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Pointless?

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POINTLESS?

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Acknowledgments

1   Introduction

A fundamental question in politics that has no conclusive answer to this day is whether or not campaign expenditures are pointless. Determining the role of campaign contributions and spending in elections is important for formulating campaign finance reform policy and also for understanding the public choice economics behind elections. Politicians seem convinced that money is an important component in any successful election as illustrated by numerous fundraisers and lofty goals of raising $1 billion for presidential campaigns, yet the empirical research on money's role in elections has not reached a consensus. This project seeks to further explore the relationship between money and a candidate's probability of winning an election using panel data econometric techniques and high frequency data from the 2008 U.S. Senate elections.

The earliest econometric studies of elections and money come from Jacobson (1978). However, his model and the many studies that followed suffer from a significant omitted variable bias by failing to adequately account for variations in candidate quality. Levitt (1994) tried to tackle the candidate quality problem by using a matched sample of candidates over two elections. In his study, Levitt concluded that money had no discernible effect on election outcomes. Since then, many researchers have challenged these findings, coming up with mixed results (Erikson and Palfrey 1998, Gerber 1998, Goldstein and Freedman 2000, Stratmann 2006, 2009, Jacobson 1985, 1990, 2006). Feigenbaum and Shelton (2010) point out one flaw in Levitt's study is that his work lacks external validity since repeat candidates already have an established name and reputation. Furthermore, empirical data shows that at least challengers in elections benefit from more money although incumbents are barely affected when using OLS models (Gerber 1998). Since then, researchers have not been able to conclusively determine if money has an unambiguous effect on elections after controlling for other factors. Most recently, Feigenbaum and Shelton study money in presidential primaries using methods similar to this project. Using data from the Iowa Electronic Market, IEM, and presidential primaries, they find evidence for a positive feedback loop between campaign contributions and likelihood of winning the election.

Similar to Levitt (1994), Feigenbaum and Shelton (2010) use panel data to solve the candidate quality measure problem. However, rather than analyzing the same candidates over two elections, Feigenbaum and Shelton are able to observe a candidate within an election cycle. Instead of using vote share as the dependent variable, this project will follow Feigenbaum and Shelton by using daily political prediction market data, which they treat as a real-time measure of the probability of winning the election due to the "winner-take-all" market structure of the IEM that pays a certain amount only if the event described in the

specific contract occurs (Wolfers and Zitzewitz 2004).

By observing the same candidate over an election period, one can observe the effects of changes in funding and spending on election probabilities without worrying about the effect of cross-candidate quality variation. Feigenbaum and Shelton's (2010) econometric method is to model two regressions based on the causal loop between campaign expenditures, contributions, and probability of winning in order to simulate what occurs during a campaign. This project will borrow these ideas but differ from Feigenbaum and Shelton by applying the method to Senate general elections from one election cycle rather than presidential primaries from the past decade and will also use data from Intrade.com rather than the Iowa Electronic Market. Applying Feigenbaum and Shelton's method to Senate races will hopefully yield different insights into money's role in elections due to the larger pool of candidates and focus on a single election cycle. The use of Senate elections for the analysis will ideally be a better indicator of any effect of money than presidential elections since Senate candidates need to establish a brand and possibly experience less diminishing returns due to lower expenditures. In addition, a potential problem with Feigenbaum and Shelton's work is that the elections they analyze straddle the enactment of the Bipartisan Campaign Reform Act of 2002, which obscures the role of money due to the changes in fundraising techniques.

Data on candidate contributions, available with a daily frequency, and expenditures, available quarterly, will be obtained from the Federal Elections Committee website. The ultimate goal is to understand and possibly rectify the discrepancy between academic research and the public's general consensus that money plays a large role in elections.

2   Literature Review

Campaign finance, especially campaign finance reform, has been a hot topic for political scientists and economists since the Federal Election Campaign Act of 1971 mandated campaign contribution and expenditure reports. Most recently, the focus has been on Political Action Committees, PACs, and their ability or inability to influence elections and legislative decisions. While there have been sensationalist stories of lobbyists lavishing Congressmen with perquisites, pinpointing the numerical effect of special interest contributions has been somewhat difficult. Stratmann (1991, 1998, 2002) argues that PACs influence legislative votes after examining farm and finance legislation. However, Ansolabehere et al. (2003) make many good points countering the claim. First, PAC contributions are limited to only $5,000 a year. Second, the average PAC contribution is less than $2,000, which is significantly below the maximum allowed contribution. And finally, individual contributions make up the bulk of a campaign's funding. Given that a single candidate may have thousands of individual

donors, it is highly unlikely that a single donation will provide special privileges. Instead, most contributors may donate to express their opinion and participate in the election process outside of voting. Furthermore, Ansolabehere et al. point out that the numbers simply do not make sense from an investment point of view. Given that legislation can bring billions in subsidies, why aren't organizations competing with each other for the enormous rents, which would increase the number of PAC contributions due to competition? The conclusion Ansolabehere et al. reach is that there simply is no well-defined method by which groups are compensated for political contributions.

While the role of PACs is an interesting topic, one should take a step back since a major unresolved problem in the field is whether money matters at all in the first place, which still lacks a definitive answer after 30 years of debate. Jacobson (1978) formed the foundation for the empirical investigation of money's role in elections. Utilizing the first reliably collected data on election expenditures due to the establishment of the Federal Election Commission in 1971, Jacobson analyzed a cross section of the 1972 and 1974 U.S. House and Senate elections, investigating the effect of campaign expenditures on election results. Jacobson recognized a simultaneity problem when using an Ordinary Least Squares, OLS, regression, preferring to use a Two Stage Least Squares, 2SLS, regression using party, challenger party strength in the given district, previously holding office, years as an incumbent, and running in a primary election as instruments under the assumption that these factors are exogenous variables. Using this method, Jacobson found that although spending by challengers had a clear positive and significant effect on the challenger's vote share, incumbent spending had a negligible impact and was statistically insignificant, which has been repeatedly demonstrated in various ways since the initial paper (Jacobson 1985, 1990, 2006, Stratmann 2006). This finding was incredibly perplexing at the time since it flew in the face of the obvious fact that incumbent candidates spent money during elections. Were incumbents irrational? Uninformed? It is hard to believe that the successful candidates, having won an election, could drastically misunderstand how they won the election.

Although it is important that Jacobson (1978) realized the simultaneity problem inherent in campaign finance regressions, his 2SLS regression was unconvincing since one could easily argue his instruments were inadequate. For instance, Green and Krasno (1988) make the observation that Jacobson's first stage regression barely accounts for the variation in expenditures for challenger and incumbent. In addition, another weakness of Jacobson's method was the use of a linear specification for expenditures, which prevented the possibility of diminishing returns. However, a more important criticism of Jacobson's initial work is that he failed to account for candidate quality, which is a key consideration for all future works studying campaign finance. By omitting quality, Jacobson neglected an important posi-

tive influence on vote share and also the candidate's ability to fundraise and spend money, which would lead him to underestimate the role money has for incumbents and overestimate money's effect for challengers.

To solve the omitted variable bias involving candidate quality, Green and Krasno (1988) created a metric for challenger quality on a scale from 0 to 8 based on factors such as prior political office, occupation, and fame. Green and Krasno found that incumbent spending had a significant effect that was much larger in magnitude than Jacobson's (1978) results. Since then, many researchers have reached the same conclusion that both challenger and incumbent spending are important determinants in election performance (Erikson and Palfrey 1998, Gerber 1998, Goldstein and Freedman 2000, Stratmann 2009). One might call this the common sense conclusion. To the average person on the street, this is the expected result. In fact, most might consider the question of whether money matters in elections a dumb question; of course money matters. Unfortunately for those believing the common sense result, there are criticisms that lead to an even more absurd finding.

Despite the innovative approach of adding in challenger quality and realizing that diminishing returns for expenditures was a useful respecification of the model, Levitt (1994) pointed out that the regressions with quality barely changed the total amount of variation explained, echoing Green and Krasno's (1988) criticism of Jacobson's poor instruments. Levitt postulates that creating an effective measure of candidate quality may be impossible given the complexity involved. For instance, presidential candidate Barack Obama was a relatively inexperienced junior Senator at the time of his presidential campaign yet managed to win it all. How could one possibly capture the charisma and talent that helped lead him to victory? Regardless, Green and Krasno demonstrated that candidate quality was a factor in elections and should not be ignored for cross-sectional data in addition to changing the functional form of expenditures. Given the empirical work showing that candidate quality is important yet not easily estimated, one might think the literature would have reached a dead end. Fortunately, Levitt realized a beautiful solution to the problems involving campaign finance analysis: panel data.

Levitt's (1994) paper used a sample of U.S. House elections from 1972 to 1990 comprised entirely of elections in which both candidates participated in two consecutive elections. By looking at the first differences between the elections, Levitt was able to drop the fixed effects of each race, candidate quality and district quality in particular. Remarkably, Levitt found coefficients with small magnitudes and no significance and could not reject the null hypothesis that his model explained no variation in vote share, even when using models with diminishing returns for expenditures. Levitt tried numerous methods, such as breaking up the data into two time periods and using a Chow test to see if some temporal change existed

or only considering competitive races defined as elections in which the challenger spent at least $10,000, but still could not find a discrepancy to explain the lack of significance for his variables. The simple fact was that removing district and candidate fixed effects accounted for 95% of the variation in candidate success, leaving little else for any variable to explain. If one believes Levitt's results, the implications for elections would be earth-shattering. In essence, money would be meaningless in elections. The only competition in elections would be based on the specific qualities of each candidate. Furthermore, the numerous campaign finance acts passed since the 1970's would become an exercise in bureaucratic frivolity. However, none of this has actually occurred so there must be something missing in Levitt's findings.

Although Levitt's (1994) findings were shocking given the conventional wisdom that money is needed to win elections, Levitt's work has not escaped criticism. The use of only elections with repeat challengers is especially problematic, as Feigenbaum and Shelton (2010) mention, since it leads to bias and a lack of external validity. In cases where there is a repeat challenger and an incumbent, it is hard to expect the challenger to perform any better in the next election since such an election is likely for a safe seat in Congress and by the second repeat election a candidate's "brand", i.e. name recognition and prestige, are already settled. Although flawed, Levitt's contribution to the literature was invaluable in prompting future researchers to consider methods of dropping the fixed effects involved in an election.

The most recent breakthrough in campaign finance literature is the use of panel data in order to ignore the fixed effect of candidate quality without suffering from the problems associated with Levitt's findings. Jacobson (2006) follows the panel data trend by using the National Annenberg Election Survey, NAES, as a measure of candidate success. Similar to his 1978 paper, Jacobson fails to see any impact or significance for incumbent spending. In addition, Jacobson concludes that rather than directly decreasing an incumbent's vote share, challenger spending impedes the increase in vote share an incumbent experiences over time as people begin to realize that the candidate is no longer a credible challenge to the incumbent. More recently, Feigenbaum and Shelton (2010) have performed research using panel data with daily frequency. Feigenbaum and Shelton use presidential primary contract prices from the Iowa Electronic Market as a measure for the probability of a candidate's success. They perform two regressions, IEM contract price on lagged expenditures and campaign contributions on lagged IEM contract price, which avoid identification and simultaneity problems due to the lags. Finding significance for both regressions, they then created a model to simulate the role of money in presidential primaries. These simulations of the feedback loop included random shocks and the results allowed Feigenbaum and Shelton to conclude that the feedback mechanism cannot solely sustain a frontrunner candidate while it is possible

for a candidate to spend a large quantity of his or her own money to become a frontrunner. While fascinating and an inspiration for this project, one problem with Feigenbaum and Shelton's findings is that they used data from presidential primary elections from the late 1990's and as recently as 2008. Although the nature of panel data allows certain fixed effects within an election to be stripped from the regression, it is possible that changing campaign finance laws, e.g. the Bipartisan Campaign Reform Act of 2002, could lead to a change in effects across elections, which Feigenbaum and Shelton might ignore. By using data from only one election cycle, such inter-temporal effects over a long period of time would not affect the regression. Even with this criticism, Feigenbaum and Shelton's work is significant for introducing the use of prediction markets as a method of measuring the effects of money in elections.

In light of all this research, there is a small niche to fill that will hopefully add to the debate regarding the role of money in elections. First, using panel data will drop the issue of candidate quality that plagued earlier research before Levitt (1994). In addition, this project improves on Levitt's method by using electronic prediction markets to allow for a less biased form of panel data. However, all this merely leads to Feigenbaum and Shelton's (2010) work with presidential primaries using the Iowa Electronic Market. This project will instead focus on the U.S. Senate in only one election cycle, 2007-2008. Applying Feigenbaum and Shelton's method to Senate elections will offer an interesting comparison to other studies on money's role in Senate elections, such as Jacobson (2006) and Gerber (1998), and offers a good opportunity to analyze money's effect without the distortion of diminishing marginal returns when spending $100 million on a campaign. Furthermore, using Senate elections not only allows for a wider pool of candidates and variation, but also prevents long-term effects due to policy changes from affecting the results.

3 Data and Method

The data used in this analysis is comprised of prediction market data from Intrade.com and campaign finance data, in U.S. dollars, from the Federal Election Commission website, fec.gov. The FEC provides a multitude of data for each candidate on contributions and expenditures, even going as far as describing each contribution by name, address, and amount. The prediction market data is in the form of a daily contract price where the contract pays $10 if the candidate specified in the contract wins his or her election. However, although the contract pays $10, the contract price is reported as a number of points, where each point is worth $0.10, leading to a scale from 0 to 100. Wolfers and Zitzewitz (2004) categorize such a contract construction as "winner-take-all", which allows the price to be treated as

the probability of victory for the specified candidate.

An important issue in regards to prediction markets is whether or not a prediction market correctly estimates the probability of an event occurring. Using Inkling Markets to run a prediction market on boat races, Christiansen (2007) found that small volume markets were still surprisingly accurate and that even markets with small probabilities of success were somewhat accurate based on the expected number of rare event occurrences matching what actually occurred. From his empirical data, Christiansen concludes that a market with 16 traders is sufficiently calibrated even though one third of traders trade exactly once and over half only trade in one direction, i.e. only buying into a market.

Intrade markets do not specify how many traders participate in a market, so some estimation is needed to determine which markets should be included. Using a cutoff of 16 trades in determining which markets to include, the prediction market data follows 26 candidates in 13 races for the U.S. Senate in 2008. Both the Democratic and Republican candidates are represented for the states of Alaska, Colorado, Georgia, Kentucky, Louisiana, Minnesota, Mississippi, New Hampshire, New Mexico, North Carolina, Oregon, Texas, and Virginia. The Senate races for Alabama, Arkansas, Delaware, Idaho, Illinois, Kansas, Maine, Massachusetts, Michigan, Montana, Nebraska, New Jersey, Oklahoma, Rhode Island, South Carolina, South Dakota, Tennessee, West Virginia, Wyoming, and the race in Mississippi between Thad Cochran and Erik Fleming are excluded due to a lack of trading volume.

One problematic part of the Intrade data is the Minnesota election between Norm Coleman and Al Franken. This election resulted in multiple recounts continuing into the next year, which extended the contract beyond all other election contracts included and inflated the number of trades. Despite this issue, before the election this contract was expected to end on Election Day so the data is still useful up to Election Day for this project's purpose. The Senate race in Georgia also exhibited a less severe case of this problem due to a run-off election that followed in December. On account of the the anomalous nature of these two races, robustness checks will be performed that exclude this data.

One weakness of the project is the relative paucity of data. While 13 Senate elections are represented in the dataset, there are still 20 other races not included. The main reason why Intrade data does not exist for these other candidates is a lack of interest in the market, likely due to these races involving seats considered safe for one political party. Such a problem could bias the data set in favor of races that are more contested than others, which typically have higher amounts of campaign spending. One cannot control such a selection problem by adding an additional control variable because the data on elections that are not credibly contested simply does not exist. However, the elections included in this study may in fact be the elections of most interest to questions of whether money matters in elections since

elections involving incumbents may hide the role of money behind a cloud of other effects, such as the established brand of an incumbent decreasing the need for any spending at all.

Another problem is the unreliability of the disbursement data, which was reported less frequently than the contributions data. Expenditures are typically reported quarterly but the FEC requires candidates to also file a report on expenditures two weeks before the election and approximately twenty days after Election Day, which causes a nontrivial mismatch between the data measuring candidates' probabilities of winning and expenditures. This introduces two issues when using the FEC's expenditure data. First, the less-frequent reporting requirement for expenditures is an aggregate of spending from the previous reporting date, which hinders the ability to accurately pick up the marginal effect of money when paired with the daily frequency of the Intrade data. The second issue is that two elections, Minnesota and Georgia, continued after November 4, which challenges the assumption that candidate spending ceased after Election Day. Robustness checks will be utilized to see if those races significantly impact the results of the analysis.

As an additional robustness check for the Intrade analysis, we also use estimates for a candidate's probability of victory derived from polling data provided by Nate Silver on the website fivethirtyeight.com. Nate Silver's data aggregates polling data approximately every week starting in July 2008 into a probability of a candidate winning his or her election. Although similar in form to the Intrade data, Silver first takes raw poll data from numerous agencies, such as Rasmussen Reports and SurveyUSA, and creates a weighted polling average. Using that value, he runs a regression controlling for other factors, such as the Partisan Voting Index, incumbency, and the political party composition of the relevant state's voting body. Silver then runs 100,000 simulations with slight tweaks, e.g. giving a certain party a small boost in the poll value, before arriving at a candidate's probability of winning the election (Silver 2010). This data can be used as a measure of a candidate's current success that is more reliable than unaltered poll data due to the numerous repetitions and randomness in Silver's method.

One drawback to Silver's work is the inconsistent frequency of his predictions. At one point, no predictions were made for ten days due to a business trip while the frequency increases to a prediction every one to four days as the election nears. This causes problems when analyzing the effect of expenditures on Silver's poll data because the lag on expenditures would not remain consistent for regression purposes. To solve this issue, the next available estimate from Silver was used as the estimate of a candidate's probability of winning for the day following the reporting of expenditures. This introduces noise when estimating the effect of disbursements since the actual reporting date of the poll-derived data ranges from three to six days later.

Using the Intrade data as a dependent variable, a panel data regression will be run using expenditures to estimate the effect additional spending has on a candidate's likelihood of winnings. For all regressions, the relevant independent variables will have a one-day lag in order to avoid identification and simultaneity problems that would bias the results due to endogeneity. The Intrade or poll data versus expenditure regressions are then of the form:

$$y_{i,t} = \beta_1 x_{i,t-1} + \beta_2 x_{i,t-1}^2 + \beta_3 x'_{i,t-1} + \beta_4 x'^2_{i,t-1} + a_i + u_{i,t} \tag{1}$$

where $y_{i,t}$ is the ith candidate's probability of winning at time t, as measured by either Intrade price or poll-derived data, $x_{i,t-1}$ is the candidate's own expenditures at time $t-1$, $x'_{i,t-1}$ is the opponent's expenditures at $t-1$, a_i represents the fixed effects, and $u_{i,t}$ is an error term. Quadratic terms for both expenditure variables are included to account for diminishing marginal returns in expenditures. Intrade prices exhibit an AR(1) signature but the structure of the data prevents the inclusion of autoregressive terms. The poll-derived data did not include enough observations to determine autoregressive behavior.

In addition, another regression will use lagged Intrade data or poll-derived data as an independent variable to estimate how the perceived viability of a candidate affects contributions, which is the dependent variable. The form is similar to the previous regression except $y_{i,t}$ is instead the contributions received by candidate i at time t and the only dependent variable is the candidate's probability of winning at time $t-1$, $x_{i,t-1}$. For this regression, contributions showed no clear autoregressive signature and the logarithm of contributions will be used to linearize the monetary value of contributions, leading to the regression:

$$\ln(y_{i,t}) = \beta x_{i,t-1} + a_i + u_{i,t} \tag{2}$$

4   Results

Table 2 summarizes the regressions specified in (2). One interesting result was that a candidate's probability of winning has a statistically significant positive relationship with contributions. One might consider this a bandwagoning-effect as contributors want to be associated with the winning candidate, similar to conclusions reached by Feigenbaum and Shelton (2010) and Brown Jr. et al. (1995). An interesting aspect of this particular regression was that the estimate on the coefficient for the likelihood of winning differed by a factor of three between the poll-derived data and Intrade prices. Due to the specification of the regression, a one-unit increase in the relevant independent variable raises contributions by a percentage equal to 100 times $\hat{\beta}$. Thus, a one-point increase in Intrade price is estimated to increase

contributions by 0.5% while an increase in the poll-derived probability of winning of one percentage point is estimated to raise contributions by 1.6%.

While the exact reason for the discrepancy between two supposedly equal measures may not be certain, there are a few possible explanations. One, it is possible that each is measuring a slightly different bit of information. Although we treat both numbers as the percentage chance each candidate has of winning the election, each was formulated in a different manner. The most likely suspect is the difference in frequency between the two sets of data used. With the Intrade data, which had a daily frequency, large variations in price could occur in one day due to a significant event but contributions may not increase by a large amount the next day compared to the previous day. In contrast, the poll-derived data had observations every few days or weeks. When comparing one data point to the other in the poll-derived data, any trends are amplified more than the daily frequency Intrade data. For example, suppose a candidate received contributions of \$1,000 on both day n and day $n + 1$, but his Intrade price fell by 10 points on day n. In contrast, the poll-derived data that most closely matches that period may only have observations on days n and $n + 9$, by which time contributions have fallen to \$500 to reflect the general downward trend of the candidate. In such a case, regression analysis using a daily frequency would underestimate the effect of the fall in Intrade price because of an inappropriate lag while the poll-derived data would pick up the effect of the lower probability of winning. However, finding the appropriate lag when using daily data is somewhat unfeasible since it is not likely a one-size-fits-all lag.

Another possible explanation is that the sample of people involved in formulating the data likely varied. An important issue in prediction markets is the question of who actually participates, specialists or amateurs? While the identity of participants is not revealed, we can speculate on possible mechanisms by which the composition of Intrade participants may affect the results. If we suppose experts are the people participating in the prediction markets, it could be that they are acting on information not generally known. This would cause larger fluctuations in Intrade price but the major source of campaign contributions, private individuals with unspecialized knowledge, would not drastically change contributions because the experts' information is not known to them. If contributions remain relatively stable while Intrade prices move more dramatically compared to polling data, which instead relies on the general public's unspecialized knowledge, the effect of price on contributions would be lower than the effect of the poll-derived data. Looking at it from the other direction, one might think that poll participants only change their answers when significant events occur. Such after the fact behavior would amplify the perceived role of polling data since poll participants are simply reacting rather than predicting a candidate crashing and burning or having an unexpected surge.

A final relevant point is that one might trust Nate Silver's data as more accurate than Intrade data due to the sheer number of simulations run in estimating probabilities of victory even in light of the fact that prediction markets often outperform raw poll data in regards to variance (Wolfers and Zitzewitz 2004). On the other hand, Erikson and Wlezien (2008) find that polling data that has been properly discounted and modified outperforms prediction markets. Furthermore, from a statistical point of view, even if the polls Silver uses are a somewhat noisy measure of political popularity, if the polls are an unbiased measure of a candidate's probability of winning, most of the noise should be removed by the Monte Carlo method utilized. Thus, it might be the case that the Intrade price is a biased measure of probability of winning in this case, leading to the discrepancy.

For the regressions investigating the relationship between probability of winning and expenditures, most of the variables were not statistically significant (Table 3). However, a candidate's expenditures did have a statistically significant effect on Intrade price at the 90% level. To put it into perspective, the coefficient estimates that a $1 million increase in expenditures during a reporting period would increase the candidate's price on Intrade by 8.03 points, ignoring the negative quadratic term. In fact, if we ignore the quadratic term's insignificance, we can say that the turning point, i.e. the dollar amount where extra spending begins to negatively affect Intrade price, occurs at approximaltey $5.1 million. Although one might question whether more spending could ever hurt a candidate, the turning point occurs at an amount most candidates do not reach in a single reporting period. Another interesting point is that despite the other variables lacking significance, they all exhibit the signs one would expect using conventional wisdom for both the price and poll-derived regressions. In particular, for a candidate's own expenditures, the coefficients indicate that there is a postive effect with a parabolic shape demonstrating diminishing marginal returns for expenditures. Similarly, an opponent's spending has a negative effect on a candidate's probability of winning but that effect gradually diminishes as the opponent spends more and experiences his own diminishing marginal effect on the candidate.

Although the regressions involving expenditures showed some statistically significant results, there are two problems with accepting the results without any reservations. First, the amount of data available was not optimal. This problem is particularly relevant to the regression involving price since Intrade price showed a clear AR(1) signature. Unfortunately, there was simply not enough data to perform a regression with an autoregressive term. The second issue is that the expenditure measurement is an incredibly noisy measure of expenditures and, by extension, advertisements and campaigning, which is what one really wants to measure. Due to the poor measurement of expenditures, the standard errors reach a level where significance is hard to conclude. Ideally, one would like to imitate Stratmann's (2009)

method of normalizing by the regional cost of advertising but such a task requires research beyond the scope of this project.

As a robustness check, the same regressions using Intrade price were performed on the data after excluding the races from Minnesota and Georgia due to their extended campaigning and expenditures beyond November 4. As shown in Tables 4 and 5, omitting these candidates did not change the conclusions reached using the previous analysis of the entire data set. For the regressions involving contributions as the dependent variable, the coefficient on Intrade price remained statistically significant at the 99% level but fell by about 20% in magnitude. Interestingly, the coefficient of a candidate's own expenditures remained significant at the 90% level and actually increased by roughly 25%. The increase in the effectiveness of expenditures is likely due to the fact that the dropped candidates were excluded specifically because their spending was overestimated due to the November 24 filing date for general election expenditures. By omitting those candidates, the variation in expenditures for the sample falls while maintaining approximately the same variation in Intrade price so the effect of expenditures becomes more pronounced.

5   Conclusion

Beginning with Jacobson (1978), scholars have attempted to use econometrics to answer a question with a seemingly obvious answer: is there any point in spending money during a political campaign? Although this project was not able to conclusively decide whether money matters in elections, the research is one step closer to a more refined answer. Using a panel data regression method pioneered by Feigenbaum and Shelton (2010), data from the prediction markets of Intrade.com and poll-derived data from Nate Silver was used in conjunction with campaign finance data from the Federal Election Commission for the 2008 U.S. Senate elections. While we do not find a link between spending money and the probability of winning elections, the positive relationship between a candidate's perceived chance of winning and the contributions he receives is still an important result. Moreover, a key distinction must be made that this study only considered the expected results of an election instead of the actual result. However, during an election the final result is not absolutely certain so research such as this has a role in analyzing behavior and forming policy suggestions during an election cycle.

From the data, it is estimated that a one-point drop in a candidate's probability of winning can decrease contributions between 0.5% and 1.6%. However, whether or not such an effect is a critical factor is debatable. For example, if a candidate has a five-point fall in his perceived probability of winning in one day, contributions are estimated to decrease

between 2.5% to 8%. For the average candidate who receives approximately $15,000 a day, that's only a drop in daily contributions by $375 to $1,200. Although that amount will add up over the entire election cycle, it is not particularly common to have such a large change in probability of winning persist early in the campaign season. Instead, candidates trend up or down gradually as election day approaches and the uncertainty in the likely victor diminishes. This type of trend would tend to lessen the change in contributions. To illustrate, suppose two candidates each receive $100 a day normally. Candidate A's probability of winning falls by 5 percentage points on day 0, so contributions fall 8% to $92 per day. Over the next two days, Candidate A has $16 less than usual due to his lower probability of winning. Now consider candidate B, whose probability of winning falls 2.5 percentage points on day 0 and also on day 1. Initially, Candidate B's contributions fall to $96 and on the second day he receives $92.16, for a total loss of only $11.84. By day 2, both candidates have experienced the same five-point decrease in probability of winning, yet Candidate B has only lost 74% as much as Candidate A in contributions. Similarly, gradual increases in Intrade price or poll-derived data also diminish the gains a candidate would experience in contributions relative to one large surge. Although it is undeniable that the probability of winning has a tangible effect on contributions, there are likely more important determinants of contributions that are captured in the fixed effects, as indicated by the low within R^2 value of 0.002 and 0.02 for each of the relevant regressions.

If one were to accept the regressions involving Intrade price or Nate Silver's measures and expenditures as meaningful, there are a few interesting points regarding the statistically significant explanatory variable. First, a candidate's own expenditures does have a positive relationship with at least one measure of a candidate's chances of winning, Intrade price. Given the average candidate's spending of $1.41 million in a reporting period, he can expect that $1.41 million to raise his Intrade price by 9.77 points if we include the squared expenditure term but before taking into account the effects of other factors. Despite the lack of significance, it is important that the terms involving opponent's expenditures indicate that spending by an opponent decreases a candidate's chances of winning with diminishing returns since it indicates that the main issue preventing significance may be high standard errors. Interestingly, the magnitude of the effect of opponent's expenditures is roughly half as large as a candidate's own expenditures when considering Intrade price. This is in contrast to the regression using the poll-derived data, which has coefficients of equal magnitude but opposite sign. The reason for such a result using the poll data is the zero-sum construction of the poll data. Unlike Intrade prices, which had slight differences such that the sum of a single race's prices was not necessarily 100, Nate Silver's predictions had to sum to 100% for each race so it is not surprising that the coefficients mirror each other.

Unfortunately, a more accurate conclusion regarding the expenditure data is that the problems involving the data were too much to overcome in this study. Between the lack of data, no more than four observations per candidate, and the noise due to the quarterly reporting requirement, the expenditure regressions simply did not have the substance to make statistically significant inference. Although there is some evidence that expenditures by opponents lowers a candidate's probability of winning the election, such a relationship must be taken with a grain of skepticism due to the data issues. However, rather than conclude that the lack of significance indicates that money indeed has no effect on elections, we must instead defer making such claims due to the unsatisfactory data.

Despite these issues, there is much promise for the future. One further step to take would be to follow Stratmann (2009) by normalizing expenditure values by the cost of advertising in a candidate's relevant media markets. In addition, the FEC has recently created a Disclosure Database starting with the 2010 election cycle that provides detailed expenditure data similar to contribution data. Stratmann's method was able to remove a significant portion of the noise in expenditure data and having spending data broken down into what it was spent on exactly should remove even more noise, allowing for more accurate measures of money's role in elections. However, an issue that complicates the entire picture is the recent Supreme Court case, *Citizens United v Federal Election Commission*, which recently lifted restrictions on campaign spending by certain third parties. Such spending is not necessarily directly monitored by the FEC, causing a large deal of measurement error since not all advertisements in support of a candidate are accounted for. While this may seem like one leap forward followed by a gigantic leap backwards in regards to the data available for this research topic, we are optimistic that improvements can be made with the new wealth of data that may hopefully answer the question of whether or not money is pointless in elections.

6   References

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7 Appendix

Table 1: Descriptive Statistics

	Mean	SD	Min	Max
Daily Contributions	14915.73	27406.06	0	1391275
ln(Contributions)	8.68	1.51	0	14.15
Price	47.99	25.13	0	99.1
Poll	49.33	36.53	0	100
Expenditures	1.41×10^6	1.42×10^6	0	6.40×10^6
Opponent's Expenditures	1.35×10^6	1.45×10^6	0	6.40×10^6
Total Volume$_{\text{No MN, GA}}$	621.1	399.8	135	1,873
Trades$_{\text{No MN, GA}}$	62.4	33.8	16	161

Table 2: Contribution and Probability of Winning Regressions With Full Dataset

	ln(Contributions)	
	(1)	(2)
Price$_{t-1}$	.005***	-
	(.001)	
Poll$_{t-1}$	-	.016***
		(.006)
Constant	8.451***	8.172***
	(.068)	(.317)
N	7252	368
R^2 Within	.002	0.02
R^2 Between	0.282	0.008

Table 3: Probability of Winning and Expenditure Regressions With Full Dataset

	Price	Poll
	(1)	(2)
Expenditures$_{t-1}$	8.03e-06*	2.81e-6
	4.69e-06	4.72e-06
Expenditures$^2_{t-1}$	-7.81e-13	-2.49e-13
	7.24e-13	6.87e-13
Opponent's Expenditures$_{t-1}$	-4.14e-06	-2.81e-06
	4.50e-06	4.72e-06
Opponent's Expenditures$^2_{t-1}$	2.52e-13	2.49e-13
	7.20e-13	6.87e-13
Constant	46.167***	50***
	2.966	5.275
N	131	100
R^2 Within	0.051	0.013
R^2 Between	0.423	0.516

Table 4: Contribution and Probability of Winning Regressions With Restricted Data Set

	ln(Contributions)	
	(1)	(2)
Price$_{t-1}$	.004***	-
	(.001)	
Poll$_{t-1}$	-	.017***
		(.007)
Constant	8.443***	8.013***
	(.071)	(.363)
N	6374	309
R^2 Within	.002	0.02
R^2 Between	0.493	0.007

Table 5: Probability of Winning and Expenditure Regressions With Restricted Data Set

	Price	Poll
	(1)	(2)
Expenditures$_{t-1}$	1.02e-05*	2.57e-06
	5.20e-06	5.41e-06
Expenditures$^2_{t-1}$	-1.20e-12	-2.54e-13
	8.42e-13	8.02e-13
Opponent's Expenditures$_{t-1}$	-5.51e-06	-2.57e-06
	5.10e-06	5.41e-06
Opponent's Expenditures$^2_{t-1}$	3.94e-13	2.54e-13
	8.37e-13	8.02e-13
Constant	46.554***	50***
	3.152	6.095
N	118	86
R^2 Within	0.057	0.008
R^2 Between	0.433	0.5062