Notes

Voting as an act of contribution

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Abstract

This paper presents a theory which rationalizes voting in terms of the marginal utility a citizen derives from contributing a small amount of effort in the political process when the cost of voting is small. Citizens abstain when the marginal cost of voting exceeds the marginal perceived benefit. A simple choice rule for voting in a two candidate race is derived from the theory. This rule depends on the voter's subjective belief about the election outcome as well as his preferences for the candidates. The key assumption is that the voter's utility increases if he votes for a winner, or decreases if he votes for a loser. This assumption is no less plausible than the assumption that voters believe they can be pivotal.

People participate in politics in many ways. They can contribute money, contribute their time as campaign workers, display bumper stickers and other advertisements for their favorite candidates, and they can vote. The act of voting is the least cost form of political participation for most people. This paper presents a decision model which rationalizes voting in terms of the marginal utility a citizen derives from contributing a small amount of effort in the political process, and his subjective beliefs about the election outcomes. In contrast to the famous Riker-Ordeshook model, I do not assume that voters consider the possibility of determining the winner.[1]

Assume that a voter contributes resources in order to change the utility he receives if his candidate wins, rather than acting to change the probability of winning, which is taken as given. For a large contributor, utility can be in the form of private benefits derived from his association with the candidate. For the small contributor, the utility is a personal satisfaction gained from giving up some resources to provide some support to a candidate and from the act of participating in the process.

Suppose that a voter contributes $r_R \geqslant 0$ resource units to the Republican

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candidate and $r_D \geqslant 0$ to the Democratic candidate prior to an election where both parties are active. The assumption that the voter can contribute to both candidates allows me to connect a utility maximizing theory of contributions with my non-instrumental voting model. Voting is the act of contribution when $r = r_R + r_D$ is small.[2] In this case r is interpreted as the cost of voting. If a citizen does not vote, $r = 0$.

Suppose that every potential voter, regardless of personal preferences, perceives the candidate positions as points θ_R and θ_D respectively, in an n dimensional Euclidean space whose axes are related to salient political issues. Let us concentrate on one citizen. Let $u^R(\theta_R, r_R)$ denote the *net* utility which this citizen derives from having contributed r_R to the Republican and he (or she) wins.[3] Let $u^D(\theta_D, r_D)$ denote the net utility which the citizen derives from having contributed r_D to the Democrat and he wins. Assume that u^R and u^D are continuously differentiable in r_R and r_D, respectively.

Although the winner often can be accurately predicted using paired comparison polls taken at the end of the campaign, there is no reason why *all* voters should believe the polls. It is reasonable to assume that voters have idiosyncratic beliefs about the election outcome even if the polls show one candidate in the lead.

In order to model this idiosyncratic element, assume that each citizen has a subjective a priori probability distribution for the election outcome. Let p denote the subjective probability the citizen holds for the event that the Republican will win. His subjective probability that the Democrat will win is $q = 1 - p$. Since one of the two candidates will win, the expected net utility our citizen derives from a decision to invest r_R in the Republican's campaign and r_D in the Democrat's campaign is

$$U(\theta_R, \theta_D, r_R, r_D) = pu^R(\theta_R, r_R) + qu^D(\theta_D, r_D) \qquad (1)$$

Modeling voting in terms of contributions introduces the subjective probability of winning into the voting decision rule.

First let me consider the decision to vote. If u^R is concave in r_R and u^D is concave in r_D, it is shown in Aranson and Hinich that the citizen contributes if and only if $\partial u^R(\theta_R, 0)/\partial r_R > 0$ or $\partial u^D(\theta_D, 0)/\partial r_D > 0$. Assuming that the citizen votes if and only if he contributes, one of the above inequalities must hold if he votes. The marginal utility $\partial u^R(\theta_R, 0)/\partial r_R$ is the marginal change in the citizen's utility if he makes a small contribution to the Republican *and* the Republican wins. Note that $\partial u^R(\theta_R, 0)/\partial r_R$ is a function of the Republican's position θ_R. The term $p\partial u^R(\theta_R, 0)/\partial r_R$ is the citizen's *expected* marginal utility of contributing a small amount to the Republican. Similar interpretations hold for the marginal utility $\partial u^D(\theta_D, 0)/\partial r_D$.

Application of the contributions model to voting requires some modification since there is an interval for p (for fixed θ_R and θ_D) where the contributor gives to both candidates. A voter may vote for only one. One way around this division problem is to assume that the voter randomizes his choice using r_R^*/r as his probability of voting for the Republican, where r_R^* is his optimal contribution to θ_R and $r_D^* = r - r_R^*$ is his optimal contribution to θ_D (r_R^* is a function of p, θ_R, and θ_D).

To avoid this complexity and the concavity assumptions, I will assume that the budget and the cost of voting are small. In essence I use the calculus of the decision rule for optimally investing in candidates to derive a simple voting choice rule when r is small. This rule depends on the voter's subjective belief about the outcome as well as his utilities for the two candidates. The fundamental assumption in this approach can be stated as follows: Given θ_R and θ_D, the utility of a voter increases if he votes for the winner, or decreases if he votes for the loser.

Suppose that the citizen's participation budget and his cost of voting is very small. Then the marginal utility $\partial u^R(\theta_R, 0)/\partial r_R$ can be interpreted as the marginal change in the citizen's utility if the Republican wins the election *and* the citizen voted for him. Thus $p\partial u^R(\theta_R, 0)/\partial r_R$ is the citizen's expected marginal utility from voting for the Republican.

Consider, for example, the special case $u^R(\theta_R, r_R) = r_R \pi(\theta_R)$ for small positive r_R, where $\pi(\theta) > 0$ denotes the utility the citizen derives from the position θ.[4] The marginal change in his expected utility from voting for the Republican is $p\pi(\theta_R)$. The marginal change in his expected utility from voting for the Democrat is $q\pi(\theta_D)$ if $u^D(\theta, r_D) = r_D \pi(\theta)$. It thus follows that he votes for the Republican if and only if $p\pi(\theta_R) > q\pi(\theta_D)$. If $p\pi(\theta_R) = q\pi(\theta_D)$, assume that he is indifferent between the alternatives since the marginal utilities are equal for both actions.

Returning to the more general model, the citizen will not vote for the Republican if $\partial u^R(\theta_R, 0)/\partial r_R \leqslant 0$. If in addition $\partial u^D(\theta_D, 0)/\partial r_D \leqslant 0$, then he abstains.[5] A citizen who abstains for all positions θ_R and θ_D is defined to be an *habitual abstainer.*

A citizen is defined to be a *Republican partisan* if $\partial u^D(\theta_D, 0)/\partial r_D \leqslant 0$ for all θ_D, i.e. he will never vote for a Democratic party candidate. Similarly, a citizen is a *Democratic partisan* if $\partial u^R(\theta^R, 0)/\partial r_R \leqslant 0$ for all positions θ_R.

A *swing voter* is a citizen who will consider voting for either candidate in terms of their positions, i.e. $\partial u^R(\theta_R, 0)/\partial r_R > 0$ and $\partial u^D(\theta_D, 0)/\partial r_R > 0$. Under the assumption that voting is the limiting act of contribution as $r = r_R + r_D \to 0$, a swing voter votes for the Republican if $\partial U(\theta_R, \theta_D, 0, 0)/\partial r_R > 0$, or for the Democrat if $\partial U(\theta_R, \theta_D, 0, 0)/\partial r_D > 0$.

To show that the theory implies that the citizen votes for only one candidate, and to illustrate the dependence of the choice on the subjective probabilities, let me derive these partial derivatives from (1). Since $r_D = r - r_R$,

$$\frac{\partial}{\partial r_R} U(\theta_R, \theta_D, r_R, r - r_R) = p \frac{\partial}{\partial r_R} u^R(\theta_R, r_R) - q \frac{\partial}{\partial r_D} u^D(\theta_D, r_D) \ . \tag{2}$$

In the limit as $r \to 0$,

$$\frac{\partial}{\partial r_R} U(\theta_R, \theta_D, 0, 0) = p \frac{\partial}{\partial r_R} u^R(\theta_R, 0) - q \frac{\partial}{\partial r_D} u^D(\theta_D, 0) \ . \tag{3}$$

Similarly,

$$\frac{\partial}{\partial r_D} U(\theta_R, \theta_D, 0, 0) = -p \frac{\partial}{\partial r_R} u^R(\theta_R, 0) + q \frac{\partial}{\partial r_D} u^D(\theta_D, 0)$$

$$= -\frac{\partial}{\partial r_R} U(\theta_R, \theta_D, 0, 0) \ . \tag{4}$$

From (3), (4) and the utilitarian decision rules given above, the citizen votes for the Republican if

$$p \frac{\partial}{\partial r_R} u^R(\theta_R, 0) > q \frac{\partial}{\partial r_D} u^D(\theta_D, 0) \ . \tag{5}$$

He votes for the Democrat if the inequality in (5) is reversed. This decision rule does not require that voting be costless. The results follow when the cost of voting is small.

The marginal changes in expected utility are equal if

$$p \frac{\partial}{\partial r_R} u^R(\theta_R, 0) = q \frac{\partial}{\partial r_D} u^D(\theta_D, 0) \ ,$$

but the citizen votes since the marginal changes in his utility are positive by assumption. We say the citizen is *indifferent* between the candidates if the above equality holds. If so, assume that he votes for the Republican with probability 1/2, i.e. he is equally likely to vote for either θ_R or θ_D.

This concept of indifference is different from the Hinich-Ordeshook indifference model. First, the decision to vote depends upon $\partial u^R(\theta_R, 0)/\partial r_R$ and $\partial u^D(\theta_D, 0)/\partial r_D$ rather than $u^R(\theta_R, 0)$ and $u^D(\theta_D, 0)$. Second, the criteria for indifference involves the subjective probabilities of the election outcome.

Recall the special case given above. The swing voter votes for the Republican if $p\pi(\theta_R) > q\pi(\theta_D)$. Since $\pi(\theta) > 0$ for all θ, the choice rule can be written as follows: The swing voter votes for the Republican *if and only if*

$$\log \pi(\theta_R) - \log \pi(\theta_D) > \log \frac{q}{p} \tag{6}$$

where the utility $\pi(\theta)$ and p are idiosyncratic. The voter is indifferent between the candidates if the inequality in (6) is an equality.

This voting rule differs from the Riker-Ordeshook rule. In their model a citizen who chooses to vote will vote for θ_R if and only if $\pi(\theta_R) > \pi(\theta_D)$, or equivalently, if and only if $\log \pi(\theta_R) - \log \pi(\theta_D) > 0$. To illustrate the difference, suppose that $\pi(\theta_R) = 2\pi(\theta_D)$. Then the Riker-Ordeshook voter always votes for the Republican. My swing voter votes for the Democrat if and only if $2 < q/p = (1/p - 1)$. Thus if $p < 1/3$, the swing voter votes for the Democrat. In other words, if the swing voter believes that the Republican has less than a one in three chance of winning the election, he votes for the Democrat. He will be indifferent if $p = 1/3$.

This model provides some insight to the 'bandwagon effect'. Suppose that the Republican has a commanding lead in a poll taken prior to the election. If many swing voters believe the poll and adjust their p's upward, then some of them who would have voted for the Democrat swing over to the Republican. Not every swing voter, however, will vote for the leader. For example, a voter whose subjective probability that the Republican will win is $p = 9/10$ will still vote for the Democrat if $\log \pi(\theta_D) - \log \pi(\theta_R) > \log 9$. On the other hand, the model does imply that a voter who sets $p = 1$ will always vote for the Republican. The concept of subjective probability allows for an individual to disbelieve 'objective' probabilities and to set his own.

This theory of voting can be related to the n dimensional spatial model by assuming that for all θ,

$$\pi(\theta) = \exp(\alpha - \| \theta - x \|_A^2) \tag{7}$$

where α is an arbitrary scale parameter, x is the citizen's ideal point in the space and A is an $n \times n$ positive definite matrix of issue weights.[6] A utility function $\pi(\theta)$ of this form has the shape of a normal density, and is thus quasi-concave. Applying (7) to (6), a swing voter votes for θ_R if and only if

$$\| \theta_D - x \|_A^2 - \| \theta_R - x \|_A^2 > \log \frac{q}{p} \tag{8}$$

This model is testable if we can obtain the p's.

In order to illustrate the way $\log (q/p)$ modifies simple spatial voting, consider the unidimensional spatial model ($n = 1$ and $A = a > 0$). Suppose that voter one sets $p = q = ½$. Then he votes for the candidate closest to his ideal point, i.e. he votes for the Republican if and only if $| \theta_R - x | < | \theta_D - x |$. Suppose that voter two has the same ideal point as one, but his subjective probability that the Republican will win is $p^* > ½$. Then voter two votes for the Republican if and only if $\theta_D^2 - \theta_R^2 + 2(\theta_R - \theta_D)x > \log (q^*/p^*)$, where $\log (q^*/p^*) < 0$ since $q^*/p^* < 1$.

Connecting a rational model of campaign contributions with the act of voting does not violate the expected utility maximizing model if elections were not secret. Since most elections are secret, my theory requires a purely psychological mechanism. As was previously mentioned, the model rests on the key assumption that a voter gains a bit of utility for voting for the winner, or loses some utility for voting for the loser. I suggest that we give some attention to the proposition that many citizens behave as if their voting decision depends upon their beliefs about the election outcome, as well as their preferences for the candidates. I claim that my assumption is no less plausible than the assumption that voters believe they can be pivotal.

NOTES

1. W.H. Riker and P.C. Ordeshook, 'A Theory of the Calculus of Voting,' *American Political Science Review*, 63, 25-43 (1968); J.A. Ferejohn and M. Fiorina, 'The Paradox of not Voting: A Decision Theoretic Analysis,' *American Political Science Review*, 68, 525-536 (1974).
2. For mathematical details of the campaign contributions model, see M.J. Hinich, 'A Model for Campaign Contributions', in *American Re-evolution Papers and Proceedings*, edited by Auster and Sears, University of Arizona, 47-52 (1977). These results are expanded and exposited in P.H. Aranson and M.J. Hinich, 'Some Aspects of the Political Economy of Election Campaign Contribution Laws,' *Public Choice*, 34, 435-461 (1980). Writing u^R (θ_R, r_R) as a function of r_R, but not r_D implicitly assumes that if the voter contributes resources to both candidates, the contribution to θ_D does not effect the utility derived from a contribution to θ_R. However the limiting result will be the same if a positive r_D has a *negative* effect on u^R (θ_R, r_R). A similar assumption holds for u^D for each citizen.
3. The utility is idiosyncratic, but u is not subscripted since we are concentrating on the behavior of a representative citizen.
4. The citizen votes since $\pi(\theta_R) > 0$ and $\pi(\theta_D) > 0$. If the utility π is bounded below, it can be made *positive* with no loss of generality by adding the minimum level of $\pi(\theta)$ to the function.
5. This type of abstention is related to the abstention from alienation model. See M.J. Hinich and P.C. Ordeshook, 'Abstentions and Equilibrium in the Electoral Process,' *Public Choice*, 8, 81-100 (1969). Also see S. Kelley Jr. and T. Mirer, 'The Simple Act of Voting,' *American Political Science Review*, 68, 572-591 (1974).
6. See O. Davis, M.J. Hinich, and P.C. Ordeshook, 'An Expository Development of a Mathematical Model of the Electoral Process,' *American Political Science Review*, 64 (2), 426-448 (1970).