# Vote production functions: An analysis of campaign expenditures and election outcomes in North Carolina

J. Brett Joyal
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East Carolina University
Department of Economics
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**Abstract**

This study analyzes the effects of campaign expenditures on electoral outcomes in North Carolina using data from the 1998 and 2000 state House and Senate elections. Two hypothetical vote-production models are proposed and tested. Results reveal a statistically significant relationship between expenditure levels and vote totals. The appropriate vote production model and an estimate of the price of a vote in North Carolina are also identified.

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## Introduction

American society, it seems, is being bombarded with new and increasingly complex problems. Along with the traditional cornerstones of national discomfiture, such as economic malaise, faltering educational systems, corporate malfeasance, fractious social divisions, and war, we now must confront the sweeping affects of globalization, an embattled healthcare system, pandemic terrorism, the uncertainties of bioengineering and genetically modified foods, pending catastrophic climate changes, and a questionable future for the vitality of the social security system. Today, possibly more than ever, the need for leaders endowed with the aptitudes and abilities to address our most pressing concerns has reached a zenith. Yet the integrity and efficiency of the process by which public officials are elected is at its most controversial moment. Mounting discontent with our electoral system is becoming systematically examined and recorded.

In a March 2001 nation-wide survey conducted by Ohio State University (Grabmeier, 2001), researchers found that seventy-percent of those surveyed wanted to change or replace the current system of financing political campaigns. The issue of campaign finance reform was identified within the study group as one of top or high priority when reforms were proposed to either "give everyone an equal voice in politics", or to "reduce the role of money in politics." The role of money in the electoral process was the most significant concern among the participants, with 84 percent of all surveyed choosing spending limits for U.S. Congressional candidates as their most preferred reform. The second most popular reform, with 83 percent approval, was to increase the percentage of funds U.S. Congressional candidates were required to raise in their own states.

The Ohio State study provided two additional findings of interest. One, reform was most strongly favored by those who reported being political independents. The importance of the independent voting block has been steadily rising for the last three decades. Their strong support for

campaign finance reform in part explains why it's a recurring political issue. The level of partisanship is somewhat mixed - Democrats supported reform slightly less than independents, and Republicans generally opposed reforms. The second interesting finding was that the more a respondent knew about the campaign funding process, the more they supported reform.

Overall the study suggests that the American public strongly perceives that money has a significant impact on the election process; they view the effect negatively and feel it reduces equality of voice; the majority favored those reforms that limit the affect of money on elections.

One glaring question that stands out in light of the study's conclusions is why does it matter if money influences election outcomes? Suppose money does partially determine which candidate wins a race. Does that necessarily connote the negative effect on the democratic system that the public apparently possesses?

Another question originates from an examination of a political election as an economic forum, or marketplace. Anecdotal evidence on political campaign strategies suggests there are two basic fund expenditure models for increasing vote totals. One is to spend money on efforts that increase the turnout of the constituency, the 'Turnout' strategy. The other is to expend funds on efforts that lull voters away from one's opponent, the 'Swing Vote' strategy. The empirical question is which vote production model best describes candidate expenditure decisions?

This paper proceeds with a theoretical discourse that, using simple economic concepts, explores potential consequences arising from an electoral system that allows money to significantly affect the outcomes of a political race. In this regard no position on the subject is taken. What is sought is a theoretical explanation of the public's negative perception of money and elections. A review of the literature on the subject is presented with new avenues of inquiry providing guidance for the current study. The empirical portion of the paper presents two vote production models and OLS analyses of

campaign expenditures and election outcomes in the 1998 and 2000 North Carolina State House and Senate races.

The empirical results corroborate previous studies by demonstrating a positive and significant relationship between political candidate's level of expenditure and the number of votes he or she receives. Additionally, we find that on average, candidates for state House and Senate in North Carolina use the 'Swing Vote' strategy to maximize votes. Finally, we provide an estimate of the 'price of a vote' in North Carolina.

## Conceptual Analysis

Political philosopher Dennis F. Thompson identifies the essence of the modern electoral system in his book, *Just Elections*. "Prospectively, voters try to choose an acceptable representative from among the competing candidates, and retrospectively they try to hold the successful candidate and parties accountable in subsequent elections." (Thompson, 2002) The inclusion of the concepts of "competition" and "accountability" in Thompson's characterization hints at their importance in the election process. Were money to have a significant impact on an election, it would be most likely by affecting both the process of competitive selection for determining an election's field of candidates and ultimate winner, and the elected official's level of accountability to their constituency vis-à-vis policy and legislative actions.

Consider that elections are a public good. Elections fit the definition of a public good in that they are nonrival and nonexclusive. They are nonrival in that one person voting does not prevent another person from voting; nonexclusive in that all U.S. citizens have the right to vote regardless of religion, gender, race, or other demographic characteristic.

Further, voters are benefit maximizers. The benefit to a voter of a particular candidate's ascension to office varies by individual and encompasses a range of things such as pride of party affiliation, legislated income transfers, ideological dominance, community involvement, or favored representation for their particular segment of society. Individuals that perceive no inherent benefit to be derived from an election, or do not perceive a benefit great enough for the effort, simply do not vote. Once the decision has been made to go to the voting booth, however, a participant makes a rational choice for the candidate they perceive as most likely to maximize whatever benefit is inherent for them in that election. The sum of each individual's benefit from an election represents the election's net social benefit. It follows that the greater the level of social benefit attained from a particular candidate's election to office, the greater the value to society of the election's outcome. Society is made better off, therefore, when presented in each election with a candidate field consisting of those most able to maximize potential social benefit.

The forces of competition, assuming the process of field selection is determined competitively by ability to maximize social benefit, assure that this condition prevails. If money significantly impacts the likelihood of being elected, however, with all other factors held constant, then the competitiveness of candidate field selection based on ability is called into question. If on average the candidate who spends the most money wins office, then potentially the candidate field will not be determined by ability to maximize social benefit, but instead by factors like wealth or the capacity to fund a campaign.

Further, if the skills for acquiring personal wealth or raising campaign funds are not correlated with the skills for maximizing social benefit, then lower levels of social benefit from election outcomes are being realized. The same scenario applies to the quality of competition between two candidates chosen from the field to ultimately run in the race.

Once elected, a politician's level of accountability to, and action on behalf of, their constituency determines the level of social benefit derived from an election. Recall that most political races are won with narrow margins. Primarily due to ideological differences, it is impossible for the winning politician to represent the interests of the opposing party's voters as well as the candidate who lost. Such is the nature of America's "first past the post", winner take all electoral system. Yet the extent to which the newly elected official is accountable to his or her supporting constituency, and the extent to which they attempt to represent the non-supporting constituency, in part determines the level of social benefit derived from their tenure in office.

For example, from the perspective of maximizing social benefit, a particular district or state will achieve greater benefit levels from a representative that legislates with accountability to the 52 percent of the population that elected them and some percentage of the population that opposed them, than say, from a candidate who makes no effort to represent constituents from the opposing party, but further, legislates on behalf of only a select portion of his or her supporting constituents. This intuitively makes sense, but it is important to recognize that the former candidate is preferred from the perspective of maximizing social benefit because he or she represents the interests of a broader swathe of constituents. Essentially this is the goal of a democratic system.

If it is the case that money significantly alters election outcomes, and a candidate's electability is therefore some function of his or her level of campaign expenditure, then the possibility exists that an office holder's governing accountability is skewed toward the portion of the constituency with the greatest capacity to fund an election victory; an accountability orientation potentially yielding a lower level of social benefit than the one that treats all constituents as equal campaign donors with equal representation importance. In other words, the value of each constituent may not be equal and neither, then, is the value of his or her vote.

From the candidate's perspective, the role of money in the election process can be considered within the economic framework of a market. Candidates are analogous to companies competing in the electoral marketplace for consumer revenue, i.e. votes. Interestingly, the outcome of a political race results in a monopoly power outcome, with one candidate (company) awarded sole right to govern for that district for the duration of office. Again, such is the nature of America's political system. The interesting question stems from determining whether the process of attaining the seat of monopoly power is analogous to a competitive market, where the firm providing best service at lowest cost is awarded the monopoly contract, or if it is something else altogether.

Economists generally agree that consumers achieve higher benefit levels from competitive market outcomes than from monopoly outcomes. If it is shown that money significantly affects election outcomes, then entry into the race depends not on being the best at maximizing social benefit through governing skill, but on being able to pay the costs of entering and winning a campaign. Money, then, could represent a barrier to entry into the electoral market to those that cannot afford it, regardless of ability. The consequences become circular.

The social benefit maximizing theory of elections demonstrates undesirable consequences potentially arising from an electoral system that allows money and campaign expenditures to impact election outcomes and an official's term in office. Though this is only an intuitive framework examining one dimension of our electoral system, it is hard to argue against the assertion that democracy is best served by its' most qualified members. Or, that a district is better off when represented by an official who governs with regard to the interests of as many constituents as possible. But there are considerations omitted by the theory presented.

For example, many have proposed that the skills needed to fund, run, and win a campaign, whether with acquired personal wealth or raised funds, are highly correlated with the skills needed to

successfully execute the duties of elected office. Another excellent point highlights the difficulty of measuring the merits of such a social benefit maximizing theory through empirical testing: campaign funding and expenditures are potentially an endogenous component of a candidate's electability. The more electable a candidate is perceived to be by campaign donors, the more money they receive to spend on their campaigns. Identifying the catalyst of political victory is not easily identified because ability and expenditures are difficult to distinguish. Identifying corollary and causal relationships among voters, money, and election outcomes remains an important and challenging goal of empirical researchers.

## Literature Review

The literature pertaining to the effects of money on elections has expanded rapidly since the early 1970's and been gradually adopted as a fruitful research subject throughout the social sciences. The literature on money and elections shows a general acceptance of repeated studies that demonstrate a significant and positive relationship between campaign expenditures and vote outcomes. Alan Gerber cogently summarizes the status quo of research in his 1998 paper. "The canonical example of work in this literature is a regression of a candidate's vote level on some function of the candidate's spending levels and other variables relevant to the election outcomes" (Gerber, 1998). He describes the basic difference among 14 works referenced in his paper as model specification for "converting spending into votes (linear, quadratic, and logarithmic functions) and analyses of different types of campaigns" (House, Senate, state, national, etc.), (Gerber, 1998).

Pioneering work on the subject is unanimously credited to Gary Jacobson. Gerber quotes Jacobson, "The idea that the challenger's spending levels is what matters most for election results is repeatedly supported. Indeed, it is supported by results from almost every set of elections where the question has been tested." (Gerber, 1998).

Jacobson (1978, 1980) used 1972 and 1974 House and Senate campaign expenditure data and with OLS and 2SLS specifications, demonstrated a positive and statistically significant relationship between challenger spending and vote counts. Surprisingly, he found a negative relationship, sometimes significant, sometimes not, between incumbent spending and election outcomes. That the marginal product of spending for incumbents was negative, despite the fact that incumbents win 90 percent of the time, set off a dueling maelstrom of research.

Steve Levitt suggested that studies arriving at the conclusion that incumbent spending is negative are not using model specifications that account for two potentially significant biases: 1) High quality challengers will receive a high fraction of the vote, and therefore, beforehand, will receive and spend more money – causing an upward bias on estimates of spending effectiveness. 2) Incumbents tend to increase expenditures in response to a strong challenge – which will have a downward effect on the marginal productivity of their spending (Levitt, 1995). Levitt adjusted for the proposed biases and found there are no statistical differences between incumbent spending and challenger spending (Levitt, 1995). Levitt reasserted the finding that campaign spending has a significant impact on election outcomes. Peverill Squire points out in his excellent review of the literature that others (Green and Krasno, 1988, 1990) have expounded on Jacobson's work using models with greater sophistication, and likewise found that incumbent spending is significant and positive.

With this established, the research has begun to fine-tune the empirical analyses of political science and economic theories that explain vote maximizing behavior and the role of money in elections. Not only has this substantiated the prevailing argument that more money begets more votes, but it has also progressed the complex task of dissecting the interdependent relationships of variables affecting the election process. Two motivating questions of interest are: 1) how do candidates spend their campaign

funds to increase vote totals, and 2) is there a vote production model that describes campaign expenditures?

In his book *Congressional Elections*, Paul S. Herrnson provides the reader with the basic purpose of a campaign for political office. "Political campaigns are designed to communicate ideas and images that will motivate voters to cast their ballots for particular candidates" (Herrnson, 2000). Communications with the public serve a dual purpose. One is to compel people to actually exert the effort to go to the polls and vote. The other is to introduce the candidate and convince potential voters that he or she is the person to elect.

Herrnson also reveals a surprising fact about how candidates spend their money. Regardless of how much money a congressional candidate has to spend, they differ very little in how they apportion their budgets (Herrnson, 2000). Approximately 53 percent of a candidate's budget is spent on public communication. The remainder is spent on overhead costs.

Coyote and Landon conducted a study in 1995 to determine the effects of advertising on competition. They did this by using Canadian election data and examining the effects of competition on advertising decisions of political parties. Though we are more interested in candidate spending due to the candidate-centered nature of the U.S. election system, the party driven study still yielded relevant findings.

For one, the authors modeled the parties' attempts to maximize votes as an outcome of an optimization problem (Coyote, 1995). This supports the inclination to view candidates as firms seeking to maximize votes. They controlled for voter preference. And they compared expenditure differences across regions for three different parties.

Among their results was the finding that parties had different expenditure responses to changes in the level of competition. They also rejected the hypothesis that funds were randomly allocated among

constituencies. Further, they were unable reject the assumption that parties do not alter their expenditure choices in response to their competitors.

These findings have two not insignificant shortcomings for aggregating across elections. For one these data are from a Canadian political system that potentially differs markedly from that of the U.S. And second, the data explain decisions by parties, not those of individual candidates. Those concerns not withstanding, the Coyote and Landon findings are still useful because they modeled the parties as vote maximizing entities with budget constraints responding to given market conditions. Their findings suggest that, although congressional candidates apportion their budgets similarly, corroborating Herrnson, they have different strategies for how to spend their funds.

In his 1996 study, The Mobilization of the Congressional Electorate, Jackson describes the difficulty facing all studies of campaign expenditures and elections. “Mobilization of voters may be largely a by-product of the quality of candidates who decide to run for office and the amounts of money that they are able to raise and spend” (Jackson, 1996).

Jackson’s study was motivated by an earlier turnout study by Cox and Munger (1989). They hypothesized that campaign spending, in response to race competition, drove the electorate out, but that voters did not show at the polls just because the race was close. The authors used ‘82 election data, a non-presidential year, and modeled district turnout as a function of expenditures by House, Senate and Gubernatorial candidates. Included were measures of competition for each race type and quadratic terms for House competitiveness and expenditures for all types. Their finding was that both expenditure levels and the closeness of the race drove the voters out to the polls.

Jackson expanded on their theoretical framework. His model was similar to the previous study with alternative measures of competitiveness and a variable for candidate quality. He used 1988 and 1990 election data, thereby including a presidential year election into his study. Jackson’s study

presents stronger results than the '92 data used by Cox and Munger. His findings support Cox and Munger's original hypothesis that the primary catalyst for voter turnout is determined by campaign expenditure levels rather than the motivation of a close race (Jackson, 1996). In the House races in particular, Jackson found that both incumbent and challenger campaigns significantly affect voter turnout and that "action efforts, associated with large expenditures, translate into higher turnouts" (Jackson, 1996).

The Coyote and Landon (1989) paper suggest that parties utilize different advertising expenditure strategies. The Jackson (1996) paper provides evidence that expenditures do significantly influence vote mobilization. Together the two studies support the notion that two candidates in a political race for office will utilize different expenditure strategies to maximize their vote totals through advertising and vote mobilizing efforts. This paper aims to supplement the advancing body of research of money, voters and elections by proposing and testing two hypothetical vote production models that explain the expenditure behavior of North Carolina candidates.

## Conceptual Model

We utilize an economic analogy of an output-maximizing firm, subject to a budget constraint, operating in an electoral marketplace to evaluate alternative campaign expenditure models for maximizing vote totals. Like firms, politicians face a production function and a budget constraint. In the political context firms are candidates and output is votes. Vote maximizing behavior by candidates, then, is analogous to that of output maximizing by firms. This economic conceptualization is simplified by the fact that there are generally only two competing firms. Further, the firms face a budget constraint

in which we assume all of their funds are spent on campaign efforts. We developed two vote maximizing production models: the Voter Turnout Model and the Swing Vote Model

## Turnout Model

The strategy of turning out voters entails expending campaign funds on efforts to motivate voters from the candidate's party. These efforts include direct mailings, telemarketing, door-to-door canvassing, posters and lawn signs, billboards, and vanpools for transporting constituents to registration stations and voting booths.

The turnout model identifies expenditures consistent with the candidate trying to maximize the registered voter turnout of his or her party. Ideally the candidate will motivate one hundred percent of his or her registered constituents. The party preference of the voter is not affected by campaign expenditures, but the probability of voting is.

Expressed formally, the probability a registered voter participates in an election is a function of the expenditures of the two campaigning candidates:

$$Pr(V_i) = V(X_D + X_R) \qquad (1)$$

Where $Pr(V_i)$ is the probability that a registered voter participates, $X_D$ is campaign expenditures by the Democrat candidate, and $X_R$ is campaign expenditures by the Republican candidate.

The unconditional probability that a registered voter casts a Republican vote, $Pr(R_i)$, is the probability that the voter participates in the election multiplied by the conditional probability that he or she votes Republican, $Pr(R_i / V_i)$, denoted as:

$$Pr(R_i) = Pr(V_i)\, Pr(R_i \mid V_i) \qquad (2)$$

The candidate is constrained by the condition $X_R \leq C_R$, where $C_R$ is contributions to the Republican candidate's campaign. For simplicity, the Democrat expenditure, $X_D$, is taken as given for the Republican candidate. The goal of the Republican candidate under the voter turnout model then, is to maximize the turnout of registered Republicans:

$$Max\ E(R) = \sum_i Pr(R_i/V_i)\, Pr(V_i(X_D, X_R)) - \lambda(X_R - C_R) \qquad (3)$$

Further, let there be two types of voting individuals identified as R*, registered Republicans, and D*, registered Democrats. We make two assumptions concerning an individual's vote for a candidate given the voter's party registration:

$$Pr(D|D^*) \geq Pr(D|R^*) \qquad (4)$$

Where Pr(D|D*) is the probability a voter casts a Democrat vote given they are a registered Democrat, and Pr(D|R*) is the probability a voter casts a Democrat vote given they are a registered Republican. This assumption merely recognizes that the probability a registered Democrat votes Democrat is greater than or equal to the probability a registered Republican votes Democrat.

Alternatively, we assume that the probability a voter casts a Republican vote given they are a registered Republican is greater than or equal to the probability that a registered Democrat casts a Republican vote. Conversely denoted as:

$$Pr(R|R^*) \geq Pr(R|D^*) \qquad (5)$$

Because candidates cannot perfectly observe the party preferences of voters in their districts, campaign funds expended to turnout the vote will have a positive impact on voters throughout the district; motivating the following positive cross partials:

$$\frac{\partial E(R)}{\partial E_D} > 0 \quad and \quad \frac{\partial E(D)}{\partial E_R} > 0 \qquad (6)$$

The positive cross partials indicate that Democrat expenditures to encourage turnout of their registered party members will increase the expected number of Republican votes, and vise versa. Thus the turnout strategy results in a simultaneous benefit for both candidates from "leakage" of voters motivated by the opposition's expenditures.

## The Swing Vote Model

An alternative candidate expenditure objective is to maximize the total number of votes he or she receives from registered non-affiliates, independents, and voters loosely aligned with the opposing party. This primarily entails advertising expenditures on multimedia ads. The goal is to convey information to the public about the candidate's personal and professional attributes, and their policy and ideological differences to the opposition.

The swing vote model is motivated by the recognition that one of the most critical elements of candidate advertising is courting the unaffiliated voter. Most election outcomes are decided by narrow margins. The average election in North Carolina for State House and Senate in 1998 and 2000 had Democrats receiving approximately 52.5 percent of the vote and Republicans approximately 47 percent; representing an average vote difference of only 5.5 percent. The importance of the non-party affiliated voting block has risen dramatically over the last three decades as their percent of the total number of registered voters has increased. Registrations by district for the 1998 and 2000 elections indicate the

percentage of voters registered unaffiliated ranged from 6.5 percent to as much as 25.50 percent. Convincing some portion of this block of constituents to vote on his or her behalf is essential to a candidate's success and constitutes a key strategy for maximizing votes.

The probability of a voter voting Republican given they are registered to vote is a function of campaign expenditures denoted as:

$$Pr(R) = Pr\,(R_i\,(X_D, X_R)\,|\,V_i) \qquad (7)$$

In contrast to the turnout model, the swing vote model assumes that the probability a registered voter turns out for the election is given, $\Pr(V_i)$.

The Republican candidate's vote maximizing function, therefore, is:

$$Max\ E(R) = \sum_i Pr\,(R_i\,(X_D, X_R)\,|\,V_i)\ Pr(V_i) \qquad (8)$$

The cross partial of the Republican vote production function with respect to the opposing Democrat's expenditures ($X_D$) indicates that an increase in Democrat spending reduces the number of registered voters who vote Republican. Formally denoted as:

$$\frac{\partial E(R)}{\partial X_D} < 0 \quad and \quad \frac{\partial E(D)}{\partial X_R} < 0 \qquad (9)$$

The negative cross-partials suggest that expenditures by one candidate will swing voters away from the opponent.

The empirical objective of the study is to determine whether the Turnout Model or the Swing Vote Model best describes fund expenditures by political candidates in the 1998 and 2000 elections. The specified models will produce cross partials that are either positive or negative. If the regressions result in positive cross partials then we potentially have evidence that candidates are utilizing the turnout strategy. Alternatively, if cross partials are negative, then we potentially have evidence that candidates are adopting the swing vote strategy. In addition to determining the appropriate model, OLS tests

provide estimates of the average price of a vote for North Carolina candidates from both parties in the 1998 and 2000 state elections.

## Voter Party Preference

Model specification common to both models is a control measure for voter preference in each district. Studies have repeatedly found that accurately estimating the effect of expenditures on election outcomes requires controlling for the party preference of the voters in the observed area. This makes sense intuitively. Take a Democrat in traditionally liberal Massachusetts for example. Their vote is unlikely to be changed from their usual Democrat preference in favor of the Republican candidate regardless of his or her campaign expenditure level. Conversely, a Republican from traditionally conservative Orange County California is unlikely to change their voting behavior because of large campaign expenditures by a Democrat candidate. Absent a control for party preference, estimates of the effects of campaign expenditures on vote totals would likely be biased.

## Data

The data for this study are divided into four categories: election outcomes, candidate expenditures, preference proxy, and voter registration. The data were collected from the public websites of the North Carolina State Board of Elections (SBOE) and the North Carolina General Assembly. The SBOE is the state government agency responsible for overseeing state elections and administering state election policy, registering candidates, and maintaining a databank of election statistics. The data are from the 1998 and 2000 state House and Senate elections. One presidential election year is included

(2000). North Carolina was divided into 98 House and 42 Senate single-member districts for the 1998 and 2000 elections.

The election outcome data are the actual vote tallies for each district. The vote totals show how many votes each candidate in the race received. Candidate expenditure data were obtained from a SBOE databank that tracks campaign related financial activity for every candidate running for public office in North Carolina. Variables pertinent to this study include total contributions to the candidate, candidate total expenditures, and expenditure totals for the contest.

Data used to formulate preference proxies were taken from the North Carolina General Assembly website. Throughout the last decade the General Assembly has proposed several plans for establishing new voting districts due to the state's rapid population growth. Most of the proposed divisions were deemed unacceptable by state courts because they were drawn according to parameters that violate the constitution. What is pertinent to this study is that the various plans were conceived using a proxy for party preference of the existing districts. District developers used the 1990 Senate race between Gantt and Helms, the 1988 Lieutenant Governor race between Rand and Gardner, and the 1988 North Carolina Court of Appeals race between Smith and Lewis. The proxies were calculated according to the same district configuration as the 1998 and 2000 elections in this paper.

We suspect these races are good proxies for several reasons. The 1990 Senate race between Helms and Gantt was a well publicized, polarizing contest that motivated voters to the polls and presented them with two very distinct ideological choices. Additionally, this proxy incorporates an ethnicity factor as one candidate was white and one black.

An advantage of using the Lieutenant Governor race is that the contest took place during a presidential year election, which corresponds with higher voter turnouts than non-presidential year

elections. This race was also highly publicized and 'party charged' – a lawsuit was filed by one of the candidates against the other for allegations made in media ads during the campaign.

Finally, the court race reveals party loyalty from a different perspective. Court races have only Democrats and Republicans running for office. Additionally, these contests are typically low profile and voters have very little information about the candidates running for office. With only two candidates to choose from, voters that identify themselves as independents are forced to make a decision between one of the two major parties – thus revealing an underlying party preference; likewise with voters that identify themselves with a third party – they too will reveal a secondary party preference by their choice. One major criticism of this proxy is that an absence of information about the candidates, and the absence of a third choice, will cause many voters not to vote on this particular race; mitigating the accuracy of the proxy. Though a valid concern we do not believe this to be the case in the elections observed in this dataset. There was only 3.84 percent fewer votes cast for the court of appeals race than for the governor race.

Various regressions were specified and testing using different proxy configurations. The results from the different proxy specifications were similar in significance and magnitude. Results presented in the paper were obtained from a specification using the court race proxy.

The voter registration data for 1998 and 2000 are the actual number of registered voters for each district. There was one small notable difference between the data for the two years. The '98 voter registration did not provide registrants with a third party choice. Voters who identified with a third party were lumped into the single unaffiliated category. The '00 registration data recognized a third party designation for libertarians. To reconcile the difference we added the libertarian registrants to the unaffiliated category for the '00 data.

## Models and Specifications

Regression models were specified for two subject groupings. The first grouping is the aggregated dataset that has observations for both parties. The second grouping is a separation of the data by party, which allows for an examination of the effects of Democrat and Republican expenditures. The total number of votes received is the dependent variable of interest for both groups. Also common to both groups were three dummy variables – House Races (1 if a House race, 0 otherwise), 1998 Races (1 if a race in 1998, 0 otherwise), and an Interaction Variable: 1998 House Races (1 if 1998 House race, 0 otherwise).

The House Race dummy is a potentially significant control because House districts are larger than Senate districts (98 and 42, respectively), and the two kinds of districts could have different reactions to expenditure levels. It's also important because House races receive less attention and discourse than Senate races and thus possibly lower participation rates and less information about the candidates.

Controlling for the year of the race is important because non-presidential year elections are associated with lower turnout levels. In North Carolina the average number of votes cast for House and Senate seats was approximately 24,000 for the 1998 races, and 36,000 for the 2000 presidential year. The interaction variable is implemented to control for the fact that the growth rate of the total number of registered voters (i.e. those susceptible to the influence of expenditure efforts), is different for the two types of districts. Because there are about half as many Senate districts as House districts, the growth rate from 1998 to 2000 of the total number of registered voters in Senate districts could be twice as much as that of the House districts. Not controlling for these chamber and year effects potentially yields biased estimates.

For the pooled study group, specification (I) is total votes regressed on the three chamber/year dummy variables – House Races, 1998 Races, Interaction variable. Specification (II) adds Candidate Expenditures, which are the expenditure levels in dollar amounts of the candidate. Specification (III) incorporates opposition expenditure levels, which are expenditure levels of the candidate's opponent. Specification (IV) omits expenditure variables and incorporates the Democrat and Republican Proxies so as to compare the effects of expenditures variables and proxy variables on vote totals. Specification (V) is the full model formally expressed as:

$$\textit{Total votes} = \beta_0 + \beta_1\ \textit{House} + \beta_2\ \textit{Year} + \beta_3\ \textit{Interaction} + \beta_4\ \textit{Candidate Expenditure} +$$

$$\beta_5\ \ \textit{Opponent Expenditure} + \beta_6\ \textit{Democrat Proxy} + \beta_7\ \textit{Republican Proxy}$$

The second subject group comes from the aggregate dataset separated by party. The Total Votes dependent variable is regressed on identical specifications for both Democrat and Republican candidates. Specification (I) is identical to the pooled data group – House Races, 1998 Races, and Interactive Variable. Specification (II) adds the candidate's expenditures, denoted Democrat Expenditures and Republican Expenditures for Democrat and Republican candidates respectively. Specification (III) incorporates the expenditures of the opposing party, again denoted as Democrat and Republican Expenditures. Specification (IV) incorporates the two proxy variables and represents the full model, formally expressed as:

$$\textit{Total Democrat Votes} = \beta_0 + \beta_1\ \textit{House} + \beta_3\ \textit{1998} + \beta_3\ \textit{Interaction} + \beta_4\ \textit{Democrat Expenditure}$$

$$+ \beta_5\ \textit{Republican Expenditure} + \beta_6\ \textit{Democrat Proxy} + \beta_7\ \textit{Republican Proxy}$$

The specification for Republican candidates is identical to the Democrat to specification with total Republican votes received as the dependent variable.

## Results

Descriptive statistics presented in Table 1 provide the means and standard deviations for variables of interest from 212 observations. For the dummy variable means, 66 percent of the races were for House seats, 47 percent took place in 1998, and 31 percent were 1998 House Races. The average total contest expenditure in North Carolina was $103,653, and the average total number of votes cast was approximately 30,265. The district average for total registration was just under 60,000. Registered Democrats outnumbered registered Republicans, comprising slightly over 50 percent of the registration totals, with Republicans averaging approximately 33 percent. Non-affiliates and independents averaged 15 percent of total district registration. Proxy averages for the combined study group provide significant insight into the participation rates of the two major parties. The Democrat proxy estimates that the Democrat candidate will on average receive approximately 30,000 votes if turnout is 100 percent. The Republican proxy predicts that the Republican candidate will receive an estimated 29,000 votes if turnout is 100 percent.

Table 1 shows that Democrat and Republican expenditures averaged approximately $62,215 and $41,437, respectively. The Democrat candidates received an average of 16,205 votes and the Republican candidates 14,240. A simple bivariate comparison of expenditure and vote total variables indicates that Republicans earn a greater return on their campaign expenditures than Democrats. Though Democrat candidates on average outspent their opponents by approximately 50 percent, they ultimately captured only about 7 percent more votes than Republican candidates. The fact that the Democrat constituency represents over 50 percent of the total registration hints that either the Democrat candidates are ineffectively motivating their constituency to the polls, or the Republicans are doing an exceptionally good job, or both.

Table 2 presents OLS regression results from the combined study group. The independent variables in specification (I) are all significant at the .01 levels and indicate a statistically significant difference in the total number of votes received according to chamber, year and year/chamber. A North Carolina candidate for Senator expected to receive 29,216 votes in 2000, and 17,838 in 1998. The House candidate expected to receive 12,339 and 8,762 votes in 2000 and 1998, respectively. The R square value is .62 and the test statistic for joint significance is high.

Specification (II) estimates the effect of the candidate's expenditures on vote totals. All independent variables are significant at the .01 levels. The positive expenditure coefficient indicates that the marginal effect of a dollar is .0314 votes. Or, more easily understood, an expenditure increase of $31.85 will result in one extra vote. Specification (II) yields an R square value of .66 and a significant F test value.

Specification (III) estimates the effect of expenditures by the opposition on vote totals. All independent variables are highly significant. The expenditure variables have the expected signs with candidate expenditures increasing vote totals, in this case one vote for $28.17, and the opposition's decreasing vote totals. The marginal effect of a dollar spent by an opponent is a decrease of .0252 votes, or one vote for a $39.68 expenditure. The R square value is .68 and the model continues to be jointly significant.

Specification (IV) regresses vote totals on the district characteristics and the proxies for the two parties. All variables are significant at 99 percent except the House district control, which is no longer significant at all. This is expected as the proxies explain the variance in vote totals arising from district differences in the number of potential voters. The R square value is .88 and the test for joint significance is high. This specification significantly corroborates the notion that studies have to control for voter preference when estimating the effects of expenditures on vote totals. The proxy specification

demonstrates, given the comparative R square values, that a districts overall preference for a particular party is a greater predictor of vote outcomes than expenditure levels alone. That does not mean that money has an insignificant effect on vote outcomes, as specification (V) illustrates.

Specification (V) is the full model with controls for year and chamber effects, district party preference and expenditure levels for both candidates. All variables are significant at the 99 percent level, the R square value is .90 and the test statistic for joint significance remains high. The model's final specification, which explains 90 percent of the variation in vote totals, puts the price of a vote for a North Carolina candidate at $49.26. The price to an opposing candidate to take away a vote costs $78.13. In addition to providing an estimate of the price of a vote, the key finding of this model is that we can recognize that the cost of swinging a vote from one candidate to another exceeds the cost of turning a vote out by about $29.

Table 3 presents regression results for the dataset separated by party. Specifications I – IV are identical for candidates of both parties. Specification (I) includes the chamber/year chamber effects. For both parties the independent variables are significant at the 99 percent level. A major difference between the models is the R square values. For Republicans, specification (I) returns a R square value of .46 while for Democrats the R square value is .85. The tests for joint significance are significant for both parties at the .01 level, though the F value is much higher for Democrats than Republicans.

Specification (II) incorporates the candidate's own expenditures. For both parties the year/chamber controls remain significant, and for Republicans the expenditure coefficient is both positive and highly significant. For the Democrat candidate the expenditure coefficient is insignificant. This is somewhat unexpected.

Specification (III) includes expenditures of the opposing candidate. Chamber and Year controls remain significant for both parties, with expenditures variables remaining significant for Republican

candidates. The R square value is .56 and the F test is significant. For the Democrat candidate, however, money continues to have a still insignificant effect on vote totals.

The insignificance of the Democrat expenditure coefficients for Democrats in Specifications (II) and (III) was surprising as it runs counter to findings from previous studies. This suggests, among other things, the possibility that the model for Democrat candidates is incorrectly specified.

A Chow test on the pooled study group model (unrestricted) and the two-party models (restricted), however, failed to reject the null hypothesis that there are no differences between the two parties. We feel confident then that the insignificant results for those specifications do not arise because of structural differences between Republican and Democrat candidates.

A Breusch-Pagan test was also applied to the models and the null of homoskedasticity was rejected. We therefore weighted the baseline model using the Total Registration variable (results not shown). This removed the presence of heteroskedasticity, though it did not change the implications or significance of any of the independent variables.

Specification (IV) is the full model, incorporating chamber and year effects, expenditure measures and proxies. The R square values are .90 and .94 for Republicans and Democrats, respectively. The F statistics for joint significance are highly significant. For both parties the House dummy variable is insignificant. As with the results in Table 2 this is expected due to the inclusion of the proxy variables. The proxy variables estimate that on average the percentage of registered constituents participating in an election to be 40 percent for the Democrat Party, and 48 percent for the Republican Party.

Most importantly, the expenditure variables in both party specifications are significant at the 99 percent level. This finding substantiates the prevailing argument that greater campaign expenditure levels are associated with higher vote counts, all other factors held constant.

Further, Specification (IV) returns negative cross partial derivatives for the candidate's vote totals with respect to the opponent's expenditures. This indicates that the Swing Vote model best characterizes the expenditures of North Carolina candidates in the 1998 and 2000 elections.

Another implication of the Voter Turnout model is that districts with greater spending should have higher voter turnouts. We test this implication by regressing total votes cast on total expenditures in the race, the number of registered voters, and the house, year and interaction indicators (not shown). We cannot reject the null that total expenditures have no effect on the number of total votes. This finding provides additional support against the voter turnout model.

Finally, the cross partials yield estimates for the price to turnout a vote, to swing a vote, and the net price of a vote for each party's candidates. The marginal effect of a dollar spent by a Republican to turnout a voter is estimated to be a .0301 vote increase, or a vote price of $33. The marginal effect of a dollar spent extracting a vote from a Democrat opponent is -.0134, or a swing vote cost of $75. The net price of a vote then for the Republican candidate is the quotient of 1 and the sum of the two marginal effects, or approximately $23. For Democrat candidates the turnout vote costs approximately $83, the swing vote price is $68, and the net price of a vote is approximately $37. [1]

## Conclusions

Public discourse and the recurrence of campaign finance reform as a national election issue convey the sense that a majority of Americans want a change in the electoral system. Periodic surveys of public sentiment on the topic strongly suggest that the discontent originates from the perception that money plays too significant a role in political outcomes. The accuracy of this perception, and the range of potential consequences if valid, continues to be an important area for research.

This paper was motivated by the topical controversy that frequently surrounds the subject of money and politics, and aims to supplement the body of research on the subject through an examination of money and votes in the 1998 and 2000 North Carolina State House and Senate elections.

The first aspect of the paper is a theoretical illustration of the potentially negative consequences from an electoral system that allows money to significantly affect the election process. The main assertion is that money potentially limits the field of candidates in an election to those that can afford the victory, rather than competitively narrowing the field to those with the greatest aptitude for representing the concerns of the majority of the constituency.

To analyze the effects of money on vote outcomes we collected election data from the North Carolina State Board of Elections and the North Carolina General Assembly. Data included observations of registered voters, vote counts and expenditures levels. There were 212 observations.

Viewing elections from the context of an economic market and utilizing a simple production function for producing votes, we developed two hypothetical models that explain campaign expenditure behavior in North Carolina elections. The Swing Vote model involves candidate fund expenditures on efforts to swing votes away from their opponent, and predicts negative cross partials from the vote production function. In contrast, the Turnout Model has politicians expending funds on efforts to motivate voters to the polls and predicts positive cross partials.

Among the findings we found a statistically significant and positive relationship existed between campaign expenditures and the total number of votes received by a candidate. Our model specification enabled us to estimate the net price of a vote to be $33 for Republican candidates, and $37 for Democrat candidates. Finally, the regressions yielded negative cross partials, indicating that the appropriate vote production model for the 1998 and 2000 elections is the Swing Vote model.

The limitations of this study represent the continuing challenges of future research on the subject. For one, the simple models used in this study do not capture the strategic interaction that likely takes place between opposing candidates concerning the acquisition and spending of campaign contributions. Game theory could be utilized to predict probable outcomes resulting from various actions taken during the campaign process.

Another limitation is the aggregating quality of the results. The findings are North Carolina State race data. North Carolina could have political characteristics that do not approximate other regions. Additionally, the state races involve smaller numbers of voters and expenditure levels compared to larger races at the national level.

Yet still the most significant obstacle to pinpointing the effects of money on the election process is the endogenous relationship between campaign contributions and candidate electability. Candidates that are highly electable will receive a disproportionate share of campaign contributions. Therefore, they have more money to spend. The issue then is determining whether the candidate won because they had the most money to spend, or because he or she was the most electable candidate.

Divided by many characteristics though it may be, nothing is so idealistically and unanimously coveted by American society as the notion and process of Democracy. Because of its symbolic and practical importance, breakdowns within democracy's delivery system, whether real or intuited, result in recurring demands for correction. The challenge then to researchers is scientific clarification of perceived inequities and system failures. The complexity associated with measuring the effects of money on politics in the United States, and the importance to American society of such findings, ensure the topic will continue to be one of research interest and public consumption.

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## Table 1

## Descriptive Statistics

| N = 212 | Mean | Standard Deviation |
|---|---|---|
| House Races | 0.66 | 0.47 |
| 1998 Races (non-presidential year) | 0.47 | 0.50 |
| Iteractive Term: 1998 House Races | 0.31 | 0.46 |
| Total Race Ependitures | 103653.07 | 91356.72 |
| Candidate Expenditures | 51826.54 | 58973.20 |
| Opponent Expenditures | 51826.54 | 58973.20 |
| Democrat Expenditures | 62215.32 | 62689.71 |
| Republican Expenditures | 41437.76 | 53300.00 |
| Democrat Proxy | 30137.28 | 18404.04 |
| Republican Proxy | 29353.10 | 18948.92 |
| Percent of district voting Democrat for Senate (Gantt) | 0.45 | 0.10 |
| Percent of district voting Republican for Senate (Helms) | 0.55 | 0.10 |
| Percent of district voting Democrat for Lt. Governor (Rand) | 0.49 | 0.08 |
| Percent of district voting Republican for Lt. Governor (Gardner) | 0.51 | 0.08 |
| Percent of district voting Democrat for Court (Lewis) | 0.51 | 0.10 |
| Percent of district voting Republican for Court (Smith) | 0.49 | 0.10 |
| Total District Registration | 59490.38 | 28832.10 |
| District Democrat Registration | 30741.90 | 15235.26 |
| District Republican Registration | 19849.27 | 11293.92 |
| District Unaffiliated Registration | 8899.20 | 6026.79 |
| Percent Registered Democrat | 0.52 | 0.10 |
| Percent Registered Republican | 0.33 | 0.08 |
| Percent Registered Unaffiliated | 0.14 | 0.04 |
| Seat Status (signifies open seat) | 0.15 | 0.36 |
| Votes Received by Candidate | 15132.69 | 9210.96 |
| Race Vote Total | 30265.39 | 16638.71 |
| Votes for Democrat Candidates | 16205.20 | 9163.43 |
| Votes for Republican Candidates | 14240.19 | 9214.92 |

**Table 2**

**Regression Models with pooled candidate data:**
**1998 and 2000 North Carolina House and Senate Elections**

**OLS Estimates**
**(standard errors in parentheses)**

| Dependent Variable: Total Votes | (I) | (II) | (III) | (IV) | (V) |
|---|---|---|---|---|---|
| House Races | 16877.0000** | -15912.0000** | -16561.0000** | -1475.7719 | -2179.4828* |
| | (-1146.09) | (1107.68) | (1082.93) | (956.45) | (916.45) |
| 1998 Races | 11378.0000** | -11183.0000** | -11314.0000** | -7218.2005** | -7374.1806** |
| (non-presidential year) | (-1355.66) | (1289.26) | (1246.35) | (777.51) | (726.95) |
| Interactive Term: | 7801.3480** | 7381.5249** | 7663.7185** | 4573.9838** | 4612.5034** |
| 1998 House Races | (-1668.28) | (1588.17) | (1536.43) | (938.39) | (878.10) |
| Candidate Expenditures | | 0.0314** | 0.0355** | | 0.0203** |
| | | (0.0065) | (0.0064) | | (0.004) |
| Opposition Expenditures | | | -0.0252** | | -0.0128** |
| | | | (0.0064) | | (0.004) |
| Democrat Proxy | | | | 0.5441** | 0.4991** |
| | | | | (0.025) | (0.025) |
| Republlican Proxy | | | | 0.4864** | 0.4686** |
| | | | | 0.024 | (0.023) |
| Intercept | 29216** | 26992** | 28487** | 2750* | 3824** |
| | (931.59) | (998.67) | (1036.43) | (1332.28) | (1309.99) |
| N | 212 | 212 | 212 | 212 | 212 |
| R2 | 0.62 | 0.66 | 0.68 | 0.88 | 0.90 |
| F Statistic | 111.61 | 98.44 | 87.46 | 311.73 | 260.23 |

**: Significant at 99%
*: Significant at 95%

**Table 3**

**Regression models for individual candidates:**
**1998 and 2000 North Carolina House and Senate Elections**

**OLS Estimates**
**(standard errors in parentheses)**

| Dependent Variable: Candidate's Total Votes | (I) Republican | (I) Democrat | (II) Republican | (II) Democrat | (III) Republican | (III) Democrat | (IV) Republican | (IV) Democrat |
|---|---|---|---|---|---|---|---|---|
| House Races | -14416.0000** | -19339.0000** | -14025.0000** | -19022.0000** | -15521.0000** | -18976.0000** | 941.8676 | -2911.6909 |
| | (1939.90) | (998.25) | (1825.99) | (1048.12) | (1859.80) | (1046.23) | (1995.06) | (1548.28) |
| 1998 Races | -13245.0000** | -9511.2384** | -12793.0000** | -9496.2002** | -12775.0000** | -9573.4665** | -6744.5262** | -6351.3887** |
| (non-presidential year) | (2294.63) | (1180.79) | (2159.74) | (1180.98) | (2097.22) | (1179.80) | (1069.94) | (830.34) |
| Interactive Variable: | 9682.9589** | 5919.7372** | 8412.8892** | 5926.3746** | 8119.1171** | 6161.5772** | 3284.6070** | 4148.6918** |
| (1998 House Races) | (2823.77) | (1453.08) | (2674.65) | (1453.21) | (2599.55) | (1462.38) | (1266.30) | (982.72) |
| Repuclican Candidate | | | 0.0456** | | 0.0549** | 0.0082 | 0.0301** | -0.0134** |
| Expenditures | | | (-0.012) | | (-0.012) | (0.0063) | (0.0059) | (0.0046) |
| Democrat Candidate | | | | 0.0060 | -0.0298** | -0.0084 | -0.0147** | 0.0121** |
| Expenditures | | | | (0.0060) | (0.0112) | (0.0068) | (0.0054) | (0.0042) |
| Republican Proxy | | | | | | | 0.4811** | 0.1292** |
| | | | | | | | (0.0259) | (0.0201) |
| Democrat Proxy | | | | | | | 0.0469 | 0.4046** |
| | | | | | | | (0.0524) | (0.0407) |
| Intercept | 26993** | 31439.0000** | 25029.0000** | 30849.0000** | 27565.0000** | 30990.0000** | -89.4719 | 3473.9122 |
| | (1576.83) | (811.42) | (1569.15) | (1006.27) | (1796.13) | (1010.42) | (3182.76) | (2470.00) |
| N | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 |
| R2 | 0.46 | 0.86 | 0.53 | 0.86 | 0.56 | 0.86 | 0.90 | 0.94 |
| F Statistic | 28.91 | 200.93 | 28.17 | 150.92 | 25.32 | 121.63 | 129.31 | 221.29 |

**: Significant at 99%
*: Significant at 95%

[1] Algebraic derivation of the net price of a vote for a North Carolina candidate in the 1998 and 2000 state House and Senate elections:

To calculate the turnout cost of a vote for a Republican candidate, derive the following:

$$\frac{\partial E(R)}{\partial X_R} = \beta X_R$$

The turnout cost of a vote is then: $\frac{1}{\beta X_R}$

To calculate the swing vote cost for a Republican candidate, derive the following:

$$\frac{\partial E(D)}{\partial X_R} = \alpha X_R$$

The swing vote cost is then: $\frac{1}{\alpha X_R}$

To calculate the net cost of a vote for a Republican candidate ( $E(R) - E(D)$ ), derive the following:

$$\frac{\partial (E(R) - E(D))}{\partial X_R} = \frac{\partial E(R)}{\partial X_R} - \frac{\partial E(D)}{\partial X_D}$$

$$= \beta X_R - \alpha X_R$$

$$= \theta$$

The net cost, or price, of a vote for a Republican candidate then is: $\frac{1}{\theta}$