DIVISION OF THE HUMANITIES AND SOCIAL SCIENCES

CALIFORNIA INSTITUTE OF TECHNOLOGY

PASADENA, CALIFORNIA 91125

EQUILIBRIA IN CAMPAIGN SPENDING GAMES: THEORY AND DATA

Robert S. Erikson
University of Houston

Thomas R. Palfrey
California Institute of Technology

SOCIAL SCIENCE WORKING PAPER 1006

May 1997

EQUILIBRIA IN CAMPAIGN SPENDING GAMES: THEORY AND DATA*

Robert S. Erikson Thomas R. Palfrey

Abstract

This paper presents a formal game-theoretic model to explain the simultaneity problem that has made it difficult to obtain unbiased estimates of the effects of both incumbent and challenger spending in U.S. House elections. The model predicts a particular form of correlation between the expected closeness of the race and the level of spending by both candidates, which implies that the simultaneity problem should not be present in close races, and should be progressively more severe in range of safe races that are empirically observed. This is confirmed by comparing simple OLS regression of races that are expected to be close with races that are expected not to be close, using House incumbent races spanning two decades. The theory also implies that inclusion of a variable controlling for total spending should successfully produce reliable estimates using OLS. This is confirmed.

JEL: C51, C72, D72

Keywords: campaign spending; game theory; elections; incumbency

*California Institute of Technology. The authors gratefully acknowledge the financial support of the National Science Foundation, Grant #'s SES-9224787 and SES-9223868. We thank Jonathan Katz and D. Roderick Kiewiet for helpful comments.

1 Introduction

This paper presents new estimates of the effects of spending by incumbents and by challengers on the vote in U.S. House elections. As is well known, estimation via OLS regression produces strong coefficients for challenger spending but virtually no effect for incumbent spending (e.g., Jacobson, 1978). Few would argue, however, that incumbent spending does not matter. The obvious reason for the near-zero coefficients for incumbent spending using OLS is a simultaneity bias, as incumbents spend more when they are in electoral trouble. Somewhat less obvious, and less commonly acknowledged, the opposite bias is present for challenger spending. Challengers spend more when their prospects are good. In short, estimates of spending effects via OLS are biased because one is not controlling for candidate expectations of the vote, and these expectations drive spending decisions. This paper addresses this problem directly by formulating and solving a game-theoretic model of campaign spending, and identifying the finer structure of these simultaneity problems in a precise way. This characterization of the equilibrium of the spending game has direct implications about how to obtain reliable estimates of incumbent and challenger spending effects, without resorting to multi-equation systems.

Several statistical solutions have been proposed to estimate the effects of incumbent spending by overcoming the simultaneity bias. The most common solution is two-stage least squares, whereby instrumental variables are used as proxies for observed spending. In the best-known of these 2SLS exercises, Green and Krasno (1988) used lagged incumbent spending as an instrument for incumbent spending, and found significant effects for incumbent spending. In an alternative approach, Erikson and Palfrey (1993, 1997) achieved statistical identification by means of restrictions on the variance-covariance matrix. By assuming that the covariances between each spending variable and the vote were caused by only vote-on-spending and spending-on-vote effects, they too found significant effects for incumbent spending, somewhat larger in magnitude than Green and Krasno (1988), but still significantly smaller than challenger spending effects. In still a third approach, Abramowitz (1991) used OLS but attempted to neutralize the simultaneity bias by using *Congressional Quarterly* forecasts of election outcomes as a control for expectations. Continuing to find negligible coefficients for incumbent spending even with this control, Abramowitz concluded that incumbent spending actually has little impact on the vote. In sum, due to seemingly unavoidable methodological difficulties, a consensus has not yet emerged regarding both the relative and absolute magnitudes of incumbent and challenger spending effects on congressional election outcomes. Methodologies more complex than OLS show appreciable effects for incumbent spending, but are themselves dependent on new assumptions of their own and still produce surprisingly small incumbency spending effects. And, moreover, the fact that the biased OLS estimates show incumbent spending to be ineffectual offers a handle for doubt that incumbent spending matters.

The present paper takes a new approach to estimating spending effects. We estimate spending effects via OLS, for a subset of congressional districts where a game-theoretic model predicts that the simultaneity bias should be minimal or nonexistent. This subset consists of those districts where the effect of new sources of challenger vote support do not necessarily drive up challenger and incumbent spending. Which districts are these? They are districts where, before taking spending into account, the vote is expected to be close or even slightly favor the challenger. Where the expectation is a close race, both spending effects can be reliably estimated by simple OLS. In addition, the theoretical model also implies that inclusion of a variable controlling for total spending, should successfully produce reliable estimates using OLS. This is also confirmed in our analysis. We present the theoretical model in the next section, and present the data analysis in subsequent sections.

2 Theory: The Spending Game

The empirical results we report below can be understood in the context of the simple spending game model of Erikson and Palfrey (1993). That model is meant to capture the strategic aspect of competitive spending by two competing candidates for office, candidate I (the incumbent) and candidate C (the challenger). It has the following basic features. Each candidate cares about the probability of winning more than 50% of the vote in the election. The probability I wins is determined by district characteristics, short-term forces, candidate characteristics, campaign spending, and chance. For the moment, treat the first three categories of variables as exogenously fixed. Given fixed values of these variables, we summarize the effects of campaign spending and chance by a simple function, P, which denotes the incumbent's probability of winning as a function of spending by each of the two candidates. Thus, each candidate can raise and spend money in the campaign, and the outcome of the election is a function of how much each candidate spends and some random noise.

Raising campaign resources is a costly activity for candidates. Promises must be made, issue positions compromised, fund-raisers must be attended, and so forth. This is formally represented by two fund-raising cost functions, one for each of the two candidates. The two functions could be different, reflecting cost advantages, scale economies, and other differences in fund-raising costs that might exist between an incumbent and a challenger. The final piece of the equation is the value of winning. We denote this value by V_I and V_C, respectively, for the incumbent and the challenger. Denoting the spending levels by S_I and S_C respectively, the payoff functions to the two candidates are given by:

$$U_I(S_I, S_C) = V_I P(S_I, S_C) - C_I(S_I)$$

$$U_C(S_I, S_C) = V_C[1 - P(S_I, S_C)] - C_C(S_C)$$

Thus, for the incumbent, the optimal level of spending, S_I^*, given some level of spending by the opponent, S_C, is characterized by the solution[1]to:

$$V_I \frac{\partial P(S_I^*, S_C)}{\partial S_I} - C_I'(S_I^*) = 0$$

Similarly, for the challenger, we have:

$$-V_C \frac{\partial P(S_I, S_C^*)}{\partial S_C} - C_C'(S_C^*) = 0$$

In equilibrium, these conditions would simultaneously be satisfied for both candidates, so an equilibrium would be a pair (S_I^*, S_C^*) simultaneously solving:

$$V_I \frac{\partial P(S_I^*, S_C^*)}{\partial S_I} - C_I'(S_I^*) = 0$$

$$-V_C \frac{\partial P(S_I^*, S_C^*)}{\partial S_C} - C_C'(S_C^*) = 0$$

The basic components of this model, $V_I, V_C, P(S_I, S_C), C_I(S_I), C_C(S_C)$ can be expected to vary a great deal across districts and across elections, depending on the partisanship of the district, current political conditions, and candidate specific features, such as name recognition, political talent, and previous experience. We consider a special version of the model below, which focuses on the P function. Specifically, suppose that actual incumbent share of the vote is equal to some expected share of the vote, Π, plus a random term, and that spending affects the expected share of the vote. The random term is Normally distributed with variance σ^2. Then it follows that we can write

$$P(S_I, S_C) = \Phi\left[\frac{\Pi(S_I, S_C) - .5}{\sigma}\right]$$

where Φ is the Normal cumulative distribution function. Substituting into the equilibrium conditions above, this yields the following two equations:

$$\frac{V_I}{\sigma\sqrt{2\pi}}\varphi\left[\frac{\Pi(S_I^*, S_C^*) - .5}{\sigma}\right] = C_I'(S_I^*)$$

$$-\frac{V_C}{\sigma\sqrt{2\pi}}\varphi\left[\frac{\Pi(S_I^*, S_C^*) - .5}{\sigma}\right] = C_C'(S_C^*)$$

where φ is the Normal density function. Since φ is monotonically decreasing in the absolute value of its argument, and if we make the standard assumption that cost functions are convex, then this implies that both parties spend more in elections that are expected to be close. For example, if cost functions are quadratic then spending will be

[1]Here we are assuming that the second-order conditions for a local maximum are satisfied. See Erikson and Palfrey (1993) for details.

proportional to the Normal density evaluated at the expected incumbency vote margin. In figure 1 we show a scatter plot of the logarithm of (real) challenger spending in all veteran (i.e. non-freshman) contested House elections between 1972 and 1990 against actual vote[2].

Figure 1 about here.

To illustrate how good a fit this is with this simple Normal–quadratic model, we have superimposed a fitted nonlinear regression[3] line, using locally weighted least square, or LOWESS (Cleveland, 1979). This has a shape which resembles the bell curve signature of a Normal distribution, with a maximum near to 50% of the incumbent vote, as predicted. A similar graph for incumbent spending as a function of vote shows a similar fit in figure 2.

Figure 2 about here.

The difference in the variances of the two implied density functions of figures 1 and 2 could be attributed to differences in fund-raising costs between incumbents and the challengers, or to the fact that a significant fraction of incumbent spending occurs independent of any challenge at all (Erikson and Palfrey 1994). This is consistent with the above game theoretic model of optimal spending decisions by candidates, which provides a rigorous foundation for what common sense suggests should be a basic law of campaign spending: all else equal, both candidates will spend more when the election is expected to be close.

This picture clearly indicates the nature of the measurement problem in estimating the effects of challenger and incumbent spending on the vote. Since the range of (expected) incumbent vote in contested House elections is almost entirely restricted between 55% to 80%, there is necessarily a spurious negative correlation between incumbent spending and incumbent share of the vote, while there is a positive correlation between challenger spending and the incumbent share of the vote. Thus any simple one equation model will generally overestimate the negative effect of challenger spending and underestimate the positive effect of incumbent spending on the incumbent share of the vote. What can be done to alleviate this?

Obviously, if the scatter plots between vote and spending were completely flat, there would be no estimation problem of the sort described above. Moreover, the severity of the problem is roughly proportional to the slope of the spending/vote curves. Notice that this slope is theoretically (and, it turns out, empirically) the flattest for races that are expected to be very close, and it becomes steeper as we move in the direction of relatively safe races for incumbents. This implies that simple OLS estimation of the effect of spending on vote using close races[4] will produce reasonable estimates, while the

[2] This is not exactly the correct graph to use, since the theory predicts the relationship should hold between spending and *expected* vote, rather than actual vote. A similar pattern is found if we use any of several measures of expected vote rather than actual vote. This is presented in a later section.

[3] The fit is done using a bandwidth of .20.

[4] Or, more precisely, races that are *expected* to be close.

same kind of simple OLS estimation of the effects of spending on vote using only "safe" races, will generate estimates that grossly exaggerate the effect of challenger spending and grossly underestimate the effect of incumbent spending. And, of course, the usual OLS estimates obtained by pooling the entire sample falls in between these two extremes.

3 Data Analysis

For our empirical analysis, we start with a set of virtually all House election outcomes, during the periods 1974-80 and 1982-90, involving veteran incumbents. We first generate a reduced form equation, where we predict the incumbent vote from a host of exogenous variables: the lagged incumbent vote, the district's presidential vote for the incumbent's party (1976 in the 1970s, 1988 in the 1980s), plus effects for year, incumbent party, a dummy for southern states, and the relevant interaction terms.[5] Because this reduced-form equation is lengthy and tangential to the central point of this paper, we do not present it here. It accounts for 58 percent of the variance in the veteran incumbent vote. We exploit this equation to obtain an expected incumbent vote. This "expected vote" is not identical to the expected vote that candidates themselves observe, but we consider it a good measure of the candidates' expected vote that is uncontaminated by spending effects.

Armed with a composite measure of the expected vote that spans two decades of elections, we are in a position to pool "close" contests scattered across eight separate election years. We measure close elections in two ways. Most obviously, we use our measure of the expected vote itself to select contests anticipated to be close. As a cross-check, we also use *Congressional Quarterly* forecasts to select contests identified by *Congressional Quarterly* as too close to call. Having thus identified a small set of close contests, we use OLS to estimate the effects of incumbent and challenger spending on the vote. As a further control for exogenous factors, we also include in the equations the measure of the expected vote.

3.1 Responsiveness of Spending to the Expected Vote

First, we show the effect of the expected closeness of the race on spending. Simply put, both candidates should be spending more in a race that is expected to be close. Furthermore, this relationship should become stronger in safe races, eventually levelling out for "blowout" races. This is an immediate consequence of the theoretical model above. In an earlier section, we showed that even using the actual vote, spending patterns were roughly consistent with the equilibrium predictions. here we take a closer look, using

[5] Party and year effects are always combined to represent the joint effect of party and year. Among presidential vote, south, and decade (1970s vs. 1980s), all possible interactions are included. We omit only those veteran races lacking a current or lagged major-party opponent and those complicated by redistricting.

our *ex ante* measure of expected incumbent share of the vote, rather than actual vote. Figure 3 shows spending in our eight selected election years[6] as a function of the expected incumbent vote, smoothed using weighted local linear regression (LOWESS).

Figure 3 about here.

Incumbent spending and challenger spending are measured in terms of logarithms, to reflect the decreasing effect of the next marginal dollar. More specifically, spending is measured as the log of spending (in 1978 dollars) plus $5000. The numbers in Figure 3 represent means using this measure by category of expected incumbent vote.

Figure 3 clearly shows that both incumbents and challengers spend more in close races. It also shows that the expectation of victory makes it easier for incumbents to raise cash. This is because the spending on expected-vote slope is steeper for challengers than for incumbents. The biggest (log) spending gaps are in safe districts, where contributors have an incentive to invest in (safe) incumbents but not challengers. In very competitive districts (where the expected vote is around 50 percent), the gap between (logged) incumbent and challenger spending virtually disappears.

For our purposes, the most interesting aspect of Figure 3 is the nonlinearity in the slopes, corresponding to the kind of nonlinearity predicted by the theoretical model presented in the previous section. When the expected incumbent vote falls below 55 percent or so, the spending-on-vote slopes flatten considerably. We even see evidence of the predicted sign-reversal when the incumbent's expected vote falls below 50 percent, a fate that befell 17 incumbents. When the incumbent is expected to lose, the direction of the relationship between the expected vote and spending reverses. Once an incumbent is more likely to lose than win, then the greater the expected loss, the less incentive either candidate has to spend.

3.2 Spending Effects on the Vote

Table 1 presents the OLS equations, predicting the incumbent vote from the two logged spending variables and the expected vote, where cases are grouped based on their expected vote. Let us start with the equation for the 40 very close races with an expected incumbent vote under 52 percent, shown in Column 1. For these contests, the means for both the actual and predicted incumbent vote are virtually 50 percent. By theory, if spending effects of incumbent and challenger spending are identical, we should find virtually identical coefficients for the two spending variables, except for their sign. This is precisely what column 1 shows.[7] Moreover, even with only 40 cases, both spending coefficients are statistically significant.

[6]All observations are plotted on the two curves, in order to give an indication of the density of cases as a function of our expected vote measure.

[7]Using conventional significance levels, one cannot reject the null hypothesis that these coefficients are the same.

Table 1 about here.

Column 2 expands our analysis to include the 77 cases where the expected incumbent vote was between 52 and 55 percent. As illustrated in Figure 3, this is the beginning of therange of the expected vote where the slopes for the effect of the vote on spending are negative. Here, the statistical bias should create only a mild diminution of the incumbent spending coefficient. Column 2 shows another statistically significant coefficient for incumbent spending, but one that is now less than[8] that for challenger spending, as predicted.

As Figure 3 shows, when the incumbent is expected to win by about 55 percent, the vote on spending slopes become increasingly negative, and so the bias becomes severe. Moreover, this is where most cases are found.[9] As column 3 of Table 1 demonstrates, for districts where the incumbent is expected to receive between 55.0 and 58.0 percent of the vote, the incumbent spending coefficient is negligible and decidedly non-significant. This pattern repeats itself in analysis of further categories of 3-point increments of the expected incumbent vote. Overall, for races where the expected incumbent vote exceeds 58 percent, the simultaneity problem becomes so severe that the coefficient on incumbent spending actually reverses sign. The estimates are presented in column 4. The pooled results for all cases are given in column 5, which produces the well-known implausible result that challenger spending matters, but incumbent spending does not.

The cautious reader may be tempted to argue that while Table 1 shows significant incumbent spending in close races, where it matters most (in terms of affecting the probability of winning), perhaps we just shouldn't care whether incumbent spending has significant effects on voting in safe races, since the winner would seem to be a foregone conclusion anyway. It would be a mistake, however, to treat the coefficients in Table 1, columns 4 and 5, as anything short of seriously biased. There of course is no plausible reason why marginal incumbents (often marginal because of their own ineptitude) would spend effectively while safe incumbents spend ineffectively. Going a step further, we have presented a strong theoretical reason why the estimate of spending effects by safe incumbents would be biased downward using OLS regression. Moreover, from a policy standpoint, we should be interested in the counterfactual question of what might happen if spending levels were different from the ones we observed. In order to answer such questions, we need both a model of how spending levels are set and reliable empirical measurement of the marginal effects of spending by both incumbents and challengers.

3.3 The *CQ* Expected Vote

One alternative way of measuring perceived electoral closeness deserves our attention. We supplement our measurement of electoral expectations by incorporating *Congressional*

[8] This difference is almost significant at the p=.10 level.

[9] Approximately 80% of the cases (1491 out of 1792) have expected vote in the 55-75% range.

Quarterly's measure of the expected vote. During October of every campaign over the two decades of this analysis, *CQ* rated each of the 435 House races on a scale from "safe Democratic" to "safe Republican."

We fold this scale by incumbency, to form a scale of expected vulnerability. Following is the list of three categories, along with their numbers of usable cases in parentheses.:

Close: Coded "Favoring the challenger or "too close to call": by *CQ* (N=83)

Leaning: Coded "leaning or "likely" for the incumbent by *CQ* (N=340)

Safe: Coded "safe" for the incumbent by *CQ* (N=1369)

A district's rating on this scale reflects the exogenous variables that make up our measure of the expected vote. But the rating also reflects the more intangible sources of the current vote (challenger strength, etc.) that candidates may observe during the campaign but are not part of our equation. To the extent that *CQ* raters observe the same intangible sources of the vote that candidates observe when they make their spending decisions, the simultaneity problem becomes minimized.

This argument is not new, but originates with Abramowitz (1991). Following logic similar to that of our previous paragraph, Abramowitz decided to include *CQ* expected vote category in OLS equations predicting the incumbent vote. His analysis showed that even with *CQ* ratings on the right hand side of the equation, the coefficient for incumbent spending was nonsignificant. Abramowitz concluded from this exercise that the estimates of small incumbent spending effects were not an artifact of simultaneity bias as commonly supposed.

A limitation on *CQ* ratings as a control for intangible sources of the vote is that the *CQ* ratings chop the cases coarsely into only three usable categories, with 78 percent placed in the safe category. Obviously, this categorization does not distinguish among the different degrees of "safeness" for safe races. On the other hand, the *CQ* ratings single out a select few races for the "close" category. Among our 83 *CQ*- defined "close" races, there may be little variation in degrees of vulnerability as observed by *CQ* or the candidates. In any case, *CQ*-coded close races are indeed very close on average, so that the simultaneity problem is minimal. The mean incumbent vote in the *CQ*-defined close races is 49.5 percent.

In our analysis that follows, we estimate the vote equation separately for the three categories (close, leaning, and safe districts), using as right-hand side variables the log of spending for incumbents, the log of spending for challengers, plus our measure of the expected vote. We also show the results when we pool the cases together, with *CQ* groupings on the right hand side as dummy variables. Table 2 shows the results. With the control for *CQ* ratings, the spending coefficients are slightly lower than those for Table 1, for the reason that *CQ* ratings, which are created just a few weeks before the election, inevitably absorb some of the effects of spending during the campaign.

Table 2 about here.

The fourth column of Table 2 shows the results with all cases pooled together, analogous to Abramowitz's model, and also comparable to the column 5 of Table 1, but with the addition of two *CQ* variables. Here, *CQ* categorization helps to predict the vote independent of our expected-vote measure, but just as Abramowitz observed, we find a non-significant coefficient for incumbent spending. But this is because simply throwing these variables into the regression does not capture the theoretical finding that spending is varying systematically with closeness. Hence, we consider the first three columns, showing the regressions separately by degree of *CQ*-derived "safeness."

In column 1 we observe the OLS results for *CQ*-defined close races. For this group, our expected vote measure is of little importance for predicting the outcome. Crucially, incumbent spending is statistically significant and, for the first time among our sets of equations, larger in absolute magnitude[10] than the coefficient for challenger spending.

This result contrasts with that shown in column 3 at the other end of the safety spectrum. For the vast bulk of contests deemed "safe" for the incumbent, the coefficient for incumbent spending is nonsignificant, as if incumbent spending did not matter. For these races the simultaneity distortion is present in its usual severe form, undiminished by our sorting exercise.

In between the results for "close" and "safe" races are races that lean to the incumbent." Column 2 shows that in these races, the coefficient for incumbent spending is of lesser magnitude[11] than that for challenger spending. But the incumbent spending coefficient is statistically significant, even with the evident simultaneity bias.

While the contrast among these results is startling by itself, let us focus on the crucial set of "close" races where informed observers at the time saw the race as too close to call. Here are the crucial districts that were seen to be most in play during the actual election campaign. The incumbent spending coefficient for this set of cases is even slightly stronger than that for challengers. This results from a drastic reduction if not elimination of the simultaneity bias. This reduction results in part because *CQ* ratings take into account intangible sources of the vote, such as unexpectedly strong challengers and incumbent scandals, that might affect incumbent and challenger spending. But also, where *CQ* ratings are too close to call, the simultaneity bias is minimal in the first place. These are close races where residual unobserved cause of the vote (e.g., late-occurring strong challenges or incumbent stumbles) would not affect the amount of new spending even when undetected by the *CQ* indicator.

[10]However, this difference in magnitude is not statistically significant. Using conventional significance levels, one cannot reject the null hypothesis that incumbent and challenger spending effects are equal.

[11]The null hypothesis of equal spending effects for incumbents and challengers is rejected at the .01 significance level.

3.4 Total Spending: Controlling for the Effect of Closeness on Spending

From both the theoretical and empirical analysis above, it is clear that the basic problem with OLS regressions on the pooled sample is that one does not control for that basic source of simultaneity: both candidates spend more when elections are expected to be close. Above, we used two crude measures of closeness, and broke down the sample into those races where OLS should (theoretically) work, and those where it should fail. The results were exactly as predicted. But this can be carried one step further, again without resorting to the kinds of additional identification assumptions required by simultaneous equations estimation. What is required is that we find a variable that controls, not for closeness, but for the positive correlation between both candidates' spending and closeness. There is an obvious variable to use: Total Spending. Table 3 reports the results of simple OLS regression on the pooled sample, including the control for total spending.[12] Column 1 presents the results without the *CQ* closeness dummies, and Column 2 includes these dummies.

Table 3 about here.

The findings are quite remarkable. In both cases, the incumbent and challenger spending coefficients are both significant and close in magnitude to each other. In fact, the incumbent spending coefficient is somewhat greater, although the difference is not statistically significant in either case. As expected, the coefficient on total spending is significantly negative and large in magnitude. A doubling of total spending is indicative of a race where the incumbent can expect to receive between three and four percentage points less of the two-party vote. There is no change to the nonspending coefficients in the regression.

4 Conclusion

This paper has examined a simple game-theoretical model of the spending game between competing candidates for public office, and shows how that model has strong implications for a nonlinear relationship between expected incumbent share of the vote and spending by both candidates. The theoretical model also has implications about the nature of the simultaneity bias that is introduced by running OLS regressions using cross-sectional data pooled across both safe and competitive districts. The key insight is that, in equilibrium, total spending is continuously increasing in the expected closeness of the race. Because total spending reaches a maximum when expected incumbent share of the vote is 50 percent, the slope of spending with respect to incumbent vulnerability in this range is necessarily zero, so a sample that includes only close races (i.e. races where expected incumbent share of the vote is in the neighborhood of 50%) will be immune from the

[12] The actual variable we construct is the logarithm of total spending (in 1978 dollars) plus $10000.

kind of simultaneity bias that plagues OLS regression on the full sample. This facilitates a clean estimate of incumbent and challenger spending effects.

We demonstrate this theoretical finding using veteran incumbent U. S. House races from 1974-1990. For close races, not only does incumbent spending pass the threshold of statistical analysis, but our estimate of the size of this effect is statistically indistinguishable from the effect of challenger spending. Thus, for close races, a given amount of spending wins about as large a share of the vote for an incumbent as for a challenger. We also show clearly how the simultaneity problem is progressively more severe as one move to elections that are less and less likely to be close. Two different measures of expected closeness are employed, and both yield identical conclusions. The first measure combines pre-spending district long term partisan strength, short term national forces, and lagged incumbent vote. The second measure uses the pre-election CQ categorization of close races, incumbent leaning races, and safe races. Finally, since the theoretical model indicates that spending effects can only be measured reliably if one controls for the correlation between expected closeness and spending by both competing candidates, we propose the inclusion of measure of total spending in the vote equation as an effective means to overcome the simultaneity problem. We report the results of two different OLS specifications that include a measure of total spending, both of which suggest that this is a successful estimation strategy – at least for close races – for dealing with this particular form of simultaneity that arises in campaign spending games.

Our results have potentially important consequences for understanding the connection between money and the incumbency advantage. Incumbents outspend challengers and, according to our analysis, achieve about as great a bang for the buck. In popular discussions, incumbents' advantage in resources is seen as a major source of the incumbency advantage. Political scientists have hesitated to endorse this view, in part because of the difficulty of estimating spending effects. The full implications are complex and beyond the scope of this paper, but the results reported in this paper should finally put to rest any lingering doubt about the significance (and similarity) of incumbent and challenger spending effects.

Table 1. OLS regression of Incumbent Vote on Spending.
Broken down by Expected Incumbent Vote. T-statistics in parenthesis.

	< 52%	52-55%	55-58%	> 58%	All Cases
Constant	50.55	16.72	34.21	54.10	53.92
	(2.23)	(0.48)	(1.10)	(17.52)	(19.56)
log S_I	4.04	3.06	0.86	-0.10	0.07
	(2.21)	(3.64)	(1.59)	(-0.56)	(0.38)
log S_C	-4.11	-4.37	-2.94	-3.41	-3.36
	(-3.49)	(-7.80)	(-6.47)	(-26.34)	(-27.83)
Expected Vote	0.00	0.95	0.86	0.73	0.70
	(0.00)	(0.62)	(0.59)	(31.46)	(36.07)
Adj. R^2	.193	.457	.291	.675	.722
SEE	5.23	4.55	4.99	5.26	5.24
N	40	77	119	1556	1792

Table 2. OLS regression of Incumbent Vote on Spending.
Broken down by *CQ* categories of competitiveness. T-statistics in parenthesis.

	CLOSE	LEANING	SAFE	ALL
Constant	41.02	51.98	48.92	50.98
	(3.59)	(7.74)	(16.26)	(18.54)
log S_I	2.66	2.24	-0.27	0.09
	(2.33)	(4.56)	(-1.48)	(0.55)
log S_C	-2.31	-3.84	-2.64	-2.80
	(-1.96)	(-8.88)	(-18.51)	(-20.33)
Expected Vote	0.07	0.38	0.73	0.66
	(0.70)	(7.49)	(35.06)	(34.67)
Close				-6.01
				(-9.12)
I favored				-2.27
				(-5.00)
Adj. R^2	.048	.296	.643	.735
SEE	4.80	5.20	4.92	5.12
N	83	340	1369	1792

Table 3. OLS regression of Incumbent Vote on Spending.
Including control for total spending. T-statistics in parenthesis.

	Without *CQ* dummies	With *CQ* dummies
Constant	56.64	53.09
	(20.14)	(18.92)
log S_I	3.12	2.28
	(4.34)	(3.20)
log S_C	-2.46	-2.19
	(-10.37)	(-9.25)
Expected Vote	0.69	0.66
	(36.09)	(34.27)
Close		-5.73
		(-8.65)
I favored		-2.13
		(-5.30)
log Total Spending	-3.95	-2.82
	(-4.37)	(-3.16)
Adj. R^2	.725	.736
SEE	5.21	5.10
N	1792	1792

References

Abramowitz, Alan I. 1991. "Incumbency, campaign spending, and the decline of competition in the U.S. House elections." *Journal of Politics*, 53:34–56.

Cleveland, William S. 1979. "Robust locally weighted regression and smoothing scatterplots." *Journal of the American Statistical Association*, 74: 826-36.

Erikson, Robert S. and Thomas R. Palfrey. 1993. "The spending game: money, votes, and incumbency in congressional elections." Social Science Working Paper #806, California Institute of Technology.

Erikson, Robert S. and Thomas R. Palfrey. 1994. "Preemptive spending and entry deterrence by incumbents in congressional elections." Working Paper, California Institute of Technology.

Erikson, Robert S. and Thomas R. Palfrey. 1997. "Campaign spending and incumbency: An alternative simultaneous equations approach." forthcoming *Journal of Politics*.

Green, Donald P., and Jonathan S. Krasno. 1988. "Salvation for the spendthrift incumbent: Re-estimating the effects of campaign spending in House elections." *American Journal of Political Science*, 32:884–907.

Jacobson, Gary C. 1978. "The effects of campaign spending in congressional elections." *American Political Science Review*, 72:469–491.