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IS THE ACT OF VOTING RATIONAL?

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I. Introduction

Recent work by several economists has shown that certain phenomena heretofore considered within the realm of political science are amenable to analysis via the use of "economic" models. In particular, the pioneering works of A. Downs [3] and J. Buchanan and G. Tullock [2] showed that testable hypotheses about political behavior could be formulated from the assumption of maximizing behavior on the part of individual voters. The purpose of this paper is to apply this economic reasoning to the problem of voter participation. We wish to demonstrate that varying voter turnout at different elections can be explained in part on the basis of rational, wealth-maximizing behavior on the part of the electorate.

Superficially, it seems odd that individuals bother to vote at all. The literature often expresses the view that in any issue of wide scope, the insignificant weight of his single vote would induce a rational individual to save his time and effort by not voting.[1] The fact that many nevertheless choose to vote is therefore frequently

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[1]For example, in Downs [3, p. 267], "In fact, since each citizen's vote value is usually quite small, any [voting] cost at all may threaten the political system with collapse through lack of participation." Also, in a logically similar context, Tullock [7] totally discounts the effect that any one individual might have on the outcome of a revolution in the individual's decision to participate or not.

interpreted as "irrational" or else as consumption activity on the part of an individual who derives utility from being a "responsible citizen" and discharging his civic duties.[2]

To say that a single vote is trivial, however, is to assert that individuals make decisions on the basis of average rather than marginal quantities. The crucial element in a choice-theoretic analysis of voting behavior is not the absolute number of voters, but rather, whether a given voter may prove to provide the swing vote. If the individual expects the issue to be very close to a tie, his vote could matter a great deal; otherwise he will view his (marginal) effect on the outcome as insignificant. The one who does not vote is therefore not necessarily uninterested in the result. He may be greatly interested, but may also feel that since he is unlikely to affect the outcome, the costs associated with voting outweigh the expected benefits.[3]

II. The Theoretical Model

Consider now an individual who anticipates the turnout on a particular issue to be n, where each voter is expected with probability p to vote "yes" on an issue and (1 - p) to vote "no." Assuming independence of voters, he expects the outcome of the vote to be np yeses and n(1 - p) noes with a standard deviation of $\sqrt{np(1-p)}$. If, for example, n = 1000 and p = 0.52, he expects 520 yeses with a standard deviation of about 15. Using the normal approximation to the binomial, he would expect the actual outcome to be yes with a probability of about 0.9. On the other hand, with n = 1000 as before, but with p = 0.6, np = 600 with a standard deviation still of about 15 and the probability of a yes outcome is now better than 0.999999. Obviously, the potential of a single additional vote to change the result differs greatly in the two situations.

More precisely, if an individual voter is to change the result of an election, the original outcome will have had to be either a tie when n is even (the extra vote will break the tie) or a majority of one when n is odd (the extra vote could create a tie if cast against the majority). Given n and p, the question then is about the probability of $\frac{n}{2}$ *yes* votes when n is even and of $\frac{n+1}{2}$ (or $\frac{n-1}{2}$) *yes* votes when n is odd.

This probability, or rather probability density if the normal approximation is used, is given by the density of the unit normal distribution at $\frac{np - n/2}{\sqrt{npq}}$. The higher the density, the larger the chance that the $n + 1^{th}$ voter will affect the outcome.

[2]For example, consider the following statement by Kenneth Arrow:

> To some extent, certainly, the voter is cast in a role in which he feels some obligation to consider the social good, not just his own. It is in fact somewhat hard to explain otherwise why an individual votes at all in a large election, since the probability that his vote will be decisive in so negligible [1].

Also, in Chapter 3 of Downs [3], a model of voting behavior is developed on the basis of expected "utility income" of voting. And on p. 267, Downs states that "rational men in a democracy are motivated to some extent by a sense of social responsibility relatively independent of their own shortrun gains and losses." Downs argues throughout his book that individuals vote in order to preserve the political system (see, e.g., the quote in the previous footnote). This argument fails to come to grips with the obvious "free-rider" problem associated with political choice. In Buchanan and Tullock [2, p. 133], the authors duly note the social pressures to vote out of "citizen's duty."

[3]Since the distribution of non-voters is presumably symmetric with respect to their positions on outcome, the social pressure to participate in elections, if effective, does not generally affect the outcome of the election.

A refutable hypothesis thus implied is that, other things being equal, voter participation in a given election will tend to be smaller the more lopsided the anticipated margin of victory.[4] In elections forecast as very close, we should expect a heavier percentage turnout of voters, since each voter will perceive a greater probability of affecting the outcome. For p which greatly differs from 0.5, the incentive to vote is low for members of both parties; and, when p is close to 0.5, supporters of both parties have a strong incentive to vote.

For instance, until recently the outcome was always extremely lopsided in state elections in the South; the Democratic party won, usually with majorities of 70 percent to 100 percent. We observe that in these elections voter turnout has been very low, usually only 20 percent to 30 percent of the voting-age population.[5] Clearly, such majority percentages discouraged most voters from incurring the cost of participating in elections. The crucial point is that these data are inconsistent with the hypothesis that individuals vote *solely* because of the influence of consumption variables (e.g., "civic duty," etc.). Unless tastes vary across the population (an hypothesis which explains any phenomenon), there is no reason to expect a relationship between the closeness of the election and the degree of voter participation, if the participants are motivated solely by their own consumption expectations.

We now consider a second issue. It seems reasonable to assume that not everyone views the potential outcome of an election in the same manner; i.e., the estimate of the probability p will vary across individuals. The effect of this variance of p in the population on voter turnout, however, itself depends on the (mean) value p. If the average p value is very close to 0.5, then a large variance in the estimated p on the part of voters will probably tend to disminish voter participation.[6] As we move away from p = 0.5, the opposite might be true. If p = 0.6 with little variance of opinion among voters, then a marginal vote will almost surely not count. However, with an extremely volatile voter population (large variance), the probability is heightened that a sample of voters favor election of the presumed minority candidate. Therefore, variance of the estimate of the anticipated outcome may increase voter participation if the election is not considered to be close. Since, then, the placement of the mean determines the relation between the dispersion around the mean and voter participation, we merely recognize that each voter formulates a different notion of the true p. In other words, we view the variance around the mean as a potentially relevant variable, but we do not formulate a testable hypothesis regarding it.[7]

Many other elements, of course, affect the payoff function of voting. First, the outcome of the vote may be viewed as unimportant: many individuals viewed Nixon and Humphrey as equally good (or equally bad). The more significant the outcome, the higher the incentive to vote, and voters may differ in this respect

[4]This hypothesis is mentioned in Tullock [6], where reference is also made to a paper later published by W. H. Riker and P. C. Ordeshook [5]. This latter work contains results consistent with those of this paper. However, their analysis is clouded by their use of questionnaire data rather than actual voting behavior, and the fact that their data pertained to presidential elections which, because of electoral college considerations, makes direct testing of the above hypothesis more difficult.

[5]Until recently, registration was also a relatively low percentage of total voting-age population in the Southern states. This reflects the same issue: i.e., low probability of affecting the outcome. The data are from various U.S. Statistical Abstracts.

[6]In the extreme case where p = 0.5 with no variance, the marginal voter will almost surely vote, since he will very likely change the outcome. A large variance with p = 0.5 will lessen this likelihood of changing the outcome.

[7]The variability in the value of p makes it virtually impossible to obtain an exact expression of the "distance" of the average p from 0.5 in terms of the probability of the actual outcome being 0.5.

within voting units as well as between them. Second, the cost of voting depends on whether one is already registered or not; how far from the polling place one lives; how convenient are the polling hours; and whether one planned to be in the polling place anyhow to vote on some other issue.[8] In the empirical work we attempt to capture the effect of some of these variables.

III. The Empirical Test

The actual form of the estimating equation where the unit of observation is a state is,

$$y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + u,$$

where:

y = ratio of voters that actually voted in a given gubernatorial election to to total voting-age population;

x_1 = ratio of votes for winner to that of total vote (ex post);

x_2 = total voting-age population of state;

x_3 = fraction of voting-age population registered to vote;

x_4 = absolute difference in proportion voting Democrat between current and last election;

x_5 = 1 if presidential election held that year, 0 otherwise;

x_6 = 1 if senatorial election held that year, 0 otherwise.

Data for the above variables are obtained entirely from the United States Statistical Abstracts. Gubernatorial elections were chosen because it was felt that the issues raised in this paper were relevant for such elections, and the number of observations is large enough to obtain conclusive results. Also, the issues were not clouded by electoral college considerations which affect presidential elections. We now explain briefly the roles of the variables in the regression equation.

The self-explanatory voter participation variable (y) is what we seek to analyze. Its variation is substantial, ranging from a low of 17 percent (Georgia, 1962) to a high of 76 percent (Utah, 1964). With regard to x_1, the ex-post winning majority is used as a proxy for the anticipated outcome of the election; that is, we assume that deviations of the actual from the expected result are not large.[9] It should be noted that the measurements of x_1 and y are basically independent, and spurious correlation between them is most unlikely. At worst, a positive spurious correlation may occur when one party gets a larger turnout than usual, increasing both its majority and its overall participation. Since our model predicts a negative relation between x_1 and y, any resultant bias in that case would be against our hypothesis.

The total voting-age population (x_2) is used because the closeness of an election depends upon the size of the electorate. For example, with a 52 percent expected majority in, say, New York state, a marginal vote would have almost no chance of changing the outcome. However, the probability of changing the out-

[8] In cases where the outcome of a vote depends on some minimum turnout we may get the perverse result that a person voting against a certain issue may actually make it win, since this could be the crucial vote in terms of required minimum, but it would be outweighted by a majority of more than one among other votes already cast.

[9] A more complete analysis might use the results of pre-election polls as a measure of the anticipated result.

come is much larger, given the same figure, in, say, Nevada, since the variance of the sample mean will be much greater.[10]

The percentage of registered voters (x_3) is a proxy for the intensity of feeling regarding the outcome of the election. If the election is deemed important, a larger fraction of the electorate should be moved to register. The absolute difference in the percentage of Democratic votes between the current and the last election (x_4) is used as a measure of the variance of the estimate of the election outcome. In other words, we assume that voters give little weight to elections earlier than the previous one in formulating their decisions with regard to the present election. Finally, the two dummy variables, x_5 and x_6, are included to measure the effect of the presence of other issues on the ballot.

The data used to test the hypothesis are for four years: 1962, 1964, 1966, and 1968. Since gubernatorial elections are normally held only once every four years, we have fewer than 50 observations per year. Data on registered voters are available for 1968 only, so the effect of this variable is examined only in a subset of the data. Finally, some observations were missing or inappropriate, which further reduced the number of observations.

The regression results for the four years combined are presented in Table 1. The overall regression is highly significant, and about half of the original variance is

Table 1

Variable	*Coefficient*	*t ratio*	
x_1 = winning majority	-.768	-7.24	n = 122
x_2 = voting age population (000)	-.006	-1.41	R^2 = 0.493
x_4 = difference in fraction of democratic vote	-.291	-2.41	$\bar{R}^2$ = 0.472
x_5 = presidential dummy	0.111	5.75	
x_6 = senatorial dummy	0.055	2.62	

accounted for. This is quite substantial, in view of the fact that limitations in data entirely precluded the use of any factors reflecting the importance of the outcome to the individual voter. The difference in fraction of Democratic votes between the current and the previous election, reflecting the uncertainty of voters about the value of p, proved significant. Given the sign of the coefficient, "close" elections dominate the relation.

Our hypothesis predicted a pattern of signs with respect to the other four variables, and all four coefficients obtained the right signs. The coefficient of the size of the state variable (the total voting age population) is significant at the 10 percent but not at the 5 percent level; the other coefficients are very highly significant.

The coefficients of variables for presidential and senatorial dummies indicate that in years and states in which such elections were held, the turnout of voters increased by 11 and 5 percent, respectively. On the other hand, the larger the state, as measured by voting-age population, the smaller the turnout—an increase of one million in voting-age population tends to reduce turnout by 6 percent.[11]

[10]The anticipated number of voters is the ideal variable here, and the voting-age population seems a satisfactory proxy.

[11]The relation here is clearly nonlinear, and the statement in the text applies only around the observed mean of the variable.

The most significant, and the most important, result is the coefficient of the variable for the winning majority. As this majority increases the turnout declines, as predicted by our model. A 1 percent increase in the winning majority leads to about 3/4 of 1 percent decline in turnout. If hypotheses are correct in regarding the act of voting as a civic duty or as a consumption activity, voter turnout should be independent of the majority by which a candidate wins (and, similarly, of the size of the state in which the voter resides). Since that turnout is clearly and strongly affected by the winning majority, we have to reject the above hypotheses, at least as the sole explanation of why people vote, and tentatively accept the notion that their tendency to vote increases as the likelihood becomes greater that their vote may actually decide the final outcome.

Table 2

Variable	Coefficient	t ratio	
x_1 = winning majority	−.547	−1.93	n = 22
x_2 = voting-age population (000)	−.009	−.89	$R^2 = 0.815$
x_3 = fraction of x_2 registered	−.884	5.58	$\bar{R}^2 = 0.757$
x_4 = difference in fraction of democratic vote	−.154	−.70	
x_6 = senatorial dummy	0.004	0.12	

In Table 2 we present the results for 1968 alone, for which voter registration data are available. Again, for all the variables for which our model predicts the sign, the outcome is consistent with the model. The t ratios are lower, as one would expect with fewer observations. The strongest variable here is that of the ratio of registered voters to the population of voting age, but the coefficient of the winning majority variable is also significant.[12] We also ran a regression using as the dependent variable the fraction of registered voters who actually voted. The hypothesis being tested with this regression is that, among those individuals who had already indicated their interest in the voting outcome(s) by taking the trouble to register, the ones who actually voted were motivated by their perceived chance of affecting the outcome. Here again, the signs of the coefficients are consistent with the hypothesis and the most significant coefficient is the winning majority.

IV. Some Conjectures and Conclusions

The hypothesis that political activity is determined partly by the influence each individual perceives himself to have on the outcome of elections has been tested only for one particular subset of all political activity. We feel, however, that the results are encouraging enough to offer some speculations on other aspects of

[12]By 1968 the dominance of Democrats in the "Old South" and the accompanying low participation was less pronounced. Nevertheless, a regression for 1968 deleting the variable for registered voters still explains about 50 percent of the variance, in spite of the absence of the presidential dummy that does not apply to a single year.

political choice. As an initial example, consider the campaign behavior of candidates for office. When faced with a bipartisan audience, we would expect them to stress the superiority of their platform and personality and at best give lip service to the need to vote. On the other hand, when facing a sympathetic audience, candidates can be expected to encourage voter turnout. Given our hypothesis, we predict that in front of the latter audience, candidates will stress the anticipated closeness of the outcome, trying to impress each individual in the audience that *his* vote might be the decisive one.

The same reasoning suggests that the anticipated closeness of the outcome will be a major theme in the solicitation of campaign contributions. Casual empiricism indicates that in order for candidates to receive substantial contributions, their credibility at the polls—e.g., in early presidential primaries—must be established. Also, candidates will not want to impress their supporters as being too far out in front of the other candidates, lest their contributions fall off for similar reasons. The above behavior is consistent with the hypothesis that an individual engages in political activity at least partly out of the belief that he has a significant chance of affecting the outcome.

If individuals believe that their votes have no effect on the outcome, participation rates should be independent of the benefits derived from the election of the candidate most preferred by them. The observed disproportionate participation of high income individuals, who in general tend to be affected more by the outcomes of elections, is further evidence that an individual tends to vote when he views his role as decisive. Thus our model provides an additional, and probably simpler, explanation of the high participation rate by high income people than that of Frey [4].

By the same token, our model should predict the participation rate in revolutions. Specifically, when a regime is near the brink of collapse, not only would revolutionary participation increase, but so also would counter-revolutionary participation, since individuals on *both* sides will view themselves as decisive.[13]

Our model has an interesting implication regarding the cost of operating a party machine whose objective is to win elections. Consider a state for which initially $p = 0.50$, with a normal voter turnout of one million, giving a standard deviation of the outcome of 500.[14] If the party recruits, say, 500 new voters, the actual winning majority will tend to deviate from 0.5 towards the party running the machine. It would seem that the chance that the party will win is increased from 50 percent to 68 percent. But as a result of the deviation of p from 0.5, voter turnout (from both parties) will fall somewhat and the chance of winning the election becomes higher than 68 percent. Now, if the party machine is maintained for further elections, since turnout is declining the effect of the 500 extra votes will be more decisive than before. This process (assuming the other party remains passive) will converge to the point where only the 500 recruited voters actually vote. The party machine will then tend to reduce the budget for its guaranteed vote, since the outcome of the vote becomes more and more certain with time. This converging process may explain the observed experience in the South (until fairly recently) where Democrats got almost the entire vote, and voter turnout was extremely low. Probably a large fraction of the actual vote is by individuals dependent on political patronage.[15]

[13] See, e.g., Tullock [7], in which this point is ignored.

[14] Standard deviation $= \sqrt{npq} = \sqrt{1{,}000{,}000 \times .5 \times .5} = 500$. This, however, is based on the assumption that p itself is not a random variable. If it is, as is likely the case, the standard error will be more than 500.

[15] Recipients of patronage can be relied upon to side with their patron party; if they vote, their vote then is not too secret. And since the list of actual voters is not secret, it is easy to apply pressure on this group to vote and be confident in the results.

To recapitulate, our basic hypothesis is that wealth-maximizing behavior can explain, ir part, why people bother to vote. The individual's incentive to vote increases the larger his estimate of benefits to be derived from his candidate being elected, the smaller his cost of voting, and the larger the chance he perceives of his being the decisive vote. This last item is the crucial element in our analysis. Examining the extent of turnout in gubernatorial elections, we show that in fact people tend to vote when the cost is low (as the number of issues on the ballot increases the cost of voting for each decreases) and that the fraction of individuals actually voting increases, the larger the probability that they will affect the outcome. The strong confirmation of this last hypothesis is also a refutation of the hypothesis that individuals vote solely to meet their civic duty.

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