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Analyzing the turnout-competition link with aggregate cross-sectional data*

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Abstract. Numerous papers by Public Choice oriented scholars and others have sought to test the hypothesis inspired by Downs (1957) that, *ceteris paribus*, turnout should be higher when elections are close. Most look in cross-sectional terms at variations in turnout at the constituency level for elections of a given type. By and large the results have been disappointing (see, e.g., Foster, 1984). We are skeptical of these weak findings and argue that a complete portrait of the turnout-competition link requires us to examine that link for at least three different types of turnout (turnout among potential eligibles, turnout among registrants, and turnout for a given office relative to other offices such as top of the ticket), and to take into account longitudinal changes in turnout. For recent off-year elections to the U.S. Senate and also for off-year elections to the U.S. House of Representatives in states where there was no gubernatorial or senatorial contest on the ballot, we find strong evidence for higher turnout among eligibles in close contests. For these elections to the U.S. Senate we also find evidence for an ecological effect that leads to turnout being maximized at values of competition other than 50–50. Moreover, when we look at turnout for office relative to top of the ticket voting in the California Assembly and the U.S. Senate in presidential years, we again find some evidence for an ecological effect in which turnout is maximized at a value of Republican vote share above 50 percent and find further strong evidence for a clear link between competition and turnout for office among those at the polls.

1. Introduction

In the standard Downsian approach to turnout it is posited that *ceteris paribus*, the incentive to vote increases with the closeness of the contest. Moreover, there may well be a related effect such that elections that come to be seen at close trigger greater campaign efforts, which in turn increase turnout. Indeed, if an incumbent's previous actions make him/her potentially vulnerable, then both competition and turnout may be driven up by the entry into the race of a well-financed and attractive candidate who responds to this anticipated electoral vulnerability (Jacobson and Kernell, 1983; Jacobsen,

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1989). All these considerations lead us to expect that turnout should, *ceteris paribus*, be lower in lopsided elections than in close ones. Although there are many empirical studies of the link between competition and turnout,[1] the evidence for the Downsian hypothesis is remarkably slim. For example, Foster (1984) reviews more than a dozen empirical tests of the closeness-turnout linkage in presidential elections, including work by Public Choice scholars such as Barzel and Silberberg (1973), Silberman and Durden (1975) and Kau and Rubin (1976), and finds that, while some models indicate a slight relationship for some years, other non-instrumental variables such as age and race are more consistently and strongly linked to turnout. Foster (1984: 688; see Table 1: 684) concludes that "the perceived probability of a tied election at the state level is not a powerful or reliable factor in explaining across-state voter participation rates in presidential elections."

Even though we read the empirical studies of the turnout-competition relationship literature as having a number of negative or very weak findings, we do not regard the frequency of such findings as conclusive evidence of the overall uselessness of a relational choice approach to turnout and closeness. There are a number of conceptual and methodological reasons why previous studies may not have found a strong linkage.

First, voters vote for multiple offices (and sometimes controversial and important referenda as well), yet much of the empirical work on the linkage between political competition and turnout has committed what Wuffle (1984) refers to as the "two front teeth" fallacy of only looking at closeness for the president/vice-president.[2] Moreover, because voters (especially those who fail to understand the electoral college) may be more affected by more knowledgeable about national-level competitiveness than state-level competitiveness (Uhlaner and Grofman, 1986), presidential elections are, in our view, not the best venue for testing the link between election closeness and turnout.[3]

Second, if we look at high visibility elections, we often see dramatic variation over time in how close the polls are – the 1992 presidential election is, of course, an extreme illustration of this point with the movement of Perot in and out of the contest. Thus, we should not expect to see a (subjective and voter specific) measure of closeness from any particular time-point predicting turnout very well. On the other hand, we should also not expect that election closeness as measured by the actual vote margins is a good measure of subjective perceptions (see, e.g., Uhlaner and Grofman, 1986).

Third, most studies have neglected the critical role that registration plays in the U.S. Most voters who are registered will vote in a major (e.g., presidential) election regardless of closeness; thus closeness will to a large extent have only a marginal impact on turnout – by affecting how many new vot-

ers are registered. But the vast majority of voters will have registered well before the particular election the impact of whose closeness is being estimated (Erikson, 1981; Wolfinger, 1993).

Fourth, virtually all previous studies lack a longitudinal component. For example, Hanks and Grofman (1966 forthcoming) suggest that expected closeness of elections based on well-established (and thus anticipated) historical patterns will often be a better predictor of turnout levels than current election-specific measures of closeness.

More generally, to understand turnout in the United States, where registration barriers are relatively high and ballots are often quite long, we need to go beyond Downs in distinguishing three types of turnout decisions: registration among those eligible, turnout at the polls among registrants, and vote for particular offices among those who come to the polls.[4] Indeed, the evidence for closeness effects on turnout is quite strong when we look at relative turnout levels for different offices, although there are only a handful of such studies (see, e.g., Crain, Leavens, and Abbot, 1987, who compare turnout levels in Senate and House elections on the same ballot in 1982 as a function of the relative competitiveness of each election; Dubois, 1980, who compares "roll-off" from top of the ticket offices[5] in contested and non-contested judicial elections; and Hanks and Grofman, 1996 forthcoming, who compare turnout in party primaries with that in the general election as a function of competitiveness in each election type).

This paper has two purposes.

First, we provide the first test of the practical importance of a new reason why previous empirical research using cross-sectional methods may have misspecified the turnout-closeness link: Because, on average, a higher proportion of Republican-leaning voters register, a higher proportion of the Republican (Republican-leaning) registrants come to the polls, and a higher proportion of the Republican-leaning voters who are at the polls cast a ballot for a full slate of offices, we show that there is a possibility for an ecological confound in looking at the link between turnout and competition in cross-sectional terms.[6] This ecological effect operates so that maximum turnout will not occur when Republican versus Democratic vote shares are nearly 50–50, as the Downsian model of turnout would lead us to expect, but rather will occur in more lopsided elections in which Republican vote share is substantially above 50 percent.[7] By making use of a quadratic regression we are able to directly estimate the magnitude of this partisan composition effect.[8]

For recent off-year elections to the U.S. Senate and for off-year elections to the U.S. House of Representatives in states where there was no gubernatorial or senatorial contest on the ballot (i.e., the House race was the top-of-the-

ticket race),[9] we show that this expectation of an ecological effect is confirmed (strongly for the Senate elections, only tenuously for the House elections), with turnout among eligibles maximized in the Senate when Republican vote share is 58.2% and turnout in the House maximized when Republican vote share is 52.0%. In the quadratic regression model we use to compensate for the ecological composition effect, we find strong evidence for higher turnout among eligibles in contests that are close.

Second, we provide new evidence on the turnout-competition linkage using data on roll-off rather than on turnout among eligibles. When we look at turnout for office relative to top of the ticket voting in the California Assembly, 1962–1992, and the U.S. Senate 1980–1992, in presidential years, we find further strong evidence for a clear link between competition and turnout. We also find that an analog to the ecological effect that we found for constituency partisan composition also applies to roll-off in the U.S. Senate as compared to the Presidency, i.e., roll-on is maximized at a value of Republican vote share of 54.2%. However, for the California Assembly, although the link between roll-off and closeness is quite strong, roll-off is minimized at a value indistinguishable from 50%.

2. Properly specifying the link between turnout among eligibles and closeness when looking at aggregate level data across multiple constituencies in two-party competition

Let us simplify by assuming perfect two-party competition.[10]

Let

x	=	Democratic vote share;
$1 - x$	=	Republican vote share victory margin = $\mid x - (1 - x) \mid$;
T_d	=	the turnout rate among Democrats;
T_r	=	the turnout rate among Republicans;
L_d	=	the loyalty rate among Democrats;
L_r	=	the loyalty rate among Republicans;
D	=	the proportion of the eligible electorate that is Democratic;
R	=	$1 - D$ = the proportion of the eligible electorate that is Democratic;
T	=	turnout.

Now,

$$T = \text{turnout among eligibles} = T_d \cdot D + T_r \cdot (1 - D)$$
$$= (T_d - T_r) \cdot D + T_r. \qquad (1)$$

Further,

$$\begin{aligned} x &= ((T_d \cdot L_d \cdot D) + T_r \cdot (1 - L_r)(1 - D))/T \\ 1 - x &= ((T_d \cdot (1 - L_d) \cdot D) + (T_r \cdot L_r \cdot (1 - D))/T. \end{aligned}$$

For notational convenience, let

$$\begin{aligned} (2L_d - 1) &= r \\ (2L_r - 1) &= s. \end{aligned}$$

Now,

$$\begin{aligned} \mid x = (1 - x) \mid &= \mid ((T_d \cdot (2L_d - 1) \cdot D) - (T_r \cdot (2L_r - 1)(1 - D))) \mid T \\ &= \mid (rT_d + sT_r)D - sT_r \mid /T. \end{aligned} \tag{2}$$

If we assume, not unreasonably, that party loyalties are such that both r and s are greater than zero, i.e., a majority of the voters of each party votes for the candidate of that party, then we see from Eq. (2) that margin is a positive function of D (the proportion of the electorate that is Democratic leaning) if $(rT_d + sT_r)D > sT_r$. On the other hand, if $(rT_d + sT_r)D < sT_r$, then margin is a negative function of D. That is because, if $(rT_d + sT_R)D > sT_r$, then the absolute value of the expression $((rT_d + sT_r)D - sT_r)$ increases with an increase in the first term; while if $(rT_d + sT_r)D < sT_r$, then the absolute value of the expression $((rT_d + sT_r)D - sT_r)$ decreases with an increase in the first term. Also, under these assumptions, x (Democratic vote share) is always a positive function of D (the proportion of the electorate that is Democratic leaning) and $(1 - x)$ a negative function of D. However, if $T_d < T_r$, which is generally true in the U.S., then we see from Eq. (1) that T (turnout) is a negative function of D.

Thus, in cross-sectional data, for some values of D (the proportion of the electorate that is Democratic leaning), T (turnout) will be positively related to margin; while for other values of D, T will be negatively related to margin. Similarly, since x (Democratic vote share) and D are linearly related; in cross-sectional data, for some values of x, T will be positively related to margin, while for other values of x, T will be negatively related to margin.

But then, since the Downsian model implies that turnout is always a negative function of margin (i.e., the higher the margin the lower the turnout), we have an inconsistency between what we would expect to find in cross-sectional data across constituencies and what the Downsian model would appear to imply. Because of the inconsistency between Downsian expectations and the nature of the cross-sectional turnout-closeness link caused by the ecological confound of lower turnout among Democrats,

we would not expect to find turnout maximized when margin is zero, i.e., where Democratic percentage equals exactly 50%, but instead at a value lower than 50% Democratic share. The reason is that, as we increase Republican vote share we are also, *ceteris paribus*, increasing expected turnout, due to the contextual effect of lower turnout among Democratic leaning eligibles. (Recall that Democratic percentage is positively correlated with the proportion of Democratic-leaning eligibles.)

Determining how large the misspecification caused by ecological effect will be in practice requires us to look at actual data – a task to which we now turn.

3. Data analysis

3.1. *Turnout among eligibles*

The contextual effect of lower turnout among Democratic identifiers implies that, over some range of x (Democratic vote share), T (turnout) and x (Democratic vote share) are positively correlated, while for higher values of x, T and x are negatively correlated. We may model this effect by treating T as a quadratic function of x. The Downsian hypothesis that turnout and closeness are negatively related also implies a curvilinear relationship between T and x, in that turnout should rise as we move toward a 50 percent Republican vote share (i.e., a tied election) and then decline thereafter, as elections become less competitive. The combination of the two effects should create a roughly quadratic pattern whose maximum is reached at some Republican vote share greater than 50 percent. To test for this we generate a quadratic regression and then solve for its maximum, to see how far away it is from 50 percent.

In the subsequent data analysis we look at Republican vote share rather than Democratic vote share. If we are correct in our expectations of the impact of a contextual effect: (a) both the quadratic term and the linear term should be statistically significant, and (b) the sign of the quadratic term should be negative and the sign of the linear term should be positive. Since both the contextual effect and the Downsian effect predict a curvilinear relationship between turnout and Republican vote share, to see whether both effects are present we may also regress turnout on both victory margin and Republican vote share to see whether each makes an independent contribution to explained variance.

3.2. *U.S. Senate non-presidential years, 1952–1992*

For the U.S. Senate we pooled data from all presidential year elections from 1952–1992, excluding elections (N = 387),[11] with turnout defined as total

two-party votes for the office of Senator devided by the state's voting age population.[12] Because we have pooled data we have introduced dummy year variables as controls. The dummies for 1950, 1954, 1958, 1962, 1966 and 1970 proved statistically significant at the p ¡ .001 level but their inclusion did not significantly affect the estimated value of Republican vote share at which turnout was maximized, so we have not bothered to show the parameter values for these dummies. The key variables in the quadratic regression equation between turnout and Republican vote share of the two-party vote (with t-values shown in parentheses) are given by the regression equation below:

$$\begin{aligned}&\text{Turnout among voting age population} =\\ &.101 + 1.177\ \text{REPVOTESHARE} - 1.012\ \text{REPVOTESHARE}^2\\ &(4.6)\quad (12.2)\qquad\qquad\qquad (-8.6)\\ &(\text{adj.r}^2 = .40)\end{aligned}$$

As expected the quadratic term is negative and the linear term is positive. The highest turnout (relative to voting age population) comes in state where Republican strength is over 58%, since the maximum of this equation occurs when REPVOTESHARE = .582.[13]

However, if we look simply at turnout versus victory MARGIN[14] we get an effect almost as strong (year dummy variables not shown).

$$\begin{aligned}&\text{Turnout among voting age population} =\\ &.475 - .611\ *\ \text{MARGIN}\\ &(51.4)\ (-13.7)\\ &(\text{adj.r}^2 = .37)\end{aligned}$$

But, in a multivariate model, Republican vote share remains significant even when MARGIN is also present, although the magnitude of the effect of victory margin diminishes when we control for the contextual effect by introducing the vote share variable (year dummy variables again not shown).

$$\begin{aligned}&\text{Turnout among voting age population} =\\ &.376 - .42\ \text{MARGIN} + .18\ \text{REPVOTESHARE}\\ &(14.8)\quad (-8.3)\qquad\quad (4.2)\\ &(\text{adj.r}^2 = .39)\end{aligned}$$

3.3. *U.S. House of Representatives, non-presidential years 1980–1994, in states with no senatorial or gubernatorial elections on the ballot*

For the U.S. House we pooled data from all non-presidential year elections from 1980–1994, excluding all elections in states where there was a senatorial or gubernatorial election taking place at the same time. This left us with an N of 87. Turnout is again defined as total two-party votes for the office of Representative divided by the district's voting age population.[15] Because we again have pooled data we have again introduced dummy year variables as controls. The dummies for 1982, 1986, and 1994 proved statistically significant at the p ¡ .001 level, but their inclusion did not significantly affect the estimated value of Republican (two-party) vote share at which turnout was maximized, so we again have not bothered to show the parameter values for these year dummies. The key variables in the quadratic regression equation between turnout and Republican vote share (with t-values shown in parentheses) are given by the regression equation below:

$$\begin{aligned}&\text{Turnout among voting age population} =\\ &.243 + .578\ \text{REPVOTESHARE} - .555\ \text{REPVOTESHARE}^2\\ &(10.6)\quad (7.4)\qquad\qquad\qquad (-6.8)\\ &(\text{adj.r}^2 = .60)\end{aligned}$$

As in the Senate regression, the quadratic term is negative and the linear term is positive. The highest turnout (relative to voting age population) comes in states where Republican strength is 52%, since the maximum of this equation occurs when REPVOTESHARE = .521.

However, in the House, unlike the Senate, the effect of turnout victory MARGIN alone is stronger than that of the quadratic regression using Republican vote share and the square thereof, as shown below (parameters of the year dummy variables again not shown).

$$\begin{aligned}&\text{Turnout among voting age population} =\\ &.413 - .159\ *\ \text{MARGIN}\\ &(35.8)\quad (-7.9)\\ &(\text{adj.r}^2 = .62)\end{aligned}$$

Moreover, in a multivariate model, Republican vote share is not significant (p = .14) when MARGIN is also present.[16]

Thus, for recent elections to the House of Representatives where that contest is effectively the top of the ticket we do not find a statistically significant party strength compositional context effect, although results are in the

predicted direction. We do, however, find strong evidence for a relationship between closeness and turnout.

Now we turn to an examination of the link between election closeness and degree of roll-off. We look at elections to the U.S. Senate and to the California Assembly.

4. Roll-off

4.1. *Roll-off in U.S. Senate elections, presidential years, 1952–1992*

For the U.S. Senate we pooled data from all presidential year elections from 1952–1992,[17] excluding special elections (N = 335), with turnout now defined as roll-on, i.e., as the total votes cast for the office of Senator divided by the total votes cast for the office of President.[18] Even though we again have pooled data for the case of roll-on (roll-off) we have not bothered to report results when dummy year variables are used as controls. Such dummy variables are less important in the case of roll-off because we are looking at relative turnout levels within a given election year. Introducing such dummy variables only marginally improves the r^2 but does not change the basic result as to the value of Republican vote share at which roll-off is minimized.

First we look at the relationship between roll-off and closeness (MARGIN). We would hypothesize that the less competitive the Senate election the greater the roll-off, i.e., when we regress roll-off on MARGIN, we should obtain a positive coefficient on MARGIN – and we do.

$$\begin{aligned}&\text{Roll-off for Senate compared to President} =\\ &.006 + 2.98 \ * \ \text{MARGIN}\\ &(1.4) \quad (11.4)\\ &(\text{adj.r}^2 = .28)\end{aligned}$$

However, if we look at turnout in the form of roll-off versus REPVOTESHARE and REPVOTESHARE^2 we get an even stronger relationship.

$$\begin{aligned}&\text{Roll-off for Senate compared to President} =\\ &.199 - .658\ \text{REPVOTESHARE} + .606\ \text{REPVOTESHARE}^2\\ &(15.8) \quad (-12.0) \qquad\qquad\qquad (9.5)\\ &(\text{adj.r}^2 = .34)\end{aligned}$$

With roll-off as our dependent variable, we would now expect the quadratic term to be positive and the linear term to be negative, and we are looking

for the value of Republican vote share where roll-off is minimized. The lowest roll-off for the Senate (relative to the presidency) comes in states where Republican strength is over 54%, since the minimum of the above equation occurs when REPVOTESHARE = .542.

Moreover, if we look at roll-off in a regression equation with both victory MARGIN and Republican vote share as independent variables, both variables achieve statistical significance, although the explained variance is not quite as high as in the quadratic regression.

$$\begin{aligned}&\text{Roll-off for Senate compared to President} =\\ &.047 + .247\ \text{MARGIN} - .076\ \text{REPVOTESHARE}\\ &(3.8)\quad (8.3)\qquad\qquad (-3.5)\\ &(\text{adj.r}^2 = .30)\end{aligned}$$

Thus, we would conclude that there is a type of ecological confound based on partisan composition when roll-off is the independent variable that is similar in nature to that described (and modeled) above for the case of cross-constituency effects when we defined turnout as office-specific turnout relative to eligible (e.g., voting age population). Moreover, we would again conclude that closeness has a strong effect on turnout, here defined in terms of roll-off.

5. California Assembly, 1962–1992

When we regress roll-off (using presidential contests as our top-of-the-ticket office in presidential election years, and gubernatorial contests in non-presidential years) on MARGIN in California Assembly elections for a pooled 1962–1992 data set (N = 1280),[19] we obtain

$$\begin{aligned}&\text{Roll-off for Assembly compared to top-of-the-ticket}\\ &\text{President or governor)}^{20} =\\ &.017 + .17\ *\ \text{MARGIN}\\ &(5.9)\quad (25.8)\\ &(\text{adj.r}^2 = .38)\end{aligned}$$

However, if we look at rolloff versus REPVOTESHARE and REPVOTESHARE^2 we get an even stronger relationship.

$$\begin{aligned}&\text{Roll-off for Senate compared to President} =\\ &.199 - .695\ \text{REPVOTESHARE} + .686\ \text{REPVOTESHARE}^2\\ &(15.8)\quad (-12.0)\qquad\qquad (9.5)\\ &(\text{adj.r}^2 = .43)\end{aligned}$$

With roll-off as our dependent variable, we would again expect the quadratic term to be positive and the linear term to be negative, and this expectation is again confirmed. However, the value of Republican vote share where roll-off is minimized is .502 indistinguishable from 50 percent.

If we look at roll-off in a regression equation with both victory MARGIN and Republican vote share as independent variables, both variables achieve statistical significance, although the explained variance is not quite as high as in the quadratic regression.

$$\begin{aligned}&\text{Roll-off for Senate compared to President} =\\ &.032 + .162\ \text{MARGIN} - .028\ \text{REPVOTESHARE}\\ &(6.2)\quad (23.3)\qquad\qquad (-3.5)\\ &(\text{adj.r}^2 = .38)\end{aligned}$$

We would conclude that, unlike the Senate, there is no statistically significant ecological confound based on partisan composition operating on roll-off in the California Assembly. However, for the Assembly, as for the U.S. Senate, we would conclude that closeness has a strong effect on Assembly turnout defined in terms of roll-off.

6. Discussion

When cross-sectional data on turnout level across constituencies are analyzed, our findings imply that some care must be taken in testing the hypothesis that turnout decreases with increasing victory margin since the ecological confound of lower turnout and/or roll-off in Democratic areas can lead to a situation in which turnout is maximized and roll-off is minimized when Republican vote share is somewhat above 50 percent. Thus, using victory margin as the measure of closeness may misstate the true relationship unless sufficient control variables are introduced to deal with the potential non-symmetry caused by this ecological effect.

When we control for partisan composition effects with a quadratic regression approach, we find stronger evidence for an impact of closeness on turnout among voting age eligibles than most previous aggregate-data studies of this linkage. Similarly, the link between the closeness of the non-top-of the ticket contest and roll-off it is also a quite strong relationship, although our regressions involving roll-off do not have as high an explained variance as those between closeness and turnout among eligibles.

Notes

1. Matsusaka and Palda (1991) list 25 papers devoted to the turnout-closeness relationship, and the list continues to grow (see, e.g., Berch, 1993; Matsusaka, 1993; Ansolabehere et al., 1994).
2. While the better studies introduce controls for the existence of other contests, few look at the closeness of those contests.
3. Of course, negative findings about the turnout-competition link are not restricted to studies of presidential contests. For example, Ansolabehere et al. (1994), using state-level data on the 1992 Senate election in a sophisticated multivariate model, finds closeness to be unrelated to turnout in a statistically significant fashion, albeit the directionality of the effect has the correct sign.
4. The importance of distinguishing among these three aspects of voter turnout has been largely neglected in the literature on political participation (see, however, Crain, Leavens, and Abbot, 1987; Engstrom and Caridas, 1991; Fort, 1995; Grofman, 1996 forthcoming; Hanks and Grofman, 1996 forthcoming, and the discussion of the four factors that affect "effective minority voting equality" in Brace et al., 1988).
5. The term "roll-off" is commonly used to indicate the drop-off in total votes cast as we move from top-of-the-ticket offices to offices lower down. (The opposite of roll-off is "roll-on.")
6. This line of argument was suggested by the work of Glazer and Grofman (1992).
7. For further discussion of related methodological issues see Matsusaka and Palda, 1991; Glazer and Grofman, 1992; Grofman, 1993.
8. The standard approach to the turnout-competition link has been to examine election results for a particular type of election (e.g., U.S. Senate) in a particular year (or for a pooled data set) using constituencies as the units of analysis. In such analyses, turnout at the polls as a proportion of the eligible electorate is regressed against candidate victory margin, with controls for other factors likely to impact turnout (such as the racial and income composition of the electorates in each of the constituencies and the presence of other types of election contests). If victory margin is statistically significant in the full regression, then this is taken to support the hypothesis that higher turnout is associated with higher levels of competition. Because the same variables that predict turnout, e.g., race, income, education, also are strongly associated with partisanship, the usual linear regression approach may understate the aggregate level link between turnout and competition by implicitly assuming a symmetric decline of turnout as we move away from an equal division of the vote. Thus, introducing standard demographic control variables may actually wrongly reduce the importance of the closeness variable.
9. We are indebted to an anonymous referee for suggesting that we create these data sets.
10. I.e., we neglect independent voters and independent candidates.
11. We have also run the analyses below excluding Senate elections that were not contested. The differences are quite small and so we have not bothered to report those results.
12. To obtain voting age population estimates for non-census years we used a simple linear interpolation.
13. To find the maximum we use simple calculus. If the equation is $-aR^2 + bR + c$, then the maximum occurs when Republican vote share (R) is b/2a.
14. MARGIN is defined as the absolute value of Democratic share of the two-party minus Republican share of the two-party vote.
15. Voting age population estimates were taken from the biennial volumes of the *Almanac of American Politics*.
16. The adjusted r^2 rises from .662 to only .668.
17. In a later section of the paper we report roll-off results for the Senatorial elections in the 1962–1992 period that took place during presidential election years (N = 335).

18. To obtain voting age population estimates for non-census years we used a simple linear interpolation.
19. For the California Assembly, because there are 80 districts up for election (every two years) rather than only 33 (or 34) as in the U.S. Senate because of the staggered terms, we do have enough cases to look at individual years separately, rather than having to pool the data as we did for the Senate. When we regress roll-off (using presidential contests as our top-of-the-ticket office in presidential election years, and gubernatorial contests in non-presidential years) on MARGIN in California Assembly elections for each of the sixteen election years from the 1962–1992 data set, we find the MARGIN variable was significant at the .001 level in all but two years (with significance at the .01 level in 1992 and at the .10 level in 1966). Except for 1966 and 1992, where they were very low, adjusted r^2 values for this simple bivariate linear model of turnout in the form of roll-off ranged from .24 to .65. We do not bother to report this individual-election-level data, nor do we bother to report the similar data for the other two multivariate regressions we ran on Assembly roll-off that are described below.
20. As with the U.S. Senate roll-off data, using year dummy variables does not change the basic result as to the value of Republican vote share at which roll-off is minimized. However, such dummy variables have a slightly larger (although still rather small) effect on the r^2 for the Assembly races than for the U.S. Senate races, and we have reported the regression equations for the versions that use the dummies, but omitted the dummy variable parameters, since virtually all were significant at the .001 level. The years whose dummies were significant were 1968, 1970, 1972, 1978, 1984, 1986 and 1988. Also, we introduced a control for presidential year elections. Although that control was statistically significant, again its inclusion did not change the adjusted r^2 or the parameter values for the parameters of real interest such as Republican vote share.

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