. Conclusion

This research does have several limitations. Firstly, only looking at money donations cannot cover all of the exchanges between PACs and Congress members (Brooks, Cameron, and Carter 1998). Secondly, since the results of this research cannot assume causation, the discussion of the causal relationship between money donations and party representation, though rooted in previous research, is only as strong as educated guesses. Thirdly, the limitation in sample size, especially when aggregating donations by election cycle, could cause statistical errors and unreflective results. Lastly, as evident in Tables 1 and 2, the donation data does not really conform to the normality assumption of linear models, which could cause unforeseen results.

As for future work about this topic, since the results of this paper only offers a general statistical overview of how different kinds of PAC donation aggregations can correlate with Congress representation, a valuable extension of this research would be diving into the reasons behind some of the phenomena highlighted. For example, the difference in influence between different aggregations of PAC sources or the strong correlation between PAC donations from foreign countries and the party representation in the House of Representatives.

Another direction that could be pursued is furthering the research of how different aggregations correlate with party representation. This research has only scratched the surface of the possible correlations between different PAC donations and government representations. If more possibilities were covered, more than likely new notable phenomena could be discovered.

6. Reference

Chambers, John M., and Trevor Hastie, eds. 1992. *Statistical Models in S*. Pacific Grove, Calif: Wadsworth & Brooks/Cole Advanced Books & Software.

Brooks, Jonathan C., A. Colin Cameron, and Colin A. Carter. 1998. "Political Action Committee Contributions and U.S. Congressional Voting on Sugar Legislation." *American Journal of Agricultural Economics* 80(3):441–54. doi: 10.2307/1244547.

Brunell, Thomas L. 2021. "The Relationship between Political Parties and Interest Groups: Explaining Patterns of PAC Contributions to Candidates for Congress." 9.

Burris, Val. 1987. "The Political Partisanship of American Business: A Study of Corporate Political Action Committees." *American Sociological Review* 52(6):732. doi: 10.2307/2095832.

Calcagno, Peter T., and John D. Jackson. 2021. "Political Action Committee Spending and Senate Roll Call Voting." 18.

Drew Dimmery and Andrew Peterson. 2016. "Shining the Light on Dark Money: Political Spending by Nonprofits." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 2(7):51. doi: 10.7758/rsf.2016.2.7.04.

Kroszner, Randall S., and Thomas Stratmann. 2021. "Interest-Group Competition and the Organization of Congress: Theory and Evidence from Financial Services' Political Action Committees." 26.

Miller, Nora. 2021. "ANTI-SPIN: USING INTERNET RESOURCES TO UNWIND POLITICAL CLAIMS." 5.

Nickerson, David W., and Todd Rogers. 2014. "Political Campaigns and Big Data." *Journal of Economic Perspectives* 28(2):51–74. doi: 10.1257/jep.28.2.51.

Poole, Keith T., Thomas Romer, and Howard Rosenthal. 2021. "The Revealed Preferences of Political Action Committees." 6.

Wickham, Hadley. 2016. *Ggplot2: Elegant Graphics for Data Analysis*. 2nd ed. 2016. Cham: Springer International Publishing : Imprint: Springer. https://ggplot2.tidyverse.org

Lüdecke, Daniel. 2018. *SjPlot - Data Visualization for Statistics in Social Science.* Zenodo.

Hester, Jack. 2021. "Probability/Stats Lecture Notes + Quiz Guide." Lecture Notes.

7. Appendices

7.1 Appendix A

Web Scraper script for Leadership PACs

https://github.com/NuoWenLei/brown-pac-research/blob/main/data/webscrap_scripts/leadership_webscrap_process.R

Web Scraper script for Foreign-Connected PACs

https://github.com/NuoWenLei/brown-pac-research/blob/main/data/webscrap_scripts/foreign_webscrap_process.R

Web Scraper script for PACs by Industry

https://github.com/NuoWenLei/brown-pac-research/blob/main/data/webscrap_scripts/industry_webscrap_process.R

All code can be found in the following GitHub repository

https://github.com/NuoWenLei/brown-pac-research

7.2 Appendix B

PACs by industry linear model fits as predictor of House of Representatives Distribution

https://github.com/NuoWenLei/brown-pac-research/blob/main/data/fit_tables/ind_house_lm_tbl.csv

PACs by industry linear model fits as predictor of Senate Distribution

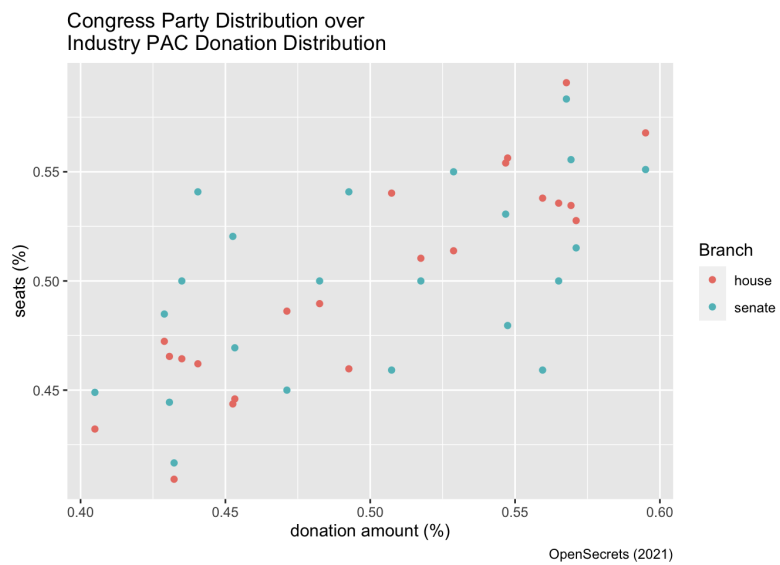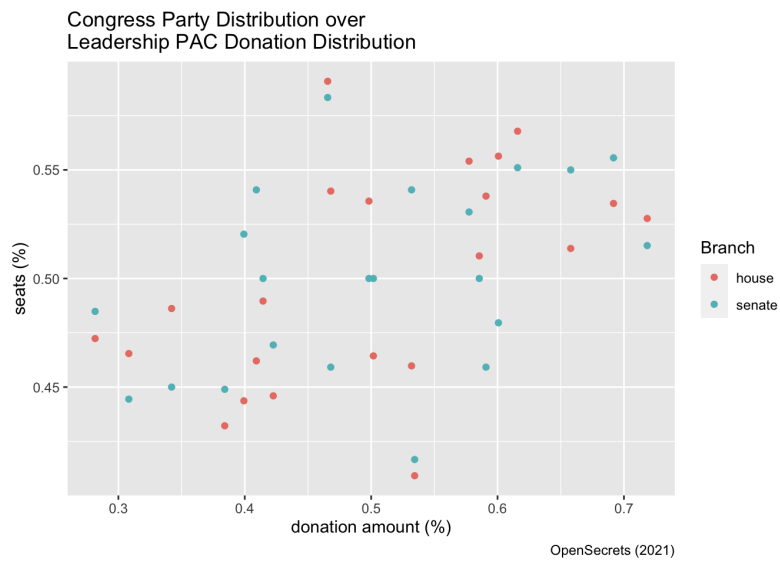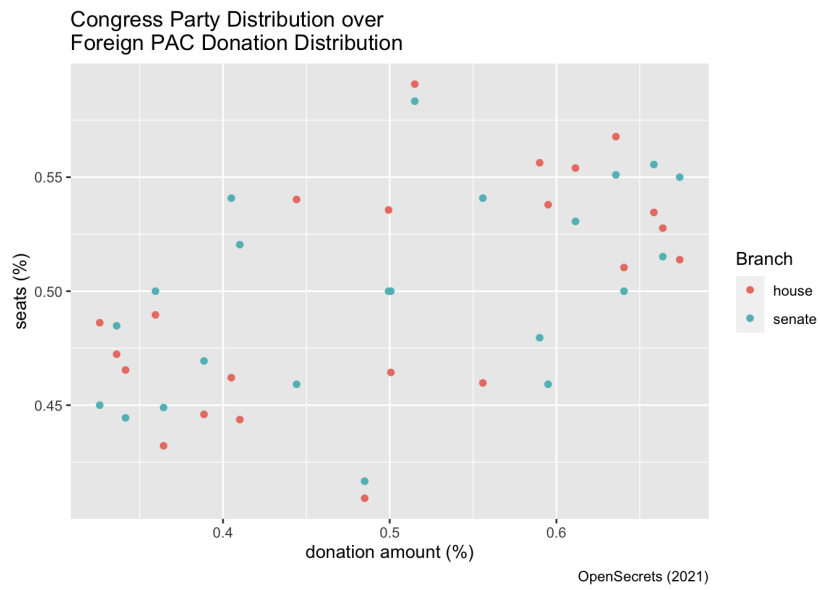https://github.com/NuoWenLei/brown-pac-research/blob/main/data/fit_tables/ind_senate_lm_tbl.csv

Foreign PAC linear model fits by country as predictor of House of Representatives Distribution

https://github.com/NuoWenLei/brown-pac-research/blob/main/data/fit_tables/cty_house_lm_tbl.csv

Foreign PAC linear model fits by country as predictor of Senate Distribution

https://github.com/NuoWenLei/brown-pac-research/blob/main/data/fit_tables/cty_senate_lm_tbl.csv

7.3 Appendix C

Congress Party Distribution over
Foreign PAC Donation Distribution

seats (%)

donation amount (%)

Branch
house
senate

OpenSecrets (2021)

Congress Party Distribution over
Leadership PAC Donation Distribution

seats (%)

donation amount (%)

Branch
house
senate

OpenSecrets (2021)

Congress Party Distribution over
Industry PAC Donation Distribution

seats (%)

donation amount (%)

Branch
house
senate

OpenSecrets (2021)

7.4 Appendix D

GitHub folder with code for all figures

https://github.com/NuoWenLei/brown-pac-research/tree/main/figures