POLITICAL CONTRIBUTIONS, VOTER TURNOUT, AND THE EFFECTS OF REDISTRICTING

BY

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DISSERTATION

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ABSTRACT

Individual contributions to political campaigns are a significant aspect of the political process in the United States. Understanding how the political environment affects these contributions increases the understanding of what drives elections and political campaigns. One aspect of the political environment is that political campaigns for the U.S. Senate overlap with campaigns for the U.S. House of Representatives. This may cause individual contributors to substitute a political contribution to one campaign with a political contribution to another campaign. Conversely, individual contributors may see contributions to overlapping campaigns as complements. Individual contributors are also impacted by redistricting which is the redrawing of the geographic boundaries of U.S. Congressional Districts every 10 years after the completion of the U.S. Census. In both these cases, more competitive elections lead to more individual contributions, and the evidence suggests campaign contributions to different political campaigns are complements rather than substitutes. The available political information also affects potential voters and their decision to vote or not to vote. A public signal on candidate quality can decrease voter turnout preventing elections from revealing the private information of potential voters on candidate quality. Finally, political campaigns themselves react to the political environment spending more on advertising and fundraising when they are more significantly impacted by redistricting. By analyzing all these processes, both empirically and theoretically, we can reach a more complete view of how the interactions between political actors generate the important political outcomes that we see.

To my parents, for their love and support, and to my brother and sister, for always being there.

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CHAPTER 1

ARE POLITICAL CONTRIBUTIONS SUBSTITUTES OR COMPLEMENTS? THE IMPACT OF U.S. SENATE ELECTIONS ON INDIVIDUAL CONTRIBUTIONS TO THE U.S. HOUSE OF REPRESENTATIVES

1.1 Introduction

In democratic countries, individuals who make contributions to political campaigns often face overlapping campaigns for elected offices at different levels. This creates a strategic decision in how individual contributors should distribute their contributions among different candidates with potentially different levels of power and influence. An interesting question is whether a political contribution to one campaign is a substitute for a political contribution to another campaign or whether the presence of multiple overlapping campaigns increases political engagement resulting in more contributions. An example of this occurs in the United States where campaigns for the U.S. Senate necessarily overlap with campaigns for the U.S. House of Representatives. Since there are only 100 U.S. Senators while there 435 members in the U.S. House of Representatives, an individual Senator can usually wield more influence on political and policy outcomes than an individual member of the House of Representatives. Consequently, when a state has a seat up for election in the U.S. Senate, this may cause individual contributors to substitute toward contributing to a Senatorial campaign and away from contributing to a campaign for the House of Representatives because of the greater perceived importance of the Senate seat. On the other hand, the presence of an election for a Senate seat in a state may result in increased political engagement in that state resulting in more contributions to campaigns for both the U.S. Senate and the U.S. House of Representatives in that state.

Answering this question can help provide insights into the motivations of political contributors. If contributors view their contributions as increasing

the probability their preferred candidate wins the election or as a way to increase their access to or influence over a particular candidate, then they are likely to substitute their contributions toward a Senatorial campaign as a Senator is likely to have greater political and policy influence compared to a Representative in the U.S. House. However, if contributors view their contributions as expressions of their political beliefs or as enjoyment from participating in the political process, then they may contribute to both U.S. Senate and House of Representatives campaigns during a Senate election as a way to further express their political beliefs or as a way to increase their engagement with the political process. Answering this question can also provide answers about optimal fundraising strategies for candidates to the U.S. House of Representatives. The effectiveness of a dollar spent on fundraising efforts may be higher or lower in the presence of a Senate election depending on if political contributions are substitutes or complements. Furthermore, this can provide evidence for additional mechanisms through which a candidate at the top of the ballot in an election affects the political fortunes of downballot candidates. Understanding campaign finance and downballot effects leads to a better understanding of how different factors affect political outcomes that are important in democracies.

The evidence presented in this paper suggests that political contributions to different campaigns are more complementary than substitutes. The presence of a Senate election in a state increases political contributions made by individuals to campaigns for the U.S. House of Representatives. The top-of-the-ballot race seems important as the Senate effect is strongest in midterm election cycles and weaker in Presidential election cycles. Moreover, this effect is stronger when the incumbent Representative in the U.S. House faces a competitive election. This supports the supposition that the complementary effect is driven by an increase in political engagement. A competitive election for a U.S. House seat is when potential contributors would be presented with the best opportunities for engagement with the political process at both the Senate and House of Representatives level.

To analyze the question of whether political contributions are substitutes or complements, this paper is organized as follows. Section 1.2 provides a review of the existing literature on political contributions and the individuals who make them. Section 1.3 provides a description of the data on political contributions. Section 1.4 presents the empirical specifications along with

results and analysis. Finally, section 1.5 concludes.

1.2 Literature Review

Early research into campaign contributions focused on trying to link campaign contributions with votes on bills in Congress. However, the results have been mixed in terms of identifying a causal link between campaign contributions and votes. Ansolabehere et al. (2003) reviews this literature. Moreover, Ansolabehere et al. (2003) conclude that the evidence suggests individual contributors are primarily consumption motivated rather than investment motivated. Individual contributors make their contributions because they value civic involvement rather than specifically trying to influence the policies of the candidates or trying to increase the likelihood their preferred candidate wins the election.

More recent research has contributed to showing that political contributors tend to be wealthier, have higher incomes, are better educated, and are more likely to be racially White than non-contributors (James 2009). The contributor's ideology as well as the recipient's ideology has also been shown to be important Barber et al. 2017; (Ensley 2009; Hill and Huber 2017).

To further understand the motivations of individual contributors several papers have looked at the destinations of individual contributions in order to try to reverse engineer the factors that influence individual contributions. Francia et al. (2005) and Rhodes et al. (2018) categorize individual contributors into groups based on similar contribution patterns and then investigate the similarities within groups and the differences across groups.

Lowry (2015) examines how the political environment impacts individual contributions to campaigns. He finds that the more competitive federal elections there are in a district, the more contributions are made to federal election campaigns. This paper examines contribution data at the ZIP Code level and more directly tests whether political contributions are substitutes or complements across political campaigns.

Another aspect of political contributions is that they are typically solicited by campaigns. This has important implications as campaigns target individuals from whom they solicit contributions as well as inducing contributions to political campaigns (Grant and Rudolph 2002; Hassell and Monson 2014).

When multiple political campaigns are taking place concurrently, individuals may receive solicitations from multiple campaigns at the same time affecting their contribution decisions. This paper seeks to investigate the extent to which political contributions are substitutes between different political campaigns and complements among multiple political campaigns.

1.3 Data

The Federal Election Commission (FEC) requires political campaigns to report information on campaign contributions and campaign spending. This paper uses information on contributions to political campaigns for the U.S. House of Representatives from 2002-2010. The reason for this time period is to avoid potentially confounding effects from the decennial redistricting of Congressional Districts while including as many U.S. Senate elections as possible. For contribution transactions $200 and over by individuals, the FEC requires the campaign to report information on the contributor including the contribution amount for that transaction, the contributor's name, and the contributor's address. This allows for the identification of contributions at the ZIP Code level. However, for contribution transactions less than $200, campaigns are not required to report any transaction-specific information. Consequently, for contribution transactions less than $200, the location from where they originate and analysis of individual transaction amounts cannot be conducted. Therefore, analysis of the effect of U.S. Senate elections on campaign contributions at the ZIP Code level is limited to those where the transaction amount is $200 and over.

In order to control for demographic characteristics of ZIP Codes since these may impact campaign contributions, data from the decennial U.S. Census and the American Community Survey (ACS) are used. Demographic controls include population, population density, education attainment, racial composition, and other information. In order to control for the effect of income on campaign contributions and campaign spending strategies, data from the IRS at the ZIP Code level is used to construct the ZIP Code's average income.

Another important aspect of Congressional Districts is their partisan composition. The proportion of Republican Party leaning individuals compared

to the proportion of Democratic Party individuals in the districts can significantly impact campaign contributions and the spending strategies campaigns use to win elections. This paper uses the Cook Partisan Voting Index (PVI) to measure the partisan composition of Congressional Districts. The Cook PVI of a Congressional District is defined as the difference between the average margin between the Republican Party and Democratic Party vote share in the last two U.S. Presidential elections within the Congressional District and the average margin between the parties at the national level. This paper uses the convention that positive margins indicate results in favor of the Republican party while negative margins indicate results in favor of the Democratic party. Therefore, a Congressional District with a Cook PVI of $+5$ had a margin 5 percentage points more in favor of the Republican Party compared to the party's performance at national level averaged over that last two Presidential elections. A Congressional District with a Cook PVI of -7 had a margin 7 percentage points more in favor of the Democratic Party compared to the party's performance at the national level averaged over the last two Presidential elections.

To allow for a flexible specification of the effect of partisan composition, a Congressional District's Cook PVI is placed in a category depending on the whether the partisan composition is favorable to the incumbent representative or not. For example, the category $\mathrm{I}[0-5]$ indicates that the Cook PVI favors the incumbent representative by 0 to 5 percentage points while the category $\mathrm{O}[5-10]$ indicates that the Cook PVI opposes the incumbent representative by 5 to 10 percentage points. In the case of $\mathrm{O}[5-10]$, a Congressional District would be in this category if an incumbent Republican representative was in a district where the Cook PVI was in favor of the Democratic Party by 5 to 10 percentage points. The categories used for the analysis are $\mathrm{I}[0-5]$, $\mathrm{I}[5-10]$, $\mathrm{I}[10-15]$, $\mathrm{I}[15+]$, $\mathrm{O}[0-5]$, $\mathrm{O}[5-10]$, and $\mathrm{O}[10+]$.

To analyze individual campaign contributions, individual campaign contributions are first limited to contributions to political campaigns for the U.S. House of Representatives. These transactions are then aggregated to the ZIP Code level.

Table 1.1 presents summary statistics for individual campaign contributions at the ZIP Code level.

Table 1.1: Individual Contributions Summary Statistics 2001-2010

Variable	Number of Obs	Mean	Std. Dev.
Total ZIP Code Contri.	83,258	18,454	53,869.07
Number of ZIP Code Contri.	83,258	26.13	66.9437
Mean ZIP Code Contri.	83,258	612.10	328.2218
Senate Election	83,258	0.7	0.5109
No Incumbent	83,258	0.0375	0.1846
Average Income (2000 dollars)	83,258	46,167.30	36,011.92
Total ZIP Code Pop	83,258	15,583	15,405.94
Pop Density (per sq. mile)	83,258	1,922.88	5,866.149
Percent College Grads	83,258	0.1579	0.0873
Percent Male	83,258	0.4948	0.0318
Percent White	83,258	0.8142	0.2015
Percent Age 55+	83,258	0.2611	0.0846
Percent Married	83,258	0.5422	0.1074
Election Cycle 2002	16,165		
Election Cycle 2004	16,684		
Election Cycle 2006	16,981		
Election Cycle 2008	16,651		
Election Cycle 2010	16,777		

The reason the *SenateElection* variable is close to 2/3 is because of the structure of U.S. Senate elections, the number of Senate election cycles in the sample, and the presence of some special U.S. Senate elections. All these components are key to the empirical identification strategy.

Table 1.2 present the number of ZIP Codes in each Cook PVI category for a Congressional District in the 2001-2010 period of analysis.

Table 1.2: Cook PVI Category Summary Statistics 2001-2010

Cook PVI Category	Number of Obs
$I[0-5]$	14,685
$I[5-10]$	16,909
$I[10-15]$	11,349
I[15+]	21,180
$O[0-5]$	9,563
$O[5-10]$	4,061
O[10+]	5,538

1.4 Empirical Specifications and Results

U.S. Senators are elected to six-year terms, and each state has two Senators representing it. However, not all Senate seats are up for election at once. Approximately, a third of the Senate seats are up for election every two years. Moreover, a particular state usually only has one Senate seat up for election at a time. The timing of when particular Senate seats are up for election is largely exogenous being determined by when a state entered the Union and random chance for how its seats were allocated across two-year election cycles. An additional factor in the timing of U.S. Senate elections is the presence of special U.S. Senate elections carried out when a seat becomes vacant in a non-election year for that seat. As a result of special elections, a state may have Senate election in a what should have been an off year for the state or may even have two Senate elections in one year. After a special election, the winning candidate serves the remainder of the existing Senate term for that seat until the seat is up for election again according to the usual schedule. The exogenous election schedule for Senate seats combined with a few special elections provide the identification for how the presence of a Senate election impacts individual campaign contributions to the U.S. House of Representatives.

The model is shown below.

$$y_{it} = \alpha_0 + \alpha_1 * SenateElection_{is} + X_{it}\beta + \mu_i + \delta_t + \epsilon_{it} \tag{1.1}$$

The dependent variable is calculated for each ZIP Code, i, in each election cycle, t. The coefficient α_1 is the effect of a Senate election in state s on the political contribution outcome. The specification controls for demographic characteristics of the ZIP Codes, X_{it}, and contains ZIP Code fixed effects, μ_i, and election cycle fixed effects, δ_t. Standard errors are clustered at the ZIP Code level. Table 1.3 presents results on the effects of a Senate election on individual campaign contributions to the U.S. House of Representatives.

The results show an increase in total political contributions from a ZIP Code, the number of contributions and the mean contribution. The presence of a Senate election increases the total political contributions from a ZIP Code by 1.8%. The number of contributions increases by 1.09% while the mean contribution increases by 0.74%. This suggests that the presence of a Senate

Table 1.3: Individual Contri. Results 2001-2010

	ln(Tot. Contri.)	ln(Count)	ln(Mean)
Senate Election	0.01831	0.0109	0.0074
	(0.0055)***	(0.0043)**	(0.0027)***
ln(Pop)	0.6156	0.597	0.01879
	(0.0572)***	(0.0456)***	(0.0280)
ln(Pop Density)	0.0538	0.0231	0.0307
	(0.0408)	(0.0322)	(0.0211)
ln(Avg. Income)	0.3081	0.1929	0.116
	(0.0399)***	(0.0323)***	(0.0197)***
Per. College Grads	1.2583	1.2821	-0.0241
	(0.3123)***	(0.2436)***	(0.1613)
Per. Male	-0.1512	0.163	-0.3145
	(0.4348)	(0.3428)	(0.2203)
Per. White	0.2601	0.139	0.1209
	(0.1630)	(0.1311)	(0.0792)
Per. Age 55+	1.0993	1.1476	-0.0482
	(0.2437)***	(0.1899)***	(0.1237)
Per. Married	0.7168	0.5764	0.14
	(0.2098)***	(0.1620)***	(0.1060)
Election Cycle FE	Yes	Yes	Yes
ZIP Code FE	Yes	Yes	Yes
Number of Obs	83,258	83,258	83,258

*** indicates $p < 0.01$, ** indicates $p < 0.05$, and * indicates $p < 0.1$

election increases political engagement resulting in increased contributions to campaigns for the U.S. House of Representatives. Furthermore, the effect of a Senate election is greater on the number of contributors compared to the mean contribution indicating that most of the effect is through new contributors rather than existing contributors giving more. This suggests that incumbents in the U.S. House of Representatives could use election cycles where there's a Senate seat up for election in their state to build up their campaign's cash reserves for election cycles when there isn't a Senate seat up for election in their state. This evidence also contributes to the existing literature that finds individual political contributions are primarily motivated by consumption of political experiences rather than investments in political candidates with an expected return.

A natural extension to these results is to see if the effect varies with the partisan composition of the Congressional District. Close elections elicit more political contributions so a Congressional District with a Cook PVI near zero would be expected to be competitive and consequently, the complementary effect of Senate elections could be stronger. Table 1.4 presents results when the a district's Cook PVI category is interacted with the Senate election indicator.

In comparison to a Congressional District that is competitive, but slightly leans towards the incumbent, the effect of a Senate election in noncompetitive districts where the incumbent has a significant advantage is much smaller. The same holds true in districts where the incumbent is at a disadvantage relative to the partisan lean of the district. These effects are primarily driven by changes in the number of contributions rather than changes in the average size of a contribution.

These results provide more evidence for the complementary effect of Senate elections. The complementary effect is strongest when the incumbent faces a competitive election, but still has the advantage. Since, by definition, the incumbent has won a previous election, this provides strong evidence that the complementary effect of Senate elections is being driven by increases in political engagement. Political engagement should be high when an incumbent representative is favored, but still faces a competitive election as this will motivate the incumbent's supporters. If the incumbent already has a significant advantage or if the incumbent is already likely to lose, then the incumbent's supporters are less likely to be politically engaged and hence,

Table 1.4: Interaction with the Cook PVI Category 2001-2010

	ln(Tot. Contri.)	ln(Count)	ln(Mean)
Senate Election	0.0541	0.0385	0.0157
	(0.0148)***	(0.0117)**	(0.0073)***
Senate*CookPVICat			
$I[0-5]$	omitted	omitted	omitted
$I[5-10]$	0.0239	0.0314	-0.0075
	(0.0200)	(0.0160)*	(0.0099)
$I[10-15]$	-0.0586	-0.0427	-0.0159
	(0.0222)***	(0.0178)**	(0.0110)
I[15+]	-0.0868	-0.0679	-0.0189
	(0.0185)***	(0.0146)***	(0.0093)**
$O[0-5]$	-0.0810	-0.0672	-0.0138
	(0.0244)***	(0.0196)***	(0.0120)
$O[5-10]$	-0.1153	-0.1068	-0.0085
	(0.0315)***	(0.0255)***	(0.0154)
O[10+]	-0.0460	-0.0572	0.0112
	(0.0289)	(0.0224)**	(0.0145)
Election Cycle FE	Yes	Yes	Yes
ZIP Code FE	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes
Number of Obs	83,258	83,258	83,258

*** indicates $p < 0.01$, ** indicates $p < 0.05$, and * indicates $p < 0.1$

less likely to engage in activities such as campaign contributions. Senate elections then increase political engagement when supporters are most receptive to being activated politically.

1.5 Conclusion

Important top-of-the-ballot races can create greater levels of political engagement that benefit downballot candidates. This paper finds that the presence of a Senate election in a state increases political contributions made by individuals to campaigns for the U.S. House of Representatives. This increase is primarily driven by an increase in the number of contributions, although there is also an increase in the size of the average contribution. Which race is the top-of-the-ballot race is also important. The Senate effect is strongest in midterm election cycles and weaker in Presidential election cycles. Furthermore, this effect is stronger when potential contributors are more receptive to political engagement such as when the incumbent Representative faces a competitive, but still favorable political environment. The evidence strengthens the conclusion that individual contributions are driven primarily by a consumption motivation rather than a strategic incentive.

The results further demonstrate another mechanism through which downballot candidates are affected by elections for offices at higher levels of government. The political environment created by these elections for higher level government positions is often beyond the control of the downballot candidates. However, downballot candidates can and do change their campaign strategies in response to factors affecting the top-of-the-ballot races. Given that positions at lower levels of government can still have a significant impact on the daily lives of people within their political districts, understanding the election dynamics of races for these lower level positions is vital for understanding governmental outcomes and the impact of the political process on people's lives.

CHAPTER 2

PUBLIC INFORMATION AND VOTER TURNOUT

2.1 Introduction

Before an election, potential voters receive information about the candidates from a plethora of sources. Some sources are available to everyone such as national media and endorsements by well-known politicians. Other sources are more private in nature such as local media, conversations with friends and family, personal interactions with candidates at campaign events, and private research on the candidates. Potential voters must combine the information from these different sources in order to make decisions on whether to vote in the election or not, and if they decide to vote, for whom to vote.

A particularly interesting case is when public information seems to contradict the private information a potential voter has. In this case, the potential voter has to decide which is more likely to be correct. If a potential voter is sufficiently worried about being misinformed, the individual may opt to abstain from voting.

One reason to have an election, however, is to aggregate the private information voters have. Public information may affect the ability of elections to aggregate private information by affecting voter turnout. In order to examine this possibility, I analyze a model of an information aggregating election allowing voters to abstain in response to a public signal on candidate quality before the election takes place. I find that the existence of a public signal can have a negative impact on how potential voters use their private information. In particular, potential voters may vote according to the public signal regardless of their own private information or may abstain when their private information contradicts public information. This paper examines how parameters such as the quality of the public information, the quality of the private information, and the expected number of potential voters affects voter

behavior. In this paper, section 2.2 presents a review of the existing literature on public information, information aggregation, and voter abstention. Section 2.3 provides the set up for the model, and section 2.4 presents analysis of voter behavior. Some results from the model's equilibrium are analyzed in section 2.5 which contains some numerical simulations of the model. Finally, section 2.6 concludes.

2.2 Literature Review

One source of public information are newspapers especially when they endorse particular candidates. Previous literature has examined endorsements from the perspective of determining how they impact voters' beliefs about political candidates. While there is evidence that voters try to filter out perceived bias in endorsements, nonetheless, there is substantial evidence that endorsements influence voting behavior. Kahn and Kenney (2002) examine newspaper endorsements in U.S. Senatorial elections between 1988 and 1992 and find that voters express more positive feelings toward the endorsed candidate. Ladd and Lenz (2009) use a switch in the pattern of endorsements by newspapers in the 1997 general U.K. election to identify the effect of endorsements on voters. In the 1997 general election in the U.K., several newspaper which had previously supported the Conservative Party switched to endorsing the Labour Party. Ladd and Lenz (2009) find that this switch in endorsements caused a substantial number of voters to also switch their support from the Conservative Party to the Labour Party.

Chiang and Knight (2011) estimate a model using data from newspaper endorsements and voter surveys to determine how voters incorporate information from endorsements from biased sources. Their estimates show that voters are more influence by more credible endorsements such as when a right-leaning paper endorses the left candidate. Other empirical and experimental evidence comes from McDermott (2006). That paper uses endorsements of political candidates by labor unions. Using survey data and hypothetical situations posed to voters in an experiment, McDermott (2006) finds evidence that endorsements by labor unions provided information to both left-leaning and right-leaning voters.

Existing theoretical research into endorsements suggests that biased en-

dorsers or prohibiting endorsements in the first place can be beneficial to voters. Calvert (1985) examines a utility maximizing voter who chooses between two alternatives. The voter can seek the advice from a single source that can endorse one alternative, neither alternative, or both alternatives. In some cases, the voter may optimally choose a source with a similar bias to the voter since if the source endorses the opposite alternative, this conveys significant information to the voter. On the other hand, prohibiting endorsements may be welfare maximizing if the political candidates change their policy platforms in order to gain endorsements from entities with their own policy interests (Grossman and Helpman 1999; Chakraborty and Ghosh 2016). Here, the benefit from the informational content of the endorsements is outweighed by the policy distortions caused the political candidates competing for the endorsements.

Another area of related literature looks at how voter abstention affects the information aggregating properties of elections. When all voters vote sincerely, the Condorcet Jury Theorem shows that elections tend to pick the correct candidate from the information that voters have. However, when abstention is allowed, it is no longer clear that the correct candidate is more likely to win. Information on who the correct candidate is may be lost from abstaining voters. Several papers show that rational voters will abstain in equilibrium in order to defer to more informed voters (Austen-Smith and Banks 1996; Feddersen and Pesendorfer 1996; Feddersen and Pesendorfer 1999; Krishna and Morgan 2012; McMurray 2013). These papers, though, also show that elections are still able to aggregate the information voters have and more often than not elect the correct candidate.

This paper differs from previous research by incorporating a public signal into a model of an information aggregating election to determine the effect of public information on voter turnout.

2.3 Model Setup

There are two possible states of the world: ω_A and ω_B. In ω_A, candidate A is a higher quality candidate or a more competent candidate than candidate B. More generally, candidate A can be said to have a higher valence than candidate B in state ω_A. Conversely, in ω_B, candidate B is the better can-

didate. The probability of ω_A and ω_B, $\mathrm{P}(\omega_A)$ and $\mathrm{P}(\omega_B)$ respectively, are assumed to be equal to 1/2.

Before the election takes place, a public signal is revealed which contains imperfect information about which candidate is the higher quality candidate. Specifically, the public signal is w_A in state ω_A with probability q_0 and signal w_B in state ω_A with probability $1 - q_0$. With $q_0 > 1/2$, the signal provides some information about the state of the world. The probability of receiving signal w_B in state ω_B and signal w_A in state ω_B are also q_0 and $1 - q_0$, respectively. All potential voters see the same public signal.

To allow for voter abstention, the number of potential voters is uncertain. The number of potential voters in an election is Poisson distributed with mean n. Potential voters also receive private signals about the quality of the candidates. Voters receive signal s_A in state ω_A with probability q_1 and signal s_B in state ω_A with probability $1 - q_1$. The signal is informative under the assumption that $q_1 > 1/2$. The probability of receiving signal s_B in state ω_B and signal s_A in state ω_B are also q_1 and $1 - q_1$, respectively. Voters can vote for candidate A, vote for candidate B, or abstain based on the information provided by the public signal and the private signal they received.

The candidate that receives a majority of the votes wins the election. In the event of a tie, each candidate has a 50% probability of winning.

Since voters receive more utility from the election of the higher quality candidate compared to the election of the lower quality candidate, the voter's decision on which action to take depends on his or her beliefs about the state of the world. Let $\mathrm{U}(A, \omega_A)$ be the utility the voter receives when candidate A is elected in state ω_A. Then $\mathrm{U}(A, \omega_A) > \mathrm{U}(B, \omega_A)$. Moreover, the action the voter takes only changes the outcome of the election when that voter is pivotal. If the voter chooses to vote for candidate A, then the voter is pivotal when either the election is tied between candidate A and candidate B or when candidate A is down by one vote. Therefore, the expected utility of voting for candidate A is given by

$$
\begin{aligned}
&\mathrm{EU}(votingA) = \\
&\mathrm{P}(m_1^A = 0|\omega_A, \Omega)\,\mathrm{P}(\omega_A|\Omega)\,\mathrm{U}(A, \omega_A) + \mathrm{P}(m_1^A = 0|\omega_B, \Omega)\,\mathrm{P}(\omega_B|\Omega)\,\mathrm{U}(A, \omega_B) \\
&+ (1/2)\,\mathrm{P}(m_1^A = -1|\omega_A, \Omega)\,\mathrm{P}(\omega_A|\Omega)\,\mathrm{U}(A, \omega_A) + (1/2)\,\mathrm{P}(m_1^A = -1|\omega_A, \Omega)\,\mathrm{P}(\omega_A|\Omega)\,\mathrm{U}(B, \omega_A) \\
&+ (1/2)\,\mathrm{P}(m_1^A = -1|\omega_B, \Omega)\,\mathrm{P}(\omega_B|\Omega)\,\mathrm{U}(A, \omega_B) + (1/2)\,\mathrm{P}(m_1^A = -1|\omega_B, \Omega)\,\mathrm{P}(\omega_B|\Omega)\,\mathrm{U}(B, \omega_B)
\end{aligned} \tag{2.1}
$$

where m_1^A is the vote margin for candidate A, $\Omega = \{s_A, w_i\}$, and w_i is the public signal.

Then a voter's utility is given by

$$\mathrm{U} = \max\{\mathrm{EU}(votingA), \mathrm{EU}(votingB), \mathrm{EU}(abstaining)\} \tag{2.2}$$

The equilibrium concept in this paper is the Perfect Bayesian Equilibrium. Based on their private signal and the public signal, voters are Bayesian in updating their beliefs. Voters' expected utility is determined by the probability the higher quality candidate is elected versus the lower quality candidate.

2.4 Analysis of the Model

The strategies used by potential voters depend on a comparison of the expected utilities from voting for candidate A, voting for candidate B, and abstaining. The problem is symmetric between potential voters with signal s_A and potential voters with signal s_B so for conciseness only the analysis for those with signal s_A is presented. The problem can be further simplified by recognizing the fact that the action that maximizes a potential voter's expected utility depends on the difference between having the higher quality candidate in office compared to the lower quality candidate for a given state of the world. Therefore, the problem can be expressed in terms of this difference in utility. Under the assumption that the candidates are ex ante symmetric, this difference is the same whether candidate A or candidate B is the higher quality candidate. Let this difference in utility be denoted by u. To analyze the problem, first consider the difference between the expected utility of voting for candidate A and the expected utility of abstaining for a potential voter who receives signal s_A. This difference is given by

$$\begin{aligned}
&\mathrm{EU}(votingA) - \mathrm{EU}(abstaining) = \\
&(1/2)\,\mathrm{P}(m_1^A = 0|\omega_A, \Omega)\,\mathrm{P}(\omega_A|\Omega)u - (1/2)\,\mathrm{P}(m_1^A = 0|\omega_B, \Omega)\,\mathrm{P}(\omega_B|\Omega)u \\
&+ (1/2)\,\mathrm{P}(m_1^A = -1|\omega_A, \Omega)\,\mathrm{P}(\omega_A|\Omega)u - (1/2)\,\mathrm{P}(m_1^A = -1|\omega_B, \Omega)\,\mathrm{P}(\omega_B|\Omega)u
\end{aligned} \tag{2.3}$$

In cases where the potential voter is not pivotal in determining the outcome of the election by either breaking a tie in favor of candidate A or creating a tie when candidate A is down by one vote, the expected utility from both actions is the same. Consequently, these terms are irrelevant for the potential voter's decision. The terms that are consequential are from when the potential voter is pivotal for the outcome of the election so that different actions result in different levels of utility.

The potential voter with signal s_A will vote for candidate A over abstaining if the difference between the expected utilities from these actions is positive. Derived from equation (2.3), the condition under which this happens is given by

$$\frac{\mathrm{P}(\omega_A|\Omega)}{\mathrm{P}(\omega_B|\Omega)} \geq \frac{\mathrm{P}(m_1^A = 0|\omega_B, \Omega) + \mathrm{P}(m_1^A = -1|\omega_B, \Omega)}{\mathrm{P}(m_1^A = 0|\omega_A, \Omega) + \mathrm{P}(m_1^A = -1|\omega_A, \Omega)} \tag{2.4}$$

Intuitively, when the voter's beliefs in the quality of candidate A are higher than the probability of mistakenly voting for the lower quality candidate, the voter will vote over abstaining. Beliefs on the state are given by Bayesian updating so

$$\mathrm{P}(\omega_A|\Omega) = \frac{\mathrm{P}(s_A|\omega_A)\,\mathrm{P}(w_i|\omega_A)}{\mathrm{P}(s_A|\omega_A)\,\mathrm{P}(w_i|\omega_A) + \mathrm{P}(s_A|\omega_A)\,\mathrm{P}(w_i|\omega_A)} \tag{2.5}$$

Since the population of eligible voters is Poisson distributed, the vote margin for candidate A follows the Skellam distribution, which is the distribution for the difference between two Poisson distributions.

$$\mathrm{P}(m_1^A = k|\omega_A) = \mathrm{e}^{-n}\left(\frac{q_1}{1-q_1}\right)^{\frac{k}{2}} \mathrm{I}_k\left(2n\sqrt{(1-q_1)q_1}\right) \tag{2.6}$$

where I_k is the modified Bessel function of the first kind.

The voters' beliefs are determined by their private signals, the public signal, and the quality of both the private and public signals. Since voters use Bayesian updating, the information provided by public signal is determined

by the ratio of a correct signal to an incorrect signal. This is given by

$$\left(\frac{q_0}{1-q_0}\right) \tag{2.7}$$

To simplify the analysis of the potential voter's decision, define m_0^i to be a real number such that

$$\left(\frac{q_0}{1-q_0}\right) = \left(\frac{q_1}{1-q_1}\right)^{m_0^i} \tag{2.8}$$

The information provided by the public signal is expressed in terms equivalent to the information provided by a potential voter's private signal. Define m_0^A as the informationally equivalent margin of votes in favor of candidate A provided by the public signal. This can be interpreted as an inherent advantage in the margin of votes that candidate A has before the election takes place although whether a voter is pivotal in the election is still determined by the actual number of votes for candidate A and for candidate B.

After using Bayesian updating, a voter with signal s_A will vote for candidate A over abstaining if

$$\left(\frac{q_1}{1-q_1}\right)^{m_0^A+1} \geq \frac{\mathrm{P}(m_1^A = 0|\omega_B, \Omega) + \mathrm{P}(m_1^A = -1|\omega_B, \Omega)}{\mathrm{P}(m_1^A = 0|\omega_A, \Omega) + \mathrm{P}(m_1^A = -1|\omega_A, \Omega)} \tag{2.9}$$

The probability that the voter is pivotal in the election depends on the extent to which other voters abstain from voting. This abstention not only changes the probability that the voter is pivotal, it also changes the information contained in being the pivotal voter. If the election is tied when voters with signal s_A abstain at some rate r_A, then there are s_A signals that were received by potential voters, but are not reflected in the vote margin. On the other hand, this reduction in signal s_A voters is constant across states of the world so even in the state where candidate B is the higher quality candidate, there are missing s_A voters. Moreover, in response to the abstention rate of s_A voters, voters with signal s_B may, under certain conditions, find it optimal to also abstain with some rate r_B. The relative abstention rates between the two types of voters changes the probability a particular voter is pivotal and changes the information contained in the event the voter is pivotal.

Accounting for the possibility of abstention for both types of voters, a voter

with signal s_A chooses to vote for candidate A over abstaining when

$$1 \geq \left(\frac{1-q_1}{q_1}\right)^{m_0^A+1} \frac{\mathrm{e}^{-n_B}\,\mathrm{I}_0\left(z\right) + \mathrm{e}^{-n_B}\left(\frac{q_1(1-r_B)}{(1-q_1)(1-r_A)}\right)^{\frac{1}{2}}\mathrm{I}_1\left(z\right)}{\mathrm{e}^{-n_A}\,\mathrm{I}_0\left(z\right) + \mathrm{e}^{-n_A}\left(\frac{(1-q_1)(1-r_B)}{q_1(1-r_A)}\right)^{\frac{1}{2}}\mathrm{I}_1\left(z\right)} \tag{2.10}$$

where $n_B = n(q_1(1-r_B)+(1-q_1)(1-r_A))$, $n_A = n((1-q_1)(1-r_B)+q_1(1-r_A))$, and $z = 2n\sqrt{(1-q_1)q_1(1-r_A)}$. Similarly, for voters with signal s_B, they will vote for candidate B over abstaining when

$$1 \geq \left(\frac{1-q_1}{q_1}\right)^{-m_0^A+1} \frac{\mathrm{e}^{-n_A}\,\mathrm{I}_0\left(z\right) + \mathrm{e}^{-n_A}\left(\frac{q_1(1-r_A)}{(1-q_1)(1-r_B)}\right)^{\frac{1}{2}}\mathrm{I}_1\left(z\right)}{\mathrm{e}^{-n_B}\,\mathrm{I}_0\left(z\right) + \mathrm{e}^{-n_B}\left(\frac{(1-q_1)(1-r_A)}{q_1(1-r_B)}\right)^{\frac{1}{2}}\mathrm{I}_1\left(z\right)} \tag{2.11}$$

where again $n_B = n(q_1(1-r_B)+(1-q_1)(1-r_A))$, $n_A = n((1-q_1)(1-r_B)+q_1(1-r_A))$, and $z = 2n\sqrt{(1-q_1)q_1(1-r_A)}$. These two equations define an equilibrium in this election.

The utility of a signal s_A voter is then given by

$$\max\{u^{s_A}, 0\} \tag{2.12}$$

where

$$\begin{aligned} & u^{s_A} = \\ & \mathrm{e}^{-n_A}\,\mathrm{I}_0\left(z\right) + \mathrm{e}^{-n_A}\left(\frac{(1-q_1)(1-r_B)}{q_1(1-r_A)}\right)^{\frac{1}{2}}\mathrm{I}_1\left(z\right) \\ & -\left(\frac{1-q_1}{q_1}\right)^{m_0^A+1}\left[\mathrm{e}^{-n_B}\,\mathrm{I}_0\left(z\right) + \mathrm{e}^{-n_B}\left(\frac{q_1(1-r_B)}{(1-q_1)(1-r_A)}\right)^{\frac{1}{2}}\mathrm{I}_1\left(z\right)\right] \end{aligned} \tag{2.13}$$

Equation (2.13) is derived from the equilibrium condition for signal s_A voters in equation (2.10). The utility of a signal s_B voter has a similar expression.

With utility functions of the voters defined and the equilibrium conditions derived, it can be shown that an equilibrium in the election exists for different values of the expected voter population n and different results when the public signal is different m_0^A.

Proposition 1. *There exists an equilibrium in this game.*

Proof. See Appendix A.1 for proof. □

2.5 Equilibrium Results

The character of the equilibrium depends significantly on the values of the parameters in the model. The effect of the public signal can reduce the likelihood the higher quality candidate wins the election. When $m_0^A \leq -1$, then all potential voters have a dominant strategy to vote for candidate B regardless of their private signal. This is an equilibrium because if everyone always votes for candidate B, then the only time a potential voter is pivotal is if either no other potential voters vote or if only one other potential voter votes. In either case, the information from the public signal outweighs the private information from the potential voter's signal so the dominant strategy for the potential voter is to vote for candidate B.

On the other hand, when $-1 < m_0^A < 0$, an equilibrium where potential voters with signal s_B always vote and potential voters with signal s_A abstain at some rate r_A^* can exist. Some potential voters with signal s_A abstain in equilibrium to reduce the likelihood that candidate A wins the election when candidate B is the higher quality candidate. In this type of equilibrium, the value of m_0^A affects the abstention rate r_A^*.

Proposition 2. *For n sufficiently large, as the quality of the public signal increases as measured by m_0^A decreasing, the equilibrium abstention rate, r_A^*, for potential voters with signal s_A increases.*

Proof. See Appendix A.2 for proof.

□

Intuitively, as the public signal becomes less informative due to lower quality information, potential voters will rely more on their private signal and vote according to that signal. Figure 2.1 shows this relationship. In the figure, as the quality of the public signal increases, the abstention rate increases because potential voters become more concerned that their private signal is wrong. From the perspective of potential voters, the increase in the quality of the public signal is equivalent to the margin increasing for the other

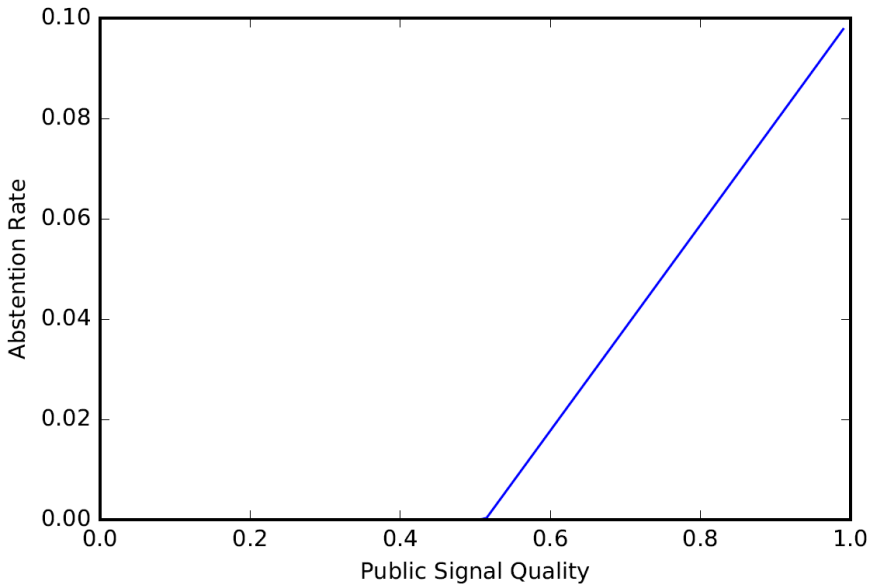

Figure 2.1: The Effect of Public Signal Quality on the Equilibrium Abstention Rate

candidate. This margin can have a decimal value depending on the quality of the public signal relative to the quality of the potential voter's private signal. When the margin is close to 0, potential voters view the public signal as uninformative and vote according to their private signal resulting in no abstention. As the margin moves away from 0 because the public signal becomes more informative, potential voters start to abstain because of their belief that their private signal may be incorrect. At this point, as the quality of the public signal increases, the abstention rate increases because potential voters believe their vote is more likely to result in mistakenly electing the lower quality candidate. The values used for this numerical simulation are $n = 10$ and $q_1 = 0.52$.

A potential implication of this result is that if potential voters trust media sources less and as a result, view public information from media sources as less informative, they may be more willing to vote even if they are no more informed than they were before. In this case, potential voters trust their private signals more making them believe their vote is less likely to result in the incorrect candidate winning the election. Perhaps counter intuitively, this suggests as distrust in the media increases voter turnout rates may actually increase and not decrease.

The effect of other parameters of the model on voter abstention rates are

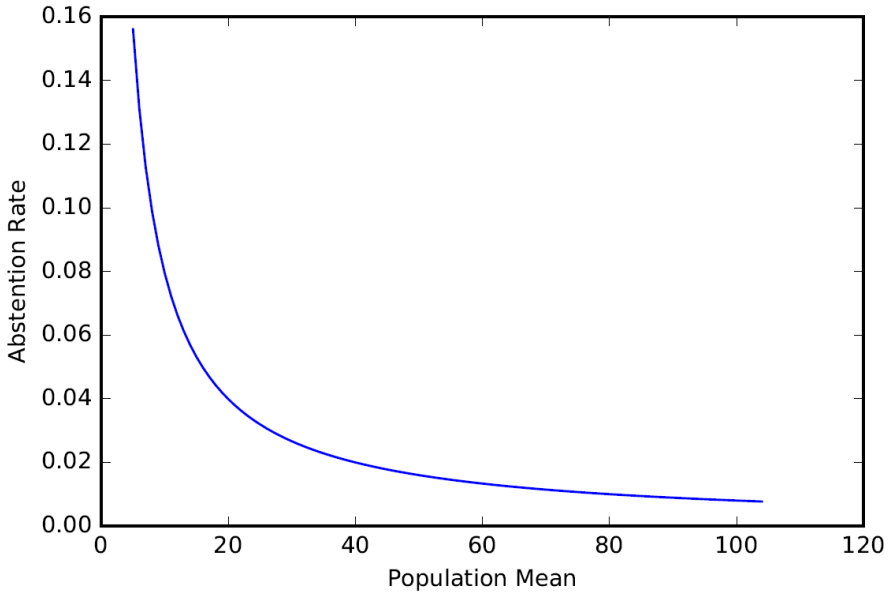

Figure 2.2: The Effect of Population on the Equilibrium Abstention Rate

less clear as they affect the not only the probability that a potential voter votes for the correct candidate, but also the probability that the voter is pivotal. In order to analyze the effect of the population mean n or the signal quality q_1 on the abstention rate in this equilibrium, numerical simulations are used. The baseline parameters for the simulation are $m_0^A = -0.9$, $n = 10$, and $q_1 = 0.52$ which corresponds to a small, relatively close election with moderately informed voters.

Figure 2.2 shows that as the population mean increases, the abstention rate of signal s_A voters decreases. This is because under these parameters with higher turnout more likely, signal s_A voters are more willing to vote since the chance of voting incorrectly and changing the outcome of the election is smaller. These results suggest a contributing factor behind lower voter turnout in local and state elections compared to national elections is abstention among potential voters who are concerned about casting a mistaken pivotal vote because their private signals conflict with the public signal. If the individual voter is uncertain about the information he or she has, then casting an incorrect vote is more costly when there are fewer other potential voters so that an individual vote has a higher probability of influencing the election. Therefore, the optimal strategy can be to abstain even when the potential voter is no less informed than an other potential voter.

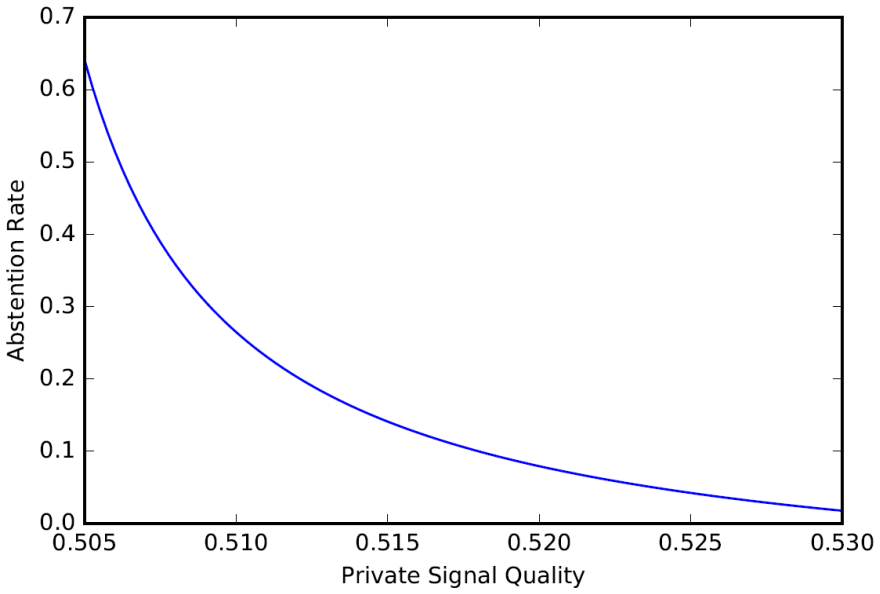

Figure 2.3: The Effect of Signal Quality on the Equilibrium Abstention Rate

The quality of private signals received by potential voters also has a significant impact on the abstention rate of potential voters. Figure 2.3 shows that as the quality of potential voters' private signals increases holding the quality of the public signal constant, the abstention rate of signal s_A voters decreases. As potential voters' quality of information increases, potential voters believe their vote is less likely to be a mistake regardless of what the public signal says. Therefore, signal s_A voters are more willing to vote. This suggests electorates where potential voters interact more directly with candidates will have higher voter turnout rates because the quality of their private signal is presumably higher. Moreover, to the extent that the public signal decreases voter turnout, a way combat this effect is to better educate potential voters to seek their own high quality information. This reduces the concern of potential voters that their information is incorrect making them more likely to vote.

The results of this model suggest that public information can negatively impact the quality of the candidate that wins the election by causing informed potential voters to abstain. This is less of a problem when potential voters view the public signal as less informative since abstention rates are lower. Consequently, the election aggregates more information from voters trust public information less. The numerical simulations also suggest that elections

with larger electorates and electorates where potential voters have better private information should see higher participation rates. In these cases, the higher quality candidate should more often win the election. While voter turnout rates depend on a multitude of factors, public information can have an impact on voter turnout rates and affect the election through multiple channels.

2.6 Conclusion

Given the importance of national sources of information for elections, this paper analyzes how that public information affects the decisions of potential voters. While having a public signal may provide potential voters with more information with which to make their decisions, it can have adverse impacts on voter behavior because of strategic considerations by these individuals. If a potential voter's private information conflicts with the public information, the voter may ignore his or her own information or choose to strategically abstain in order to avoid casting what he or she believes to be an incorrect vote. Since the public signal is imperfectly informative, this can reduce the effectiveness with which an election is able to aggregate voter information.

The results of this paper suggest that in environments where potential voters may abstain, having substantial amounts of public information can reduce the probability of electing a high quality candidate. The ability to reduce public information may not be feasible in many cases especially when there is no single authority that can exercise this type of control, but the negative effect of public information is smaller in cases where the electorate is larger and when potential voters have higher quality private signals. In cases where public information has a substantial impact on the election, promoting more direct channels between candidates and potential voters may help to increase people's quality of information and increase voter turnout through the mechanisms presented in this paper. Although many factors affect voter turnout rates and public information may have significant direct impacts on elections, public information can also affect elections through voter turnout and be a contributing factor to low voter turnout rates.

CHAPTER 3

POLITICAL CONTRIBUTIONS, CAMPAIGN SPENDING, AND REDISTRICTING

3.1 Introduction

In the U.S., the process to redraw Congressional Districts for the U.S. House of Representatives takes place every 10 years after the U.S. Census. This redistricting process can be highly disruptive for political campaign contributors as well as the political candidates running for office. Potential campaign contributors may be placed in a Congressional District with a different incumbent compared to before, and political campaigns may decide they need to respond to the changes to their constituents in order to win their race. Given the stakes involved with the control of the U.S. House of Representatives, understanding how campaign contributors and political campaigns respond to the redistricting process is critical to understanding U.S. politics.

The redistricting process in the U.S. is the response of the U.S. Constitution to changes in the population of the U.S. The decennial U.S. Census measures these changes. Some areas of the U.S. experience higher population growth rates compared to other areas with slower population growth rates or even negative population growth rates. As a result, states in the U.S. change with respect to the fraction of the U.S. population within their borders. This necessitates a reapportionment of the number of representatives from each state in the U.S. House of Representatives. States whose fraction of the U.S. population fall may lose Representatives in Congress while those states that increase their faction of the U.S. population may gain representatives. Either way, states redraw the Congressional Districts within their boundaries in response to the number of Congressional Representatives assigned to them by the rules in the U.S. Constitution.

The importance of money in U.S. politics has been pontificated by academics and pundits alike. Contributions to political campaigns are tracked

and analyzed to look for undue influence or for better understanding of the electorate. Spending by political campaigns is analyzed to understand the priorities of the candidates and to see if they are successful in persuading people to vote for them. This paper investigates the intersection between political contributions, campaign spending, and the redistricting process in order to provide insights into the U.S. political process. Using the redistricting process after the 2000 and 2010 U.S. Censuses, this paper analyzes how contribution patterns by individuals change as ZIP Codes are drawn into new Congressional Districts. Furthermore, this paper examines how campaign spending strategies change in response to new Congressional Districts analyzing campaign spending on fundraising activities and advertising.

Congressional Districts that are in more competitive Cook PVI categories after redistricting are found to have increased individual contributions. This effect is both on the extensive margin with more contributions and on the intensive margin with a higher average contribution. Moreover, individuals contributing to the challenger respond even when the incumbent's advantage remains substantial. This contrasts with individuals contributing to incumbents whose responses are significantly only when the incumbent faces a competitive election. Furthermore, this paper also finds that ZIP Codes that move to new Congressional Districts contribute more. Political campaigns respond to changes in their candidates' constituents by increasing campaign spending on fundraising and advertising which may in part explain why ZIP Codes that move to new Congressional Districts contribute more. However, these effects are only significant in the election cycle immediately following the redrawing of Congressional boundaries suggesting that both contributors and campaigns adapt quickly to the new political environment.

To explore the consequences of redistricting further, this paper is organized into the following sections. Section 3.2 reviews the existing literature on political contributions and the effects of redistricting. Section 3.3 provides a description of the data used to analyze individual campaign contributions and campaign spending strategies. In section 3.4, the empirical specifications are presented along with the results and analysis. Section 3.5 concludes.

3.2 Literature Review

Early research into campaign contributions focused on trying to link campaign contributions with votes on bills in Congress. However, the results have been mixed in terms of identifying a causal link between campaign contributions and votes. Ansolabehere et al. (2003) reviews this literature. Moreover, Ansolabehere et al. (2003) conclude that the evidence suggests individual contributors are primarily consumption motivated rather than investment motivated. Individual contributors make their contributions because they value civic involvement rather than specifically trying to influence the policies of the candidates or trying to increase the likelihood their preferred candidate wins the election.

The redistricting process changes the relationship between candidates for the U.S. House of Representatives and potential contributors. Various studies have examined how this relationship changes after redistricting and its effect on electoral outcomes. McKee (2008) finds that potential voters are less likely to be able to recall the incumbent representative in their district in the first election cycle after they have changed districts as a result of redistricting compared to those who stayed in the same district. Crespin and Edwards (2016) examines a similar research question to this paper and finds that candidates in districts that change more after the redistricting process receive less contributions from individuals within their district, but more contributions from individuals outside their district.

Theoretical treatments of redistricting have looked at how the political party in control of the redistricting process may draw districts to increase their representation in the legislature above their share of votes in elections. An early treatment of the subject, Owen and Grofman (1988), abstracted from geographical constraints, but found in their model that the party in control of the redistricting process did not significantly disadvantage the other party because of uncertainty about who the electorate in future elections would support. Sherstyuk (1998) examined the extent to which geographical constraints may prevent the party in control of redistricting from fully taking advantage of being in control of the process. She finds that the party in control can create a close to optimal district map even when the districts are required to be contiguous. Friedman and Holden (2008) reexamine how the party in control of the redistricting process should construct the optimal dis-

trict map and find that the party in control should group extreme supporters from both parties in the same district while matching moderate supporters from both parties in the other districts. Gul and Pesendorfer (2010) differs from Friedman and Holden (2008) by giving the party in control of the redistricting process less information about the preferences of voters who are to be assigned to districts. The result is that the party in control of the redistricting process uses the traditional strategies for redistricting of packing opposing voters in highly concentrated districts and cracking its own supporters over multiple districts to increase the number of seats the party is likely to win.

Empirical studies have attempted to determine if they can find the effects of party-controlled redistricting on electoral outcomes such as the level of electoral competition including the extent to which incumbents face quality challengers and polarization. Carson et al. (2014) and Henderson et al. (2018) are papers that examine how redistricting affects electoral competition. Carson et al. (2014) finds that Congressional districts drawn by partisan legislatures are less electorally competitive compared with maps drawn as a result of court cases or by independent commissions. On the other hand, Henderson et al. (2018) use alternative, but never implemented Congressional district maps compared to the actually implemented map and find that even independent commissions tend to develop maps that protect incumbent politicians. Hetherington et al. (2003) and Murphy and Yoshinaka (2009) investigate when quality challengers to incumbents emerge as a result of the redistricting process. They find that quality challengers to incumbents tend to emerge immediately after redistricting has taken place and fade over time the further the election is from the last redistricting cycle. Carson et al. (2007) attempt to measure the extent to which party-controlled redistricting has contributed to polarization in the U.S. House of Representatives. They find a positive, but small effect of redistricting contributing to the recent increase in polarization.

This paper contributes to the existing literature by not only incorporating analysis of how redistricting impacts campaign contributions, but also investigating how it effects campaign spending. Since campaign contributions and campaign spending are determined jointly, only by looking at both sides of a campaign's money flow can the effect of redistricting on the political process be properly examined.

3.3 Data

The Federal Election Commission (FEC) requires political campaigns to report information on campaign contributions and campaign spending. This paper uses information on contributions to political campaigns for the U.S. House of Representatives from 1999-2012. For contribution transactions $200 and over by individuals, the FEC requires the campaign to report information on the contributor including the contribution amount for that transaction, the contributor's name, and the contributor's address. This allows for the identification of contributions at the ZIP Code level which can then be combined with data on the ZIP Code's Congressional District to investigate how redistricting affects campaign contributions. However, for contribution transactions less than $200, campaigns are not required to report any transaction-specific information. Consequently, for contribution transactions less than $200, the location from where they originate and analysis of individual transaction amounts cannot be conducted. Therefore, analysis of the effect of redistricting on campaign contributions at the ZIP Code level is limited to those where the transaction amount is $200 and over.

Political campaigns are also required to report total campaign spending for an election cycle. Furthermore, data on individual campaign expenditures from the FEC is available starting with the 2003-2004 election cycle. Information on individual expenditures includes the amount, date, and purpose of the transaction as well as the name and address of the recipient. This paper categorizes those transactions into fundraising expenses, advertising costs, and other expenditures. Other expenditures includes administrative expenses like salaries and fee payments, travel reimbursements, and other miscellaneous expenses. This data allows for the analysis of how campaigns allocate their available resources across different campaign activities in response to changes to their Congressional District after redistricting.

In order to control for demographic characteristics of ZIP Codes and Congressional Districts since these may impact campaign contributions and spending, data from the decennial U.S. Census and the American Community Survey (ACS) are used. Demographic controls for the relevant level of geography include population, population density, education attainment, racial composition, and other information. In order to control for the effect of income on campaign contributions and campaign spending strategies, data

from the IRS at the ZIP Code level is used to construct the ZIP Code's average income. Average income for Congressional Districts is also used as a control.

Another important aspect of Congressional Districts is their partisan composition. The proportion of Republican Party leaning individuals compared to the proportion of Democratic Party individuals in the districts can significantly impact campaign contributions and the spending strategies campaigns use to win elections. This paper uses the Cook Partisan Voting Index (PVI) to measure the partisan composition of Congressional Districts. The Cook PVI of a Congressional District is defined as the difference between the average margin between the Republican Party and Democratic Party vote share in the last two U.S. Presidential elections within the Congressional District and the average margin between the parties at the national level. This paper uses the convention that positive margins indicate results in favor of the Republican party while negative margins indicate results in favor of the Democratic party. Therefore, a Congressional District with a Cook PVI of $+5$ had a margin 5 percentage points more in favor of the Republican Party compared to the party's performance at national level averaged over that last two Presidential elections. A Congressional District with a Cook PVI of -7 had a margin 7 percentage points more in favor of the Democratic Party compared to the party's performance at the national level averaged over the last two Presidential elections. The measure is used to determine the impact of redistricting on the Congressional District's partisan composition.

To allow for a flexible specification of the effect of partisan composition, a Congressional District's Cook PVI is placed in a category depending on the whether the partisan composition is favorable to the incumbent representative or not. For example, the category $I[0-5]$ indicates that the Cook PVI favors the incumbent representative by 0 to 5 percentage points while the category $O[5-10]$ indicates that the Cook PVI opposes the incumbent representative by 5 to 10 percentage points. In the case of $O[5-10]$, a Congressional District would be in this category if an incumbent Republican representative was in a district where the Cook PVI was in favor of the Democratic Party by 5 to 10 percentage points. The categories used for the analysis are $I[0-5]$, $I[5-10]$, $I[10-15]$, $I[15+]$, $O[0-5]$, $O[5-10]$, and $O[10+]$.

Redistricting then can induce a change in the Cook PVI category to which a

Congressional District belongs. Tracking these changes allows for an analysis of how the political environment impacts political contributions. Changes to the Cook PVI category are organized into small changes which include shifts between consecutive categories such as $I[15+] \leftrightarrow I[10-15]$, medium changes which include larger shifts between categories such as $I[15+] \leftrightarrow I[5-10]$, and large changes for any category changes like $I[15+] \leftrightarrow I[0-5]$ and larger.

To measure the effect of redistricting on political outcomes, measuring the extent to which contributors and campaigns are exposed to redistricting is required. At the ZIP Code level, this paper assigns a number between 0 and 1 to each ZIP Code which is the fraction of the ZIP Code that is in a new Congressional District after redistricting has taken place. Using the new Congressional District maps implemented after the 2000 and 2010 U.S. Censuses gives two instances to measure this change and analyze its political effects. After each instance of redistricting, some ZIP Codes remain in the same Congressional Districts so these ZIP Codes are assigned 0 for redistricting. For other ZIP Codes, the entire ZIP Code is placed in new Congressional Districts so these ZIP Codes are assigned 1 for redistricting. In the last case, there are ZIP Codes that are split between Congressional Districts so that a fraction of the ZIP Code changes districts while the other fraction does not. For these ZIP Codes the fraction of the ZIP Code that changes districts is the measure used for redistricting. The average fraction of a ZIP Code that changes districts is 0.22 with a standard deviation of 0.38.

In order to measure redistricting at the Congressional Districts level, the measure is simply the fraction of overlap between the districts before and after redistricting takes place. This fraction is calculated as the fraction of the population in the new Congressional District that was in the previous Congressional District. As a result, the measure also takes values between 0 and 1 inclusively.

To analyze individual campaign contributions, individual campaign contributions are first limited to contributions to political campaigns for the U.S. House of Representatives. This is because these campaigns and contributions are the ones affected by redistricting. These transactions are then aggregated to the ZIP Code level. The periods of analysis are 1999-2010 for the redistricting process determined by the 2000 U.S. Census and 2009-2012 for the redistricting process determined by the 2010 U.S. Census. Using both periods allows for a comparison across two instances of redistricting to verify

that the effects of redistricting found in one period hold across the other period as well.

Table 3.1 presents summary statistics for individual campaign contributions at the ZIP Code level for the 2000s period of analysis.

Table 3.1: Individual Contri. Summary Statistics 1999-2010

Variable	Number of Obs	Mean	Std. Dev.
Total ZIP Code Contri.	99,145	17,340	50,924.69
Number of ZIP Code Contri.	99,145	25.32	64.72
Mean ZIP Code Contri.	99,145	594.6	314.3243
Frac ZIP Code Redistr.	99,145	0.2228	0.3815
No Incumbent	99,145	0.0405	0.1915
Average Income (2000 dollars)	99,145	46,159.7	36,482.18
Total ZIP Code Pop	99,145	15,600	15,395.68
Pop Density (per sq. mile)	99,145	1,929.19	5,847.033
Percent College Grads	99,145	0.1562	0.0876
Percent Male	99,145	0.4946	0.0315
Percent White	99,145	0.814	0.2027
Percent Age 55+	99,145	0.2558	0.0841
Percent Married	99,145	0.5468	0.1074
Election Cycle 2000	15,791		
Election Cycle 2002	16,133		
Election Cycle 2004	16,656		
Election Cycle 2006	17,127		
Election Cycle 2008	16,783		
Election Cycle 2010	16,655		

Table 3.2 presents summary statistics for individual campaign contributions to campaigns for the U.S. House of Representatives at the ZIP Code level for the 2010s period of analysis.

Table 3.2: Individual Contri. Summary Statistics 2009-2012

Variable	Number of Obs	Mean	Std. Dev.
Total ZIP Code Contri.	32,488	22,409	63,730.43
Number of ZIP Code Contri.	32,488	29.81	74.61
Mean ZIP Code Contri.	32,488	647.2	383.4173
Frac ZIP Code Redistr.	32,488	0.2829	0.4165
No Incumbent	32,488	0.0559	0.2243
Average Income (2010 dollars)	32,488	23,272.8	31,989.2
Total ZIP Code Pop	32,488	15,643.2	15,989.1
Pop Density (per sq. mile)	32,488	1,804.07	6,001.809
Percent College Grads	32,488	0.1603	0.0886
Percent Male	32,488	0.4965	0.0375
Percent White	32,488	0.8129	0.2013
Percent Age 55+	32,488	0.2871	0.0935
Percent Married	32,488	0.5202	0.1158
Election Cycle 2010	16,244		
Election Cycle 2012	16,244		

Table 3.3 present the number of ZIP Codes in each Cook PVI category for a Congressional District in the 2009-2012 period of analysis.

Table 3.3: Cook PVI Category Summary Statistics 2009-2012

Cook PVI Category	Number of Obs
$I[0-5]$	7,188
$I[5-10]$	9,145
$I[10-15]$	7,163
$I[15+]$	7,116
$O[0-5]$	735
$O[5-10]$	185
$O[10+]$	4

Table 3.4 presents the number of ZIP Codes for each Cook PVI category change for the 2009-2012 period of analysis.

Since data from the FEC on itemized campaign expenditures is limited to after the 2003-2004 election cycle, analysis of the effect of redistricting on campaign spending strategies only examines the redistricting process in accordance with the 2010 U.S. Census. In this analysis, the unit of analysis is a political campaign for the U.S. House of Representatives in a particular

Table 3.4: Cook PVI Category Change 2009-2012

Cook PVI Category Change	Number of Obs
$I[0-5] \rightarrow I[5-10]$	1,833
$I[0-5] \rightarrow I[10-15]$	461
$I[0-5] \rightarrow I[15+]$	218
$I[0-5] \rightarrow O[0-5]$	274
$I[0-5] \rightarrow O[10+]$	8
$I[5-10] \rightarrow I[10-15]$	1,425
$I[5-10] \rightarrow I[15+]$	459
$I[5-10] \rightarrow I[0-5]$	1,395
$I[5-10] \rightarrow O[0-5]$	14
$I[5-10] \rightarrow O[5-10]$	8
$I[10-15] \rightarrow I[15+]$	1,035
$I[10-15] \rightarrow I[5-10]$	875
$I[10-15] \rightarrow I[0-5]$	433
$I[15+] \rightarrow I[10-15]$	1,209
$I[15+] \rightarrow I[5-10]$	406
$I[15+] \rightarrow I[0-5]$	90
No Change	17,281
$O[0-5] \rightarrow I[0-5]$	675
$O[0-5] \rightarrow I[5-10]$	152
$O[0-5] \rightarrow I[10-15]$	6
$O[0-5] \rightarrow I[15+]$	12
$O[5-10] \rightarrow O[0-5]$	4
$O[5-10] \rightarrow I[0-5]$	90
$O[5-10] \rightarrow I[5-10]$	138
$O[5-10] \rightarrow I[10-15]$	85
$O[5-10] \rightarrow I[15+]$	2

election cycle. The extent to which these political campaigns are exposed to redistricting is measured by the population overlap between the candidate's previous Congressional District and his or her new Congressional District. Data for this analysis is limited to data from the 2009-2010 and 2011-2012 election cycles. Table 3.5 presents summary statistics for this analysis.

Table 3.5: Campaign Spending Summary Statistics

Variable	Number of Obs	Mean	Std. Dev.
Total Expend.	1,034	1,300,434	1,565,662
Party Committee Contri.	1,034	2,357.94	5,388.431
Gen. Elect Expend.	758	619,590	795,238
Pri. Elect Expend.	840	524,664	648,946.9
Share Gen. Elect Expend.	758	0.4354	0.2588
Fundraising Expend.	912	164,473	343,164.6
Advertising Expend.	942	397,948	610,239.3
Other Expend.	912	721,732	764,788.6
Share Fundraising Expend.	912	0.1449	0.1328
Share Advertising Expend.	942	0.2622	0.2316
Share Other Expend.	912	0.5986	0.2151
Candidate Redistr.	1,034	0.2994	0.2446
Signed Change Cook PVI	1,034	-0.1654	5.4158
Candidate Cook PVI	1,034	7.932	11.1868
Incumbents	691		
Challengers	271		
Open	72		
Gen. Elect Obs	860		
Pri. Only Obs	174		

The data show that contributions to campaigns for the U.S. House of Representatives and spending by campaigns for the U.S. House of Representatives are significant. Given the fraction of the political process in the U.S. devoted to collecting contributions and then spending them and the large impact of redistricting on the U.S. House of Representatives, analyzing the effect of redistricting on these activities is important for expanding knowledge of U.S. politics.

3.4 Empirical Specifications and Results

3.4.1 Individual Contributions

Redistricting can first be used to to see how individual contributors respond to changes in the partisan composition of their Congressional District. Because redistricting can result in significant changes to a Congressional District's geographic boundaries, large changes to a district's Cook PVI category can be observed. Otherwise, a district's Cook PVI category is likely to only change slowly over time as the electorate shifts. Therefore, redistricting can be used to analyze the effect of large changes in a district's partisan composition that are unlikely to occur outside of the redistricting process.

Since a district's Cook PVI measures its lean towards the Democratic Party or the Republican Party, the effects of the district's partisan composition are going to be most relevant in the general election. Therefore, the analysis of how changes to the partisan composition of Congressional Districts impacts individual contributions is limited to contributions made for the general election campaign. Individual contributions made to a general election campaign are identified as all individual contributions made to a campaign for the U.S. House of Representatives after the date of the last primary election in the state. While some individual contributions made before these dates may be made with the general election in mind, it is difficult to separate out which contributions are intended for the general election and which contributions are intended for the primary election. Individual contributions made after the date of the primary election in the state are cleanly identified as contributions to a general election campaign. The model for this analysis is shown below.

$$y_{it} = \alpha_0 + \alpha_1 * DistrictCookPVICategoryChange * ElectionCycle_{it} + \alpha_2 * CookPVIDummies_{it} + X_{it}\beta + \mu_i + \delta_t + \epsilon_{it} \tag{3.1}$$

The dependent variable is calculated for each ZIP Code, i, in each election cycle, t. The coefficient α_1 measures the impact of the change in the district's partisan composition on individual contributions. The specification controls for demographic characteristics of the ZIP Codes, X_{it}, and contains ZIP

Code fixed effects, μ_i, and election cycle fixed effects, δ_t. Standard errors are clustered at the ZIP Code level. The following tables present results on the effects of changes in a district's partisan composition on individual contributions.

Tables 3.6 and 3.7 show the results of the regression on individual contributions to the district's incumbent party and changes to the district's partisan composition. Statistical significance is difficult to find among small changes to the Cook PVI category likely due to the small impact it has on individual contributions. The results do suggest, though, that in districts in competitive ranges where the advantage or disadvantage to the incumbent is between 0 and 5 percentage points, small shifts towards the incumbent increase individual contributions to the incumbent. The estimates show that total contributions are 3 times larger when the district shifts slightly against the incumbent to slightly in favor of the incumbent compared to districts that do not change Cook PVI categories. This increase in the total amount of contributions is driven by both the extensive margin with about 1.6 times more contributions and the intensive margin with 2.8 times larger average contributions compared to districts that do not change Cook PVI categories.

The results for the impact of changes to a district's partisan composition on individual contributions are clearer for medium-sized changes. The effects of shifts in the district's partisan composition are largest when the district shifts into a competitive range or out of a competitive range. Shifts where the district remains in uncompetitive ranges result in smaller and statistically insignificant effects. A ZIP Code in a district that shifts into a competitive range where the incumbent only has a slight advantage of 0 to 5 percentage points from an uncompetitive range where the incumbent had an advantage of 10 to 15 percentage points increases its total contributions to the incumbent by 6 times compared to a district that does not change categories. Again this is driven by both the extensive margin where the number of contributions increases by 3 times and the intensive margin where the average contribution increases by about 5.9 times. The effect has a similar magnitude in reverse where ZIP Codes in a district that shifts towards the incumbent from a competitive range to an uncompetitive range decrease total contributions, the number of contributions, and the average contribution. Shifts in categories from a disadvantage to the incumbent to an advantage to the incumbent still within competitive ranges are not statistically significant suggesting individ-

Table 3.6: Individual Contri. Incumbent Party Results 2009-2012

	ln(Tot. Contri.)	ln(Count)	ln(Mean)
CookPVICatChange*2012			
Small changes			
$I[15+] \rightarrow I[10-15]$	-1.8387	-1.2123	-2.0890
	(1.183)	(0.5563)**	(1.0958)*
$I[10-15] \rightarrow I[15+]$	-0.8072	-0.0077	-0.4068
	(1.1988)	(0.5644)	(1.1087)
$I[10-15] \rightarrow I[5-10]$	3.5021	1.4473	3.7421
	(3.1727)	(1.6327)	(2.7771)
$I[5-10] \rightarrow I[10-15]$	-3.852	-1.6083	-4.0458
	(3.165)	(1.6293)	(2.7696)
$I[5-10] \rightarrow I[0-5]$	3.1609	1.7187	2.4887
	(2.9958)	(1.5389)	(2.5912)
$I[0-5] \rightarrow I[5-10]$	-2.8518	-1.5576	-2.2745
	(2.9936)	(1.5378)	(2.5891)
$O[0-5] \rightarrow I[0-5]$	3.2225	1.6281	2.7733
	(0.6540)***	(0.3095)***	(0.6119)***
Medium changes			
$I[15+] \rightarrow I[5-10]$	4.0864	1.4992	3.7143
	(2.9823)	(1.5516)	(2.5893)
$I[5-10] \rightarrow I[15+]$	-4.3938	-1.5843	-4.0426
	(2.9780)	(1.8529)	(2.5847)
$I[10-15] \rightarrow I[0-5]$	6.2776	2.9817	5.8931
	(1.3499)***	(0.6801)***	(1.2783)***
$I[0-5] \rightarrow I[10-15]$	-5.8761	-2.718	-5.6332
	(1.3159)***	(0.6631)***	(1.2511)***
$O[0-5] \rightarrow I[5-10]$	2.6149	1.2234	2.4090
	(3.0306)	(1.5549)	(2.6258)
$O[5-10] \rightarrow I[0-5]$	1.0953	0.6100	1.0514
	(1.0643)	(0.5485)	(1.0382)
Demographic Controls	Yes	Yes	Yes
Election Cycle FE	Yes	Yes	Yes
ZIP Code FE	Yes	Yes	Yes
Number of Obs	32,995	32,995	32,995

*** indicates $p < 0.01$, ** indicates $p < 0.05$, and * indicates $p < 0.1$

Table 3.7: Individual Contri. Incumbent Party Results 2009-2012

	ln(Tot. Contri.)	ln(Count)	ln(Mean)
CookPVICatChange*2012			
Large changes			
$I[15+] \rightarrow I[0-5]$	6.8464	2.7568	6.2935
	(1.0117)***	(0.5341)***	(0.9869)***
$I[0-5] \rightarrow I[15+]$	-6.7713	-2.8023	-6.0447
	(0.7604)***	(0.4312)***	(0.7589)***
$I[5-10] \rightarrow O[5-10]$	-1.4447	-0.4009	-1.9246
	(1.1546)	(0.6117)	(1.1012)*
$O[5-10] \rightarrow I[10-15]$	-3.4006	-1.3462	-3.8145
	(3.7429)	(1.8529)	(3.4339)
$I[0-5] \rightarrow O[10+]$	0.6712	0.3102	0.6836
	(0.2996)**	(0.1938)	(0.2593)***
$O[0-5] \rightarrow I[15+]$	-0.2782	0.9253	-1.0056
	(0.3770)	(0.389)**	(0.3087)***
$O[5-10] \rightarrow I[5-10]$	-0.7210	-0.4009	-0.2536
	(3.1143)	(1.6092)	(2.7174)
DistrictCookPVICat			
$I[5-10]$	3.0446	1.6105	2.4988
	(2.985)	(1.5339)	(2.5807)
$I[10-15]$	6.6102	3.0658	6.3184
	(1.2575)***	(0.6377)***	(1.1969)***
$I[15+]$	6.1756	2.5147	5.5278
	(0.5345)***	(0.3475)***	(0.5650)***
$O[0-5]$	4.8778	2.3769	4.3476
	(0.5216)***	(0.246)***	(0.4903)***
$O[5-10]$	4.2116	1.9983	4.0281
	(0.5193)***	(0.3419)***	(0.5534)***
Demographic Controls	Yes	Yes	Yes
Election Cycle FE	Yes	Yes	Yes
ZIP Code FE	Yes	Yes	Yes
Number of Obs	32,995	32,995	32,995

*** indicates $p < 0.01$, ** indicates $p < 0.05$, and * indicates $p < 0.1$

uals continue to contribute similar amounts because the elections in these districts remain competitive.

Large shifts into and out of competitive ranges show similar effects to medium-sized shifts with shifts into competitive ranges significantly increasing individual contributions to the incumbent while shifts out of competitive ranges significantly decreasing individual contributions to the incumbent by similar magnitudes. Individual contributions to the challenging candidate are also important. Tables 3.8 and 3.9 show the results of the regression on individual contributions to the district's opposing party and changes to the district's partisan composition.

Again statistical significance is difficult to find among small changes to the Cook PVI category likely due to the small impact it has on individual contributions. However, there are some statistically significant effects when the district is shifting between relatively uncompetitive ranges. The results do suggest that in districts in uncompetitive ranges where the advantage to the incumbent shifts between an advantage greater than 15 percentage points to an advantage between 10 and 15 percentage points, small shifts towards the incumbent decrease individual contributions to the challenging candidate while small shifts away from the incumbent increase individual contributions to the challenging candidate. The estimates show that total contributions are about 5 times larger when the district has a small shift against the incumbent compared to districts that do not change Cook PVI categories. This increase in the total amount of contributions is driven by both the extensive margin with about 2 times more contributions and the intensive margin with 5 times larger average contributions compared to districts that do not change Cook PVI categories. The results are similar in magnitude going in to reverse direction when the district has small shift towards to incumbent. The estimates show that total contributions are about 4 times smaller when the district has a small shift toward the incumbent compared to districts that do not change Cook PVI categories. This increase in the total amount of contributions is driven by both the extensive margin with about 1.3 times fewer contributions and the intensive margin with about 4 times smaller average contributions compared to districts that do not change Cook PVI categories.

Medium-sized changes show more statistically significant effects on individual contributions to candidates challenging the incumbent. For individuals contributing to candidates challenging the incumbent, the results suggest

Table 3.8: Individual Contri. Oppo. Party Results 2009-2012

	ln(Tot. Contri.)	ln(Count)	ln(Mean)
CookPVICatChange*2012			
Small changes			
$I[15+] \rightarrow I[10-15]$	5.1203	1.963	4.994
	(1.045)***	(0.4973)***	(0.9798)***
$I[10-15] \rightarrow I[15+]$	-3.8263	-1.292	-3.9788
	(1.0633)***	(0.5077)**	(0.9935)***
$I[10-15] \rightarrow I[5-10]$	-1.3142	0.0297	-2.0805
	(2.0302)	(0.9447)	(1.8042)
$I[5-10] \rightarrow I[10-15]$	1.8185	0.2338	2.4477
	(2.0167)	(0.9384)	(1.7905)
$I[5-10] \rightarrow I[0-5]$	-0.5394	-0.0942	-0.8355
	(1.6776)	(0.8139)	(1.5177)
$I[0-5] \rightarrow I[5-10]$	1.5299	0.6649	1.563
	(1.6734)	(0.812)	(1.5136)
$O[0-5] \rightarrow I[0-5]$	0.1592	0.0601	0.112
	(0.6748)	(0.3207)	(0.6333)
Medium changes			
$I[15+] \rightarrow I[5-10]$	4.1523	2.2111	3.1748
	(1.788)**	(0.8255)***	(1.5625)**
$I[5-10] \rightarrow I[15+]$	-5.0611	-2.6409	-3.9962
	(1.7845)***	(0.8239)***	(2.5356)**
$I[10-15] \rightarrow I[0-5]$	-2.5454	-0.4056	-3.5205
	(1.4459)*	(0.6410)	(1.2757)***
$I[0-5] \rightarrow I[10-15]$	4.3123	1.2372	5.0227
	(1.4348)***	(0.6337)*	(1.2676)***
$O[0-5] \rightarrow I[5-10]$	1.1811	0.4007	1.4178
	(1.7420)	(0.8467)	(1.5705)
$O[5-10] \rightarrow I[0-5]$	-3.5134	-1.2102	-3.8912
	(1.3467)***	(0.5592)**	(1.2177)***
Demographic Controls	Yes	Yes	Yes
Election Cycle FE	Yes	Yes	Yes
ZIP Code FE	Yes	Yes	Yes
Number of Obs	32,995	32,995	32,995

*** indicates $p < 0.01$, ** indicates $p < 0.05$, and * indicates $p < 0.1$

Table 3.9: Individual Contri. Oppo. Party Results 2009-2012

	ln(Tot. Contri.)	ln(Count)	ln(Mean)
CookPVICatChange*2012			
Large changes			
I[15+] → I[0 − 5]	1.9635	1.2535	0.9236
	(1.2554)	(0.5437)**	(1.0782)
I[0 − 5] → I[15+]	-2.2198	-1.4794	-1.0954
	(1.1316)*	(0.4769)***	(0.9551)
I[5 − 10] → O[5 − 10]	-4.0262	-2.3064	-3.2142
	(2.6460)	(1.2107)*	(2.5356)
O[5 − 10] → I[10 − 15]	-3.4006	-1.3462	-3.8145
	(3.7429)	(1.8529)	(3.4339)
I[0 − 5] → O[10+]	-0.4692	-0.0022	-0.5341
	(0.2694)*	(0.1817)	(0.2491)**
O[0 − 5] → I[15+]	-0.2782	0.9253	-1.0056
	(0.3770)	(0.389)**	(0.3087)***
O[5 − 10] → I[5 − 10]	2.0160	1.3406	1.3069
	(1.8913)	(0.8739)	(1.6663)
DistrictCookPVICat			
I[5 − 10]	-2.5017	-1.142	-2.4018
	(1.6593)	(0.8052)	(1.5004)
I[10 − 15]	-4.8651	-1.6372	-5.3741
	(1.37)***	(0.6003)***	(1.2052)***
I[15+]	0.4429	0.3986	-0.1506
	(0.9368)	(0.3651)	(0.758)
O[0 − 5]	-0.2510	-0.1529	-0.2193
	(0.5587)	(0.2667)	(0.5244)
O[5 − 10]	-0.7802	0.1189	-1.4057
	(0.9279)	(0.3599)	(0.7486)*
Demographic Controls	Yes	Yes	Yes
Election Cycle FE	Yes	Yes	Yes
ZIP Code FE	Yes	Yes	Yes
Number of Obs	32,995	32,995	32,995

*** indicates $p < 0.01$, ** indicates $p < 0.05$, and * indicates $p < 0.1$

that these individuals view Cook PVI categories in favor of the incumbent by 5 to 10 and 10 to 15 percentage points as still competitive for the challenger. Individual contributions increase in terms of total, the number of contributions, and the average size of a contribution when the district shifts to these ranges toward or away from the incumbent. On the other hand, individual contributions tend to decrease when shifting away from these ranges either towards or away from the incumbent. The magnitude of the changes in individual contributions is similar to the previous results. Individual contributors to challengers may see their contributions as more critical to the challenging candidate when the district is within these ranges compared to other Cook PVI categories.

For large shifts in the Cook PVI category, the effect on individual contributions to challenging candidates is less statistically significant. This could potentially be due to shifts between categories where individual contributors to challengers see their contributions as not substantially changing in importance to the election. While these results provide evidence on how individuals respond to changes in the partisan composition of their district, the redistricting process allows further analysis of the impact of redistricting on both individual contributions to campaigns for the U.S. House of Representatives and campaign spending strategies utilized by these campaigns.

A strategy that can be used to estimate the causal effects of redistricting itself on individual contributions to campaigns for the U.S. House of Representatives is the difference-in-differences approach. ZIP Codes that largely remain in the same Congressional District provide a control group for ZIP Codes that largely change Congressional Districts. Comparisons of the 1999-2000 election cycle with the later election cycles provide before and after periods for the redistricting process. This approach is used to study how total contributions from a ZIP Code, the number of contributions from a ZIP Code, and the mean contribution in a ZIP Code change.

The model is shown below.

$$y_{it} = \alpha_0 + \alpha_1 * FractionRedistricted * ElectionCycle_{it} + X_{it}\beta + \mu_i + \delta_t + \epsilon_{it} \tag{3.2}$$

The dependent variable is calculated for each ZIP Code, i, in each election cycle, t. The coefficient α_1 is the difference-in-differences coefficient

corresponding to how much the dependent variable changes in ZIP Codes that change districts after redistricting. The specification controls for demographic characteristics of the ZIP Codes, X_{it}, and contains ZIP Code fixed effects, μ_i, and election cycle fixed effects, δ_t. Standard errors are clustered at the ZIP Code level. Table 3.10 presents results on the effects of redistricting on individual contributions.

The results show a temporary surge in political contributions in total amounts, number of contributions, and mean contribution that fades after the initial election cycle with new districts. Compared to the 2000 election cycle, ZIP Codes in completely new Congressional Districts showed an increase of 9.18% in total contributions for the 2002 election cycle. The number of contributions also increased by 4.19%, and the mean contribution increased by 4.98% for these ZIP Codes. For the election cycles 2004 and onward, these coefficients are typically statistically insignificant and consistently smaller.

To examine if these effects hold for the most recent redistricting cycle. The same regression is run on data for the election cycles 2009-2010 and 2011-2012 which take place before and after the 2010 U.S. Census resulted in new Congressional Districts. Table 3.11 presents the results from this redistricting cycle.

The results from the most recent redistricting cycle are broadly in line with the previous results. Political contributions in total amounts and number of contributions are higher in ZIP Codes the change Congressional Districts compared to ZIP Codes that do not. Compared to the 2010 election cycle, ZIP Codes in completely new Congressional Districts showed an increase of 6.47% in total contributions for the 2012 election cycle. The number of contributions also increased by 5.71%. There is no statistically significant change in the mean contribution suggesting that the increase in total contributions is almost entirely along the extensive margin.

These results confirm that redistricting has an important impact on political contributions. However, the results are surprising since ZIP Codes in new Congressional Districts may be reasonably expected to contribute less since the political candidates running in these elections may be unfamiliar to them. The results show, though, that the political process is complex and suggests that the actions of potential contributors interact with multiple elements of the political process. Not only does redistricting affect the candidates to whom an individual may consider contributing, but the campaign strategies

Table 3.10: Individual Contri. Results 1999-2010

	ln(Tot. Contri.)	ln(Count)	ln(Mean)
Redistrict*Elect 2002	0.0918	0.0419	0.0498
	(0.0233)***	(0.0197)**	(0.0103)***
Redistrict*Elect 2004	0.0393	0.0143	0.025
	(0.0255)	(0.0212)	(0.0116)**
Redistrict*Elect 2006	0.0603	0.0284	0.0319
	(0.0265)**	(0.0219)	(0.0119)***
Redistrict*Elect 2008	0.006	-0.0174	0.0234
	(0.0275)	(0.0225)	(0.0124)*
Redistrict*Elect 2010	0.0104	-0.0159	0.0265
	(0.0276)	(0.0225)	(0.0125)**
No Incumbent	0.3732	0.343	0.0303
	(0.0164)***	(0.0137)***	(0.0074)**
ln(Pop)	0.5467	0.512	0.0347
	(0.0488)***	(0.0410)***	(0.0191)*
ln(Pop Density)	0.1222	0.0898	0.0324
	(0.0309)***	(0.0256)***	(0.0142)**
ln(Avg. Income)	0.3311	0.2364	0.105
	(0.0384)***	(0.0308)***	(0.0174)***
Per. College Grads	1.0471	1.0638	-0.0165
	(0.2738)***	(0.2226)***	(0.1235)
Per. Male	-0.0644	0.0021	-0.073
	(0.3779)	(0.3033)	(0.1754)
Per. White	0.0401	-0.093	0.1287
	(0.1354)	(0.1110)	(0.0617)**
Per. Age 55+	1.504	1.489	0.0143
	(0.2022)***	(0.1629)***	(0.0975)
Per. Married	0.3924	0.3499	0.0348
	(0.1779)**	(0.1393)**	(0.0838)
Election Cycle FE	Yes	Yes	Yes
ZIP Code FE	Yes	Yes	Yes
Number of Obs	99,146	99,146	99,146

*** indicates $p < 0.01$, ** indicates $p < 0.05$, and * indicates $p < 0.1$

Table 3.11: Individual Contri. Results 2009-2012

	ln(Tot. Contri.)	ln(Count)	ln(Mean)
Redistrict*Elect 2012	0.0647	0.0571	0.0076
	(0.0210)***	(0.0167)***	(0.0108)
No Incumbent	0.337	0.339	-0.002
	(0.0284)***	(0.0236)***	(0.0139)
ln(Pop)	0.2238	0.2291	-0.0054
	(0.1112)**	(0.0948)**	(0.0621)
ln(Pop Density)	-0.0583	-0.1059	0.0476
	(0.0970)	(0.0836)	(0.0640)
ln(Avg. Income)	-0.0743	-0.0435	-0.0308
	(0.0159)***	(0.0127)***	(0.0085)***
Per. College Grads	-2.4905	-1.7753	-0.7152
	(1.1366)**	(0.9050)*	(0.6180)
Per. Male	-1.9341	-1.2086	-0.7255
	(1.6847)	(1.3507)	(0.9082)
Per. White	2.2116	1.313	0.8989
	(0.6042)***	(0.4809)***	(0.3382)***
Per. Age 55+	-0.6913	0.1035	-0.7949
	(0.8952)	(0.6903)	(0.5195)
Per. Married	1.2099	1.3728	-0.1629
	(0.8117)	(0.6354)**	(0.4606)
Election Cycle FE	Yes	Yes	Yes
ZIP Code FE	Yes	Yes	Yes
Number of Obs	32,940	32,940	32,940

*** indicates $p < 0.01$, ** indicates $p < 0.05$, and * indicates $p < 0.1$

pursued by these candidates may change in response to redistricting as well. Furthermore, the evidence here suggests that potential contributors adapt relatively quickly to the new political landscape created by redistricting by returning to typical contribution patterns in the subsequent election cycles.

3.4.2 Campaign Results

Given the interaction between campaign contributions from individuals and the campaign strategies candidates pursue, in order to fully analyze the effect of redistricting on the political process, an analysis of the effect of redistricting on political campaigns is necessary. To control for potential confounding variables due to unobservable characteristics of the political candidates, this analysis uses repeat candidates for office in the U.S. House of Representatives for the 2010 and 2012 elections. Using repeat candidates as an identification strategy has been utilized before in Levitt (1994). The advantage of this strategy is that it allows the analysis to control for time invariant differences between political candidates. While repeat candidates for office in the U.S. House of Representatives is a selected sample, given the high reelection rates for incumbents in the U.S. House of Representatives, it encompasses a large portion of the candidates running for office in the U.S. House of Representatives.

From the perspective of the candidates running for office in the U.S. House of Representatives, redistricting can impact their Congressional Districts with two related, but distinct effects. As noted by Yoshinaka and Murphy (2009), redistricting can change the population in a district even if the partisan make up of the district is not significantly affected. The change in the population of the district may affect the strategies the candidate's campaign pursues even if the Cook PVI of the district does not shift toward or away from the candidate in a meaningful way. Therefore, using both the change in the district's Cook PVI and the fraction of the district that has been redistricted are important for this analysis. The fraction of the district that has been redistricted in this analysis is measured by the fraction of a Congressional District that is new from the perspective of the candidate running after the redistricting process. The values range between 0 and 1 depending on how extensive the candidate's district has changed after re-

districting. The change in the Cook PVI of the candidate's Congressional District for the 2010 and 2012 elections provides another effect of redistricting on political campaigns. The Cook PVI of the district provides information about the political environment in which the campaign is operating. This analysis uses the convention that a positive number for the change in the Cook PVI indicates a more favorable environment for the candidate's campaign after redistricting while a negative number indicates a less favorable environment after redistricting. The values of this measure are how many percentage points the district's Cook PVI has changed toward or away from the candidate as a result of the redistricting process.

The model used for this analysis is shown below.

$$\begin{aligned} y_{it} &= \alpha_0 + \alpha_1 * FractionRedistricted * ElectionCycle_{it} \\ &+ \alpha_2 * ChangeInPVI * ElectionCycle_{it} \\ &+ X_{it}\beta + \mu_i + \delta_t + \epsilon_{it} \end{aligned} \tag{3.3}$$

This analysis uses repeat candidates i over the two election cycles t. The dependent variables, y_{it}, are various measures of the campaign's strategy such as how much the campaign spends on the general election vs. the primary election and how the campaign's expenditures on fundraising and advertising activities are affected. The interaction between the redistricting variable and the 2012 election cycle, α_1, provides the effect of redistricting on political campaigns just due to new constituents. The interaction between the change in the Cook PVI and the 2012 election cycle, α_2, is the effect of redistricting on political campaigns because the proportion of potential supporters to opposers has changed. Controls include demographic data for the Congressional District as well as whether the candidate is an incumbent, challenger, or open and if the candidate participated in the general election. Fixed effects for the candidates, μ_i and the election cycle, δ_t are included. Standard errors are clustered at the candidate level.

Table 3.12 presents the results on how party committees react to redistricting and how campaigns change their overall level of spending.

The evidence suggests that candidates with more new constituents due to redistricting receive more contributions from party committees and also spend more in total campaign spending. The estimated effect for contributions from party committees implies that a candidate whose portion of new

Table 3.12: Campaign Finance Results

	ln(Party Comm Contri.)	ln(Total Expend.)
Redistrict*Elect 2012	2.7822	0.4109
	(1.0400)***	(0.1937)**
PVIChange*Elect 2012	-0.3098	-0.0656
	(0.0892)***	(0.0374)*
Election Cycle 2012	-1.9734	-0.233
	(0.5150)***	(0.0922)**
District Controls	Yes	Yes
Candidate FE	Yes	Yes
Number of Obs	1,034	1,034

*** indicates $p < 0.01$, ** indicates $p < 0.05$, and * indicates $p < 0.1$

constituents is 50% receives 139% more contributions of party committees. The strategy of party committees appears to increase support to candidates that have more new constituents to which the candidate may need to reach out. Party committees also contribute more to candidates who are worse off after redistricting contributing 155% more to candidates who lose 5 percentage points as measured by the Cook PVI.

A campaign whose portion of new constituents is 50% responds by increasing total campaign spending by 21%. There is also some weak evidence that campaigns are also able to respond to losing support within the district. The estimates suggest that a campaign whose candidate is 5 percentage points worse off as measured by the Cook PVI increases spending by 33%.

Changes is the partisan composition of a Congressional District can also affect the level of competition a candidate faces in the general election compared to the primary election. Table 3.13 presents the results on how campaigns react in the general election and the primary election because of redistricting.

The extent to which a candidate's district becomes less favorable to the candidate and perhaps more competitive as measured by the Cook PVI of the district affects the campaign's spending in the general election. The estimates suggest that a campaign whose candidate is 5 percentage points worse off as measured by the Cook PVI increases spending in the general election by 69%. This paper cannot find any statistically significant impact

Table 3.13: Campaign Spending Results

	ln(Gen. Exp.)	ln(Pri. Exp.)	Share Gen.
Redistrict*Elect 2012	0.6686	0.4755	-0.0123
	(0.5148)	(0.3403)	(0.0642)
PVIChange*Elect 2012	-0.1373	-0.0011	-0.012
	(0.0417)***	(0.0366)	(0.0064)*
Election Cycle 2012	-0.8357	-0.3062	-0.0905
	(02159)***	(0.1540)**	(0.0285)***
District Controls	Yes	Yes	Yes
Candidate FE	Yes	Yes	Yes
Number of Obs	758	838	758

*** indicates $p < 0.01$, ** indicates $p < 0.05$, and * indicates $p < 0.1$

of redistricting on spending in the primary election. However, there is some weak evidence that campaigns shift spending from the primary election to the general election when losing partisan support in the district. A 5 percentage point loss of partisan support results in the campaign spending 6 percentage points more on the general election as a share of total spending.

Campaigns can also respond to redistricting by changing how much they spend on fundraising activities, advertising, and other campaign expenditures. Table 3.14 presents results on how campaigns change their spending in specific categories.

The evidence suggests that fundraising activities are crucial to candidates who lose partisan support, but candidates respond to new constituents through advertising regardless of the partisan composition of those new constituents. A 5 percentage point loss of partisan support results in the campaign spending 45% more on fundraising activities. This may be because campaigns have a harder time soliciting contributions from opposing constituents or realize that they will need to spend more to win the election and consequently spend more effort fundraising to obtain the necessary resources.

A campaign's advertising strategy does not appear to respond to changes in the district's partisanship, but does respond to the introduction of new constituents. While the effect of a change in the Cook PVI of the district is not statistically significant, a campaign facing a constituency that is 50% new will increasing spending on advertising by 50%.

Table 3.14: Campaign Spending Cat Results

	ln(Fund. Exp.)	ln(Ad Exp.)	ln(Other Exp.)
Redistrict*Elect 2012	0.43	0.9962	0.2945
	(0.2681)	(0.5035)**	(0.1724)*
PVIChange*Elect 2012	-0.0891	-0.0183	-0.0306
	(0.0183)***	(0.0594)	(0.0093)***
Election Cycle 2012	-0.1875	-0.8675	-0.1233
	(0.1345)	(0.2434)***	(0.0852)
District Controls	Yes	Yes	Yes
Candidate FE	Yes	Yes	Yes
Number of Obs	912	942	912

*** indicates $p < 0.01$, ** indicates $p < 0.05$, and * indicates $p < 0.1$

Other campaign expenditures such as administrative expenses and travel reimbursement also increase with a loss of partisan support. The effect is smaller compared with fundraising, but a 5 percentage point loss of partisan support results in the campaign spending 15% more on other expenditures. Other expenditures may also increase in response to more new constituents independent of changes in partisan support. The estimated effect is a 50% new constituency results in an increase of 15% in other expenditures.

Table 3.15 presents results on how campaigns change the composition of their spending in response to redistricting.

The evidence is broadly in line with the results from analyzing the total expenditure in each category. While no statistically significant effect can be found on the share of total campaign spending spent on fundraising activities, the share of total campaign spending spent on advertising increases in response to new constituents. As before, the increase in advertising spending does not appear to be related to a loss of partisan support. A campaign facing a constituency that is 50% new will increasing its share of total spending on advertising by 5.4 percentage points. The evidence suggests this is being supported by a decrease in the share of other expenditures by 5.7 percentage points with no impact on the share spent on fundraising. An improvement in a campaign's partisan support as measured by the Cook PVI by 5 percentage points increases the share spent on other expenditures by 6.5 percentage points. This suggests that candidates who, because of redistricting end up in

Table 3.15: Campaign Spending Shares Results

	Share Fund.	Share Ad	Share Other
Redistrict*Elect 2012	-0.0314	0.1081	-0.113
	(0.0264)	(0.0456)**	(0.0378)***
PVIChange*Elect 2012	-0.0038	-0.0036	0.013
	(0.0029)	(0.0086)	(0.0023)***
Election Cycle 2012	0.0224	-0.0804	0.061
	(0.0120)*	(0.0204)***	(0.0181)***
District Controls	Yes	Yes	Yes
Candidate FE	Yes	Yes	Yes
Number of Obs	912	942	912

*** indicates $p < 0.01$, ** indicates $p < 0.05$, and * indicates $p < 0.1$

safer districts, shift spending away from fundraising and advertising toward other activities. Campaigns may view fundraising and advertising as more important in competitive elections compared to other campaign activities and so shift spending depending based on whether the election is expected to be competitive or not.

The results show how campaigns and party committees may shift their strategies as a result of the redistricting process. The redistricting process can change both the proportion of new constituents in a Congressional District and the amount of partisan support a candidate can expect. The strategies of campaigns and party committees may react in different ways to the separate effects. The evidence shows that campaigns respond to more new constituents by increasing spending on advertising regardless of the partisan composition of the new constituents. Party committees also respond to candidates facing new constituents by contributing more to those candidates separate again from the partisan composition of those new constituents. Campaigns and party committees of course also react to the change in partisan support brought about by redistricting. Party committees contribute more to candidates who are made worse off in terms of partisan support after redistricting, and campaigns spend more on fundraising activities when made worse off. Campaigns will also spend more on other campaign activities, but as a share of total spending other expenditures increase when the candidate's district in more favorable as measured by its Cook PVI.

The increase in fundraising and advertising spending by campaigns as a consequence of the redistricting process may also help to explain the increase in individual campaign contributions after redistricting. The results on campaign spending suggest that campaigns respond by increasing outreach to potential contributors, and the increase in advertising may introduce the district's new constituents to the candidate. As a result, both types of spending may increase individual contributions by increasing solicitation of campaign contributions and by obtaining contributions from new constituents through increased awareness of the candidates from advertisements. The results on individual campaign contributions and campaign spending in response to the redistricting process show that in any analysis it is important to consider both aspects of campaign finance in order effectively understand the political process and how it is affected by changes in the political environment.

3.5 Conclusion

Redistricting has a major impact on the political process from both the perspective of individual contributors and political campaigns. It can change who the incumbent Representative is for individual contributors and who the constituents are for the candidate's campaign. Analyzing both contributions from individuals and campaign spending is necessary to fully understand how the political process is affected by redistricting. This paper finds that after redistricting, districts that shift to more competitive Cook PVI categories see higher levels of individual contributions. This effect is both on the extensive margin with more contributions and on the intensive margin with a higher average contribution. How individuals view the extent to which a district becomes competitive does seem to differ on whether the individual is contributing to the incumbent representative or the challenger. Individuals contributing to the incumbent representative have larger responses to shifts where the incumbent's advantage is between 0 and 5 percentage points as measured by the district's Cook PVI. On the other hand, individuals contributing to the challenger respond when the incumbent's advantage is over a wider range between 5 and 15 percentage points as measured by the district's Cook PVI. This suggests that individuals contributing to the challenger are willing to contribute under a more adverse political environment.

Moreover, perhaps counter-intuitively, this paper also finds that ZIP Codes that move to new Congressional Districts contribute more. Given the effects of redistricting on campaign spending activities, the increase in contributions can in part be explained by campaigns spending more on fundraising activities and advertisements. The increase in spending on these activities can solicit more contributions from individuals with a potentially larger effect on new constituents. However, the increase in individual contributions is only significant in the election cycle immediately following the redistricting process. This suggests that both individual contributors and political campaigns adapt quickly to the changes in the political environment initiated by redistricting.

There is also evidence that party committees respond strategically to redistricting as well increasing their contributions to candidates who face more new constituents separate from the partisan composition of those new constituents. Campaigns, furthermore, adjust their spending patterns spending more on fundraising activities when after redistricting, the district is less favorable as measured by the district's Cook PVI. However, like party committees, campaigns also respond to the proportion of new constituents separate from partisan composition spending more on advertising when there are more new constituents. Campaigns may see a need to introduce their candidate to new potential voters whether or not those voters identify with the same party as the candidate or not.

The results show that the interaction between potential contributors and campaigns jointly determine the impact of redistricting on campaign finance. Focusing only on contributions or only on campaign spending ignores the linkages between these two activities and prevents a fully comprehensive understanding on how factors in the political environment affect campaigns and campaign contributors. Redistricting has huge impacts on the political environment that campaigns operate within and within which individuals choose to make campaign contributions. However, other aspects of the political environment change from election to election such as the presence of U.S. Senate elections in particular states and the passage of new voter identification laws by some states. This paper shows to fully analyze the impact of these events on the political process requires analyzing both campaign contributions and campaign spending decisions collectively. The interactions between the two are what affect the results of the election.

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APPENDIX A

PROOFS OF PUBLIC INFORMATION AND VOTER TURNOUT PROPOSITIONS

A.1 Proof of Proposition 1

Proof. First, the utility functions for both types of potential voters are quasi-concave in the strategy used by the potential voter. Since the proof is similar for both types of potential voters, only the arguments for a potential voter with signal s_A is presented. If a potential voter with signal s_A has strictly positive utility, then it must be the case that $u^{s_A} > 0$. Therefore, this potential voter strictly prefers to vote for candidate A so $r_A = \{0\}$, a convex set. On the other hand, if $u^{s_A} < 0$, the potential voter strictly prefer to abstain so $r_A = \{1\}$, also a convex set. Finally, if the potential voter's utility is exactly 0, then it must be the case that $u^{s_A} = 0$. Then the potential voter is indifferent between voting for candidate A and abstaining so the potential voter is willing to abstain with any rate $r_A \in [0, 1]$. In all cases, the strategy set is a convex set so the utility function is quasi-concave.

Next, define a function f which takes as its arguments r_A and r_B and outputs two sets r_A^* and r_B^* which are the voters' optimal abstention rates given r_A and r_B. It follows that if $u^{s_A} > 0$, then r_A^* is a singleton consisting of $r_A^* = \{0\}$ indicating that the voter will vote. If $u^{s_A} < 0$, then r_A^* is a singleton consisting of $r_A^* = \{1\}$ indicating that the voter will abstain. If $u^{s_A} = 0$, then $r_A^* = [0, 1]$ indicating that the voter is willing to mix between voting and abstaining. For signal s_B voters, if $u^{s_B} > 0$, then r_B^* is a singleton consisting of $r_B^* = \{0\}$ indicating that the voter will vote. If $u^{s_B} < 0$, then r_B^* is a singleton consisting of $r_B^* = \{1\}$ indicating that the voter will abstain. If $u^{s_B} = 0$, then $r_B^* = [0, 1]$ indicating that the voter is willing to mix between voting and abstaining.

The function f is upper hemicontinuous. To see this, note that, I_k, the modified Bessel function of the first kind, is a continuous function. Then u^{s_A}

and u^{s_B} are continuous functions of r_A and r_B since u^{s_A} and u^{s_B} are constructed from continuous functions. Consequently, given a point $(\hat{r}_A, \hat{r}_B)$, if $u^{s_A} > 0$, then there exists a neighborhood R of $(\hat{r}_A, \hat{r}_B)$ such that $u^{s_A} > 0$ for all points in R. Therefore, $r_A^* = \{0\}$ for all points in R. The same argument holds for $u^{s_A} < 0$. If $u^{s_A} = 0$ at $(\hat{r}_A, \hat{r}_B)$, then since $r_A^* = [0, 1]$, any neighborhood R around $(\hat{r}_A, \hat{r}_B)$ has the property that $r_A^* \subset [0, 1]$ for all points in R. Since the same holds true for u^{s_B}, f is upper hemicontinuous. Moveover, by the construction of f and the fact that f is upper hemicontinuous, by the Closed Graph Theorem, f has a closed graph.

Therefore, the function f satisfies all the conditions of the Kakutani Fixed-Point Theorem and so must have a fixed point. The fixed point defines an equilibrium where given the voting strategies chosen by the other potential voters, a potential voter of each type has a best response equal to those voting strategies. □

A.2 Proof of Proposition 2

Proof. In this type of equilibrium, $u^{s_A} = 0$. Let

$$Q_1^{-1} = \left(\frac{1 - q_1}{q_1}\right)^{m_0^A + 1} \tag{A.1}$$

$$Q_1^{r_A} = \left(\frac{q_1}{(1 - q_1)(1 - r_A)}\right)^{\frac{1}{2}} \tag{A.2}$$

and

$$N_{q_1}^{r_A} = n(1 - q_1)q_1((1 - q_1)q_1(1 - r_A))^{-\frac{1}{2}} \tag{A.3}$$

Using implicit differentiation with respect to m_0^A yields

$$
\begin{aligned}
&- \ln\left(\frac{1-q_1}{q_1}\right) Q_1^{-1}\,\mathrm{e}^{-n_B}\,\mathrm{I}_0(z) - \ln\left(\frac{1-q_1}{q_1}\right) Q_1^{-1}\,\mathrm{e}^{-n_B}\,Q_1^{r_A}\,\mathrm{I}_1(z) \\
&+ nq_1\,\mathrm{e}^{-n_A}\,\mathrm{I}_0(z)\frac{\partial r_A}{\partial m_0^A} + nq_1\,\mathrm{e}^{-n_A}\,Q_1^{r_A}\,\mathrm{I}_1(z)\frac{\partial r_A}{\partial m_0^A} \\
&+ \frac{1}{2}\left(\frac{1}{1-r_A}\right)\mathrm{e}^{-n_A}\,Q_1^{r_A}\,\mathrm{I}_1(z)\frac{\partial r_A}{\partial m_0^A} \\
&- n(1-q_1)Q_1^{-1}\,\mathrm{e}^{-n_B}\,\mathrm{I}_0(z)\frac{\partial r_A}{\partial m_0^A} - n(1-q_1)Q_1^{-1}\,\mathrm{e}^{-n_B}\,Q_1^{r_A}\,\mathrm{I}_1(z)\frac{\partial r_A}{\partial m_0^A} \\
&- \frac{1}{2}\left(\frac{1}{1-r_A}\right) Q_1^{-1}\,\mathrm{e}^{-n_B}\,Q_1^{r_A}\,\mathrm{I}_1(z)\frac{\partial r_A}{\partial m_0^A} + \mathrm{e}^{-n_A}\,\mathrm{I}_1(z)(-N_{q_1}^{r_A})\frac{\partial r_A}{\partial m_0^A} \\
&+ \mathrm{e}^{-n_A}\,Q_1^{r_A}\left(\mathrm{I}_0(z) - \frac{1}{z}\,\mathrm{I}_1(z)\right)\left(-N_{q_1}^{r_A}\right)\frac{\partial r_A}{\partial m_0^A} - Q_1^{-1}\,\mathrm{e}^{-n_B}\,\mathrm{I}_1(z)\left(-N_{q_1}^{r_A}\right)\frac{\partial r_A}{\partial m_0^A} \\
&- Q_1^{-1}\,\mathrm{e}^{-n_B}\,Q_1^{r_A}\left(\mathrm{I}_0(z) - \frac{1}{z}\,\mathrm{I}_1(z)\right)\left(-N_{q_1}^{r_A}\right)\frac{\partial r_A}{\partial m_0^A} = 0
\end{aligned}
\tag{A.4}
$$

The first two terms in equation (A.4) are positive since $(1-q_1)/q_1 < 1$. Because $u^{s_A} = 0$, then terms 3-8 must be positive as the positive terms in u^{s_A} are multiplied by a larger factor than the negative terms. For n sufficiently large, terms 9-12 are also positive. To see this, first note that because $u^{s_A} = 0$ and $\mathrm{e}^{-n_A} > \mathrm{e}^{-n_B}$, it must be the case that

$$
\mathrm{e}^{-n_A}\,\mathrm{I}_0\left(z\right) - Q_1^{-1}\,\mathrm{e}^{-n_B}\,\mathrm{I}_0\left(z\right) > 0 \tag{A.5}
$$

and

$$
\mathrm{e}^{-n_A}\,\mathrm{I}_0\left(z\right)\mathrm{e}^{-n_A}\,Q_1^{r_A}\,\mathrm{I}_1\left(z\right) - Q_1^{-1}\,\mathrm{e}^{-n_B}\,Q_1^{r_A}\,\mathrm{I}_1\left(z\right) < 0 \tag{A.6}
$$

With $\mathrm{I}_0(z) > \mathrm{I}_1(z)$ and n sufficiently large, it follows that terms 9-12 in equation (A.4) again consist of positive terms multiplied by a larger factor than the negative terms. Therefore, taken as a whole, the result is $\frac{\partial r_A}{\partial m_0^A} < 0$. □