

IDIOSYNCRASY, INFORMATION AND THE IMPACT OF STRATEGIC VOTING

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ABSTRACT. Strategic voting is a familiar phenomenon in plurality rule elections. Existing formal theories (Palfrey 1989, Cox 1994) predict the complete coordination of strategic voting, and hence strictly Duvergerian bipartism as a stable equilibrium outcome. I have argued elsewhere (Myatt 2002) that these theories are flawed, since they assume that voters have perfect common knowledge of the constituency situation. Modelling the information sources on which voters base their decisions, I have shown that the uniquely stable equilibrium outcome involves only partial coordination of strategic voting and hence multi-candidate support. In this paper, I expand my model in three ways. First, I show that (contrary to intuition) the incentive to vote strategically is lower in relatively marginal constituencies, after controlling for the distance from contention of a trailing preferred candidate. Second, I develop appropriate calibrations for the idiosyncrasy of voter preferences and the accuracy of their information sources. Third, I show that a calibration of the model is consistent with the impact of strategic voting in English parliamentary constituencies and the reported accuracy of voters' understanding of the constituency situation. The model suggests that, in the British General Election of 1997, nearly 50 seats may have been lost by the Conservative party due to strategic vote switching.

1. PLURALITY RULE ELECTIONS AND STRATEGIC VOTING

Plurality rule elections, where the winner is the candidate who receives the largest number of votes, are vulnerable to the phenomenon of *strategic voting*: A voter might well switch her vote away from her preferred candidate and toward a perceived leader, in the hope of exerting a greater influence over the outcome of the election. This phenomenon has long been the focus of political scientific study. Indeed, Farquharson (1969, pp.57–60) noted interest dating back to Pliny the Younger while Riker (1982b) cited the eloquent exposition of Droop (1871) in describing the strategic voting problem:

“As success depends upon obtaining a majority of the aggregate votes of all the electors, an election is usually reduced to a contest between the two most popular candidates . . . even if other candidates go to the poll, the electors

usually find out that their votes will be thrown away, unless given in favor of one or other of the parties between whom the election really lies.”

Droop’s observation incorporates two interesting features. First, it expresses the idea that voters are instrumentally rational in their decision making. Specifically, they may choose to vote in a way that best influences who wins the election.¹ Second, it is an early version of Duverger’s (1954) Law, which suggests that plurality rule elections will tend to lead to a two-party system. Of course, Duverger’s thinking moved beyond the phenomenon of strategic voting, as he envisaged a process in which political parties would react to likely outcomes of plurality elections. Nevertheless his “psychological effect” of strategic voting was a key component of this wider process, and one which he expected to generate only a *tendency* toward bipartism. Drawing upon these classic contributions, therefore, plurality elections might be expected to exhibit some strategic voting, and the relative dominance of two candidates within a voting district, but this local bipartism will not necessarily be complete. It remains, therefore, to ask how large the impact of strategic voting should be.

Unfortunately, modern formal theories of strategic voting fail to answer this question in a convincing way. Palfrey (1989) and Myerson and Weber (1993) described formal models of strategic voting. The equilibria of these models are *strictly* Duvergerian, in the sense that strategic voting is complete: All voters fully coordinate on only two candidates. Cox (1994) highlighted the existence of a second category of non-Duvergerian equilibria. They involve vote switching away from a leading candidate and toward a trailing candidate resulting (in the context of a plurality election) in a tie for second place. Such a tie attenuates incentives to vote strategically, and hence is (technically) an equilibrium outcome.

Perhaps unsurprisingly, these predictions are not supported by the data. In Section 7 I argue that this is the case in English parliamentary constituencies. Here, however, I consider the famous example of the 1970 New York senatorial election. This was highlighted by Riker (1982a) and others as a failure of coordination of strategic voting.² In a “three

¹A succinct modern definition (Fisher 2002) is that: “A tactical voter is someone who votes for a party they believe is more likely to win than their preferred party, to best influence who wins in the constituency.”

²For instance, this traditional example is used effectively in the undergraduate text of Morton (2001).

Candidate	Votes	Share
James Buckley	2,288,190	39%
Charles Goodell	1,434,472	24%
Richard Ottinger	2,171,232	37%
Total	5,893,894	100%

TABLE 1. The 1970 New York Senatorial Election

horse race” two liberal candidates, Richard L. Ottinger and Charles E. Goodell, competed against the conservative James R. Buckley. More specifically, Goodell was an incumbent Republican who had taken a liberal stance on the Vietnam War, and hence received the nomination of the Liberal Party. The New York Conservative Party, however, rather than nominating Goodell as a “fusion” candidate instead supported the conservative Buckley. I present the outcome of this election in Table 1. A widely held belief was that the liberal vote was split between Goodell and Ottinger, allowing the win for Buckley. The outcome was certainly not Duvergerian. Neither was it non-Duvergerian in the sense of Cox (1994), since such equilibria require the challengers to tie for second place.

The failure of formal theories to accommodate such electoral outcomes is not necessarily a function of the instrumental rationality postulated by such theories. Rather, it is due to their informational underpinnings. The Cox-Palfrey model assumes that voters have perfect common knowledge of the constituency situation. Similarly, it is interesting to note that Droop’s (1871) logic can apply only when the identities of the parties “between whom the election really lies” are known to voters. Uncertainty over such identities is the important feature that is missing from existing theories. In my companion paper (Myatt 2002), I address this issue. I develop a model in which voters base their decisions on informative signals of the constituency situation. The uniquely stable voting equilibrium entails only partial coordination of strategic voting, and thus is consistent with the multi-candidate support observed in reality. In other words, I predict some, but not complete, strategic voting. Whereas my model offers an interesting range of comparative static results, further analysis is necessary to identify exactly how much strategic voting is consistent with a formal theory. This is provided in the remainder of the present paper.

2. QUALIFIED MAJORITY VOTING

Consider a stylized interpretation of the 1970 New York senatorial election. A first simplification is to suppose that all conservatives voted for Buckley, and that all liberals ranked him as their least preferred candidate. Liberal voters faced a potential coordination problem. Inspecting Table 1, a fraction $\gamma = 39\%/61\% \approx 0.635$ of liberals needed to coordinate behind either Goodell or Ottinger in order to defeat Buckley. They were playing a *qualified majority voting* game: A qualified majority γ needed to coordinate in order to stop the disliked Conservative. This is exactly the scenario consider in my companion paper (Myatt 2002), and it proves to be a convenient representation of the strategic voting problem. I offer a simplified exposition here. Proofs are omitted, and the arguments are heuristic — the reader is referred to the companion paper for a formal treatment.

I suppose that there are group of voters who wish to avoid a disliked third option $j = 0$, and to do so must vote for one of two challenging candidates $j \in \{1, 2\}$. A win by the disliked candidate generates a zero payoff, whereas a win by challenger j yields a payoff of $u_{ij} > 0$ to voter i . A fraction $\gamma > \frac{1}{2}$ need to coordinate in order to defeat $j = 0$. I write p for the proportion of the electorate (where the electorate in this case refers to those who dislike candidate 0) who vote for candidate 1. Candidate 1 (e.g. Ottinger) wins if $p > \gamma$, candidate 2 (e.g. Goodell) wins if $1 - p > \gamma \Leftrightarrow p < 1 - \gamma$ and candidate 0 (e.g. Buckley) wins otherwise. The outcome of the New York case satisfied $p = 37\%/61\% \approx 0.602$.

How should an instrumental voter act in such a scenario? She can only influence the outcome of the election when there is a tie for the lead. In the scenario described here, this happens whenever $p = \gamma$ or $p = 1 - \gamma$. It is important, therefore, to assess what such an instrumental voter knows about p . The models of Palfrey (1989), Myerson and Weber (1993) and Cox (1994) all assume that voters' preferences (and hence their voting decisions) are drawn *independently* from a *commonly known* distribution. In a large electorate, this means that p is effectively known. If $p = \gamma$, then an instrumental voter will find it optimal to vote for candidate 1, yielding a payoff of u_{i1} . All others will do the same, and a Duvergerian

outcome obtains. A similar analysis applies when $p = 1 - \gamma$. When p is not equal to either of these values, then instrumental concerns cannot guide a voter's choice.³

Clearly, the assumed common knowledge of p is both unrealistic and drives the pathological results of existing formal voting theories. Suppose, then, that p were unknown. I use a density function $f(p)$ to model a voter's beliefs over p . Given this uncertainty, she can always envisage the possibility that $p = \gamma$ so long as $f(\gamma) > 0$, and so instrumental concerns are always relevant. The relative likelihood of $p = \gamma$ and $p = 1 - \gamma$ is determined by $f(\gamma)$ and $f(1 - \gamma)$. A vote for candidate 1 will yield a payoff gain of u_{i1} in the former case, and a vote for candidate 2 will yield a payoff gain of u_{i2} in the latter. It is optimal for her to vote for candidate 1 whenever:

$$u_{i1}f(\gamma) \geq u_{i2}f(1 - \gamma) \quad \Leftrightarrow \quad \underbrace{\log \left[\frac{u_{i1}}{u_{i2}} \right]}_{\tilde{u}_i} + \underbrace{\log \left[\frac{f(\gamma)}{f(1 - \gamma)} \right]}_{\lambda} \geq 0$$

If it were not for the term $\lambda = \log[f(\gamma)/f(1 - \gamma)]$ then individual i would vote for her first choice candidate. λ , therefore, is the incentive to vote strategically, and is determined by the relative likelihood of the two "pivotal events" $p = \gamma$ and $p = 1 - \gamma$. The voter balances this incentive against her relative preference $\tilde{u}_i = \log[u_{i1}/u_{i2}]$. Importantly, it is uncertainty over p (represented by $f(p)$) that is the determinant of strategic voting — and this uncertainty is missing from the Cox-Palfrey framework.

This analysis is decision-theoretic, characterizing optimal voting conditional on a voter's beliefs. Taking a game-theoretic approach allows me to consider the generation of such a beliefs. A voter will consider the preferences, beliefs and strategies of others in order to evaluate $f(p)$. In Myatt (2002) I construct a game-theoretic model in the following way. A voter's preferences, summarized by \tilde{u}_i , are broken down into two components:

$$\tilde{u}_i = \eta + \varepsilon_i \quad \text{where} \quad \varepsilon_i | \eta \sim N(0, \xi^2)$$

³The Cox-Palfrey framework supposes that each individual casts a voter for candidate 1 with independent probability p . As the electorate grows large, the actual fraction who vote for candidate 1 becomes arbitrarily close to p with near certainty. However, there is a remote possibility that realized support will be equal to γ or $1 - \gamma$. For $p > 1/2$, the former event is infinitely more likely.

The component η is common to all voters. In fact, it is the preference of the median voter in the electorate. The element ε_i is idiosyncratic to voter i , and varies across the electorate. The variance term ξ^2 represents the extent of this variation, and hence is a measure of voters' idiosyncrasy. A voter's true first preference is for candidate 1 whenever $\tilde{u}_i \geq 0$. This means that the true support π for candidate 1 is:

$$\pi = \Pr[\tilde{u}_i \geq 0 | \eta] = \Phi(\eta/\xi) \quad \Rightarrow \quad \eta = \xi\Phi^{-1}(\pi)$$

where Φ is the cumulative distribution function of the standard normal distribution. Importantly, I suppose that a voter does *not* know η , and hence neither does she know the true support for candidates 1 and 2. She is initially ignorant (a diffuse prior over η) but accumulates information on the relative support for the two candidates. This information includes her own relative preference \tilde{u}_i , which is a signal of η . I summarize this information in an *informative signal* δ_i . This satisfies:

$$\delta_i | \eta \sim N\left(\eta, \frac{\xi^2}{m}\right) \quad \Rightarrow \quad \eta | \delta_i \sim N\left(\delta_i, \frac{\xi^2}{m}\right) \quad (1)$$

A justification for this specification is relatively straightforward. If a voter observes the preferences of $m - 1$ randomly selected voters, plus her own, then the mean of this sample δ_i will have an expectation of η and a variance of ξ^2/m .⁴ It follows that m indexes the precision of a voter's information source.⁵

A voting decision, then, is contingent on a voter's preferences (summarized by \tilde{u}_i) and her information (summarized by the signal δ_i). It is natural to seek a monotonic equilibrium that is increasing in both of these inputs — so that a voter is more likely to vote for candidate 1 when she prefers this candidate ($\tilde{u}_i \uparrow$) or this candidate is thought to be more popular among the electorate ($\delta_i \uparrow$). Adopting the convention that a voter chooses her true first preference when $f(\gamma) = f(1 - \gamma) = 0$, I show (Myatt 2002) the following.

⁴Given the normality assumption, the signal δ_i generated in this way is a sufficient statistic for η , and hence captures entirely the information and beliefs of a voter.

⁵This justification for the signal specification also results in correlation between a voters signal δ_i and her preferences \tilde{u}_i — in fact (Myatt 2002) the correlation coefficient satisfies $\rho = 1/\sqrt{m}$. This correlation is accounted for in all of the formulae that follow. See Appendix A.1 for more details.

Proposition 1 (Myatt (2002)). *There is a unique symmetric and monotonic voting equilibrium. The equilibrium strategy is linear in its inputs: Individual i votes for candidate 1 if and only if $\tilde{u}_i + b\delta_i \geq 0$ for some finite $b > 0$. b is increasing in the required qualified majority γ and the precision of the information source m , but decreasing in the idiosyncrasy parameter ξ^2 . It satisfies:*

$$\frac{2\Phi^{-1}(\gamma)}{\xi} \leq \frac{b}{\sqrt{m}} \leq \frac{\Phi^{-1}(\gamma)}{\xi} \sqrt{2 + 2\sqrt{\frac{(\Phi^{-1}(\gamma))^2 + \xi^2}{(\Phi^{-1}(\gamma))^2}}}$$

On average, a voter faces a strategic incentive $\lambda = b\eta = b\xi\Phi^{-1}(\pi)$.

Some implications are immediate. The equilibrium involves partial, but not complete strategic voting since the average strategic incentive is finite. It incorporates a voter's information sources. It allows for bi-directional strategic switching, since some realizations of δ_i will point to the wrong challenging candidate. It also offers extensive comparative statics. All of these features are highlighted, explored and explained in Myatt (2002).

A number of issues demand further analysis, however. The first is the *impact* of strategic voting. The model predicts only partial coordination, but is the degree of strategic voting generated by the model consistent with that in the data? The second is the *pattern* of strategic voting. Whereas Proposition 1 offers comparative statics in terms of γ and π , these are indirect functions of the expected vote shares in a three horse race. The third is the *importance* of strategic voting. In particular, which election results are likely to have been affected by strategic voting? I respond in the subsequent sections of the paper.

3. THE IMPACT OF STRATEGIC VOTING

A first step in measuring the impact of strategic voting is to consider the probability that an individual in an appropriate risk population votes strategically. By "risk population" I mean those for whom a strategic vote makes sense. Suppose (without loss of generality) that $\pi > 1/2 \Leftrightarrow \eta > 0$, so that candidate 1 is the leading challenger. A voter who prefers candidate 2 (so that $\tilde{u}_i < 0$) but believes that candidate 1 is in front (so that $\delta_i > 0 \Rightarrow \lambda = b\delta_i > 0$) faces a positive strategic incentive and is "at risk" of voting strategically.

An easy way to consider an “at risk” individual is to equip her with a signal satisfying $\delta_i = \eta$ (so that has an accurate expectation of the constituency situation) and then examine her behavior. She votes for candidate 1 whenever $b\delta_i + \tilde{u}_i \geq 0$, or equivalently (given that $\delta_i = \eta$) when $(1 + b)\eta + \varepsilon_i \geq 0$. Hence the realized support for candidate 1 is:⁶

$$p = \Phi\left(\frac{(1 + b)\eta}{\xi}\right) = \Phi((1 + b)\Phi^{-1}(\pi)) \quad (2)$$

Of course, this voter actually prefers candidate 1 with probability π , and so a strategic vote is observed with probability $p - \pi$. Furthermore, she is at risk of voting strategically when she prefers candidate 2 (with probability $1 - \pi$) and hence the impact of strategic voting, measured as a proportion of the risk population, is:

$$\frac{p - \pi}{1 - \pi} = \frac{\Phi((1 + b)\Phi^{-1}(\pi)) - \pi}{1 - \pi} \quad (3)$$

Equation 3 measures the *impact* of strategic voting. In a similar way, I may assess the *importance* of strategic voting. I can invert Equation 2 to yield π as a function of p : $\pi = \Phi(\Phi^{-1}(p)/(1 + b))$. This tells me what the election outcome *would* have been in the *absence* of strategic voting. If $p > \gamma > \pi$, then strategic voting changes the identity of the winning candidate. For a more accurate assessment of this effect, I must also account for the variation in voter’s signals. Doing so (Appendix A.1) generates the following:

$$p = \Phi\left(\frac{(1 + b)\eta}{\sqrt{\text{var}[b\delta_i + \tilde{u}_i | \eta]}}\right) = \Phi\left(\frac{(1 + b)\eta}{\xi} \sqrt{\frac{m}{m + b^2 + 2b}}\right) \quad (4)$$

$$= \Phi\left((1 + b)\Phi^{-1}(\pi) \sqrt{\frac{m}{(m - 1) + (1 + b)^2}}\right) \quad (5)$$

$$\Rightarrow \pi = \Phi\left(\frac{\Phi^{-1}(p)}{1 + b} \sqrt{\frac{(m - 1) + (1 + b)^2}{m}}\right) \quad (6)$$

Equation 3 measures the impact of strategic voting, requiring as input the parameters γ , π , m and ξ^2 .⁷ Equation 6 allows me to “invert” an election outcome (i.e. remove the effect

⁶Here I have actually given her a signal $\delta_i = \eta$, and so $\varepsilon_i \sim N(0, \xi^2)$. If I had considered her behavior conditional on her actually receiving a signal δ_i , then the distribution of ε_i changes slightly. The reason is that \tilde{u}_i and hence ε_i is a component of the signal δ_i , and so knowledge of δ_i influences the distribution of ε_i . Correcting for this has a minimal effect on the analysis — see Appendix A.1.

⁷A voter’s response to her signal b is contingent on γ , m and ξ^2 .

of strategic voting, and requires as input the parameters γ , p and m . The parameters γ , π and p summarize the constituency situation, and I consider them in more detail in Section 4. In the calibration exercises of Sections 5–7 I examine the response of strategic voting to the information parameter m . Before doing this, however, I must consider the specification of the idiosyncrasy parameter ξ^2 .

ξ^2 measures the idiosyncrasy of preferences across the electorate. An increase in ξ^2 results in a larger number of voters who are more heavily committed to their preferred candidate (for instance, when u_{i1}/u_{i2} is large). As I show in Appendix A.2, a value for ξ^2 may be pinned down by the preferences of the median supporter of a particular candidate. To understand this idea, consider the median supporter of candidate 1, and suppose that she prefers candidate 1 twice as much as candidate 2, so that $u_1 = 2u_2$. Since she is the median supporter, it follows that $\Pr[u_1 \geq 2u_2] = \pi/2$. Together with π , this equation is sufficient to solve for ξ^2 . In fact, for this example and $\pi = 1/2$, it solves for $\xi^2 = 1.056$ (see the Appendix). I thus fix ξ^2 at this value for the calibration exercises of Sections 5–7.

4. DISTANCE FROM CONTENTION AND MARGINALITY

Intuition suggests that strategic voting should be greater in marginal constituencies when the preferred candidate is far from contention. In the context of the current model, when the preferred candidate is far from contention any pivotal event will almost always involve the leading challenger, and so formal theory agrees with this aspect of informal intuition.⁸ The marginality hypothesis⁹ is more problematic, however. The idea is that pivotal events are more likely in more marginal constituencies. This idea has no role in a theory of purely instrumental voting, however, since it is the *relative* probability of different pivotal events that matters and not the *absolute* probability of a pivotal event.

⁸Empirically the distance from contention is well known as a strong predictor of strategic voting, allowing the measure to become a basis to construct validity tests for different measures of strategic voting (Franklin, Niemi and Whitten 1992, 1993, 1994 and Evans and Heath 1993, 1994).

⁹Cain (1978, p. 644) provides a classic example of this hypothesis in his analysis of strategic voting in Britain. He expects the pressure to defect (i.e. vote strategically) to be lower in “noncompetitive” constituencies.

In the present model, the constituency situation is summarized by γ and π . Unfortunately, these parameters are not an ideal way to separate the effects of marginality and distance from contention. Suppose, for instance, that $\gamma > \pi > 1/2$. An increase in π (associated with higher strategic voting incentives) will increase the gap between the two challenging candidates and hence the distance from contention of candidate 2. Unfortunately this parameter change also closes the gap between candidate 1 and the required qualified majority, making the constituency more marginal. It is unclear whether increased strategic voting is due to marginality or the distance from contention.

A different representation of the constituency situation is required. To do this, I expand consideration to the all members of the constituency, including those who vote (exogenously) for the disliked $j = 0$, and write the true support for these three candidates as ψ_0, ψ_1 and ψ_2 where $\psi_0 + \psi_1 + \psi_2 = 1$. This scenario may be easily mapped back into the qualified majority voting game. The qualified majority of dissatisfied voters required to defeat $j = 0$ is $\gamma = \psi_0/(1 - \psi_0)$. The true support for candidate 1 among the electorate is $\pi = \psi_2/(1 - \psi_0)$.

Using the notation ψ_j , the ideas of marginality and distance from contention may be formalized. Consider a constituency in which at least some strategic voting is needed to defeat $j = 0$, so that $\psi_0 > \psi_1 > \psi_2$, or equivalently $\gamma > \pi$. Then I may define:

$$\begin{array}{l} \text{Winning} \\ \text{Margin} \end{array} = w = \psi_0 - \psi_1 \quad \text{and} \quad \begin{array}{l} \text{Distance from} \\ \text{Contention} \end{array} = d = \psi_1 - \psi_2$$

These parameters (together with $\psi_0 + \psi_1 + \psi_2 = 1$) are sufficient to determine the constituency situation. Solving linearly to obtain ψ_0, ψ_1 and ψ_2 in terms of w and d :

$$\left. \begin{array}{l} \psi_0 = (1 + 2w + d)/3 \\ \psi_1 = (1 - w + d)/3 \\ \psi_2 = (1 - w - 2d)/3 \end{array} \right\} \Rightarrow \gamma = \frac{1 + 2w + d}{2 - 2w - d} \quad \text{and} \quad \pi = \frac{1 - w + d}{2 - 2w - d}$$

Using this formulation, I may change w and d separately, and determine the effect on γ and π . By inspection, both γ and π are increasing in d , and so (as expected) an increase in

the distance from contention results in greater strategic incentives. γ is clearly increasing in the winning margin w . Simple algebra confirms that this π is also increasing in w . Fixing the distance from contention, an increase in the size of the winning margin w (making the constituency *less* marginal) actually *increases* the incentives to vote strategically.

Proposition 2. *When coordination is required to defeat $j = 0$ ($\psi_0 > \psi_1 > \psi_2$) the incentive to vote strategically increases with both the winning margin and the distance from contention.*

Proof. See Appendix A.3. □

This prediction runs against established intuition. After controlling for the distance from contention, strategic voting should be *lower* in more marginal constituencies. An appeal to the data is required. In recent work, Fisher (2000) finds that strategic voting increases with the winning margin in recent British General Elections. The effect is small, but nevertheless statistically significant when estimated across the three elections of 1987, 1992 and 1997. This analysis is extended by Myatt and Fisher (2002) and Fisher (2001). In the former paper, a version of the strategic incentive λ is shown to explain the pattern of strategic voting across all three elections, and its inclusion eliminates the significance of the winning margin and distance from contention measures. In the latter paper, Fisher (2001) includes a range of other explanatory variables, including political interest, education, party identification and local campaign spending. A version of λ continues to have strong explanatory power. Thus there is strong empirical support for the present theory relative to informal intuition. Interestingly, this provides a partial response to the critique of rational choice theory offered by Green and Shapiro (1994): The formal theory offers explanations that differ from intuition, and yet better explain the data.

5. APPLICATION: NEW YORK 1970

I am now in a position to calibrate the Myatt (2002) model and examine the impact and importance of strategic voting in the context of reasonable parameter values. I return to

the case of the 1970 New York senatorial election (Table 1). Mapping this example into the model yields the parameters γ and p :

$$\gamma = \frac{\psi_0}{\psi_1 + \psi_2} = \frac{2,288,190}{3,605,704} = 0.635 \quad \text{and} \quad p = \frac{\psi_1}{\psi_1 + \psi_2} = \frac{2,171,232}{3,605,704} = 0.602$$

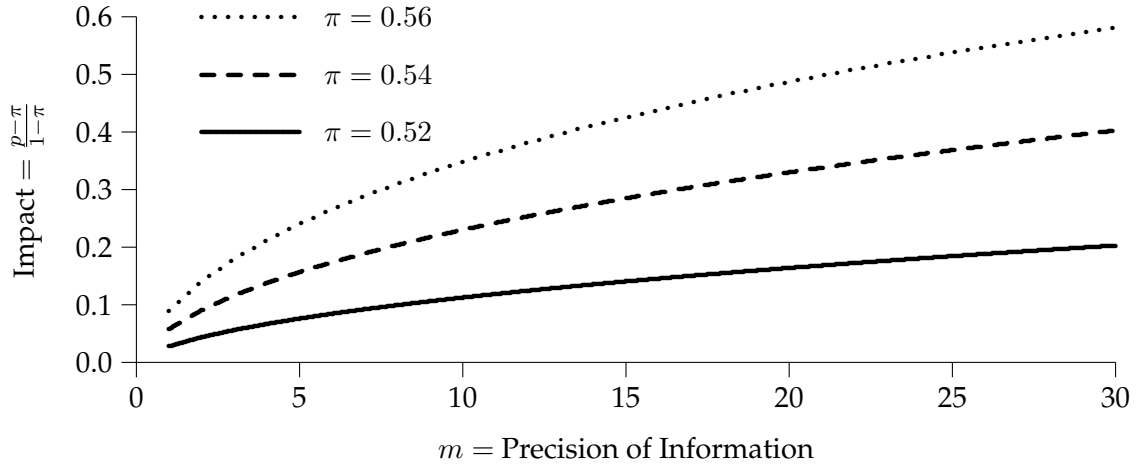
Hence liberal voters needed to achieve a qualified majority of $\gamma = 0.635$ to defeat the disliked Buckley (see Section 1) and yet achieved only $p = 0.602$, and this split in the liberal vote allowed Buckley to win. Following the analysis of Section 3, I fix the idiosyncrasy parameter at $\xi^2 = 1.056$. For any specified m , I may now calculate the equilibrium response b of a voter to her signal δ_i . Proposition 1 gives bounds to b . The exact value, however, is the solution to the following fixed point equation:¹⁰

$$b = \frac{2m\Phi^{-1}(\gamma)\sqrt{\text{var}[b\delta_i + \tilde{u}_i | \eta]}}{\xi^2(1+b)} = \frac{2\sqrt{m}\Phi^{-1}(\gamma)}{\xi} \sqrt{\frac{b^2 + 2b + m}{b^2 + 2b + 1}} \quad (7)$$

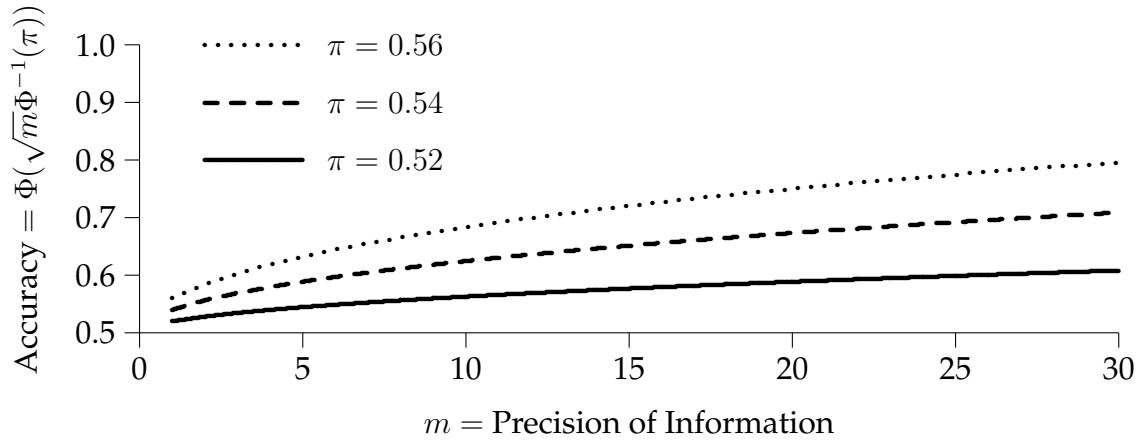
With this in hand, I am able to calculate b for various m . For a variety of values for π , I calculate the impact of strategic voting, by substituting into Equation 3. The results are displayed in Figure 1(a). As expected, the impact of strategic voting on the risk population increases with both m and π . For small m and π , strategic voting is limited. However, it takes only moderate values of m to increase the equilibrium impact of strategic voting to (when π is relatively large) higher levels. Are such larger values for m reasonable?

Adopting the micro-foundation for the informative signal δ_i described in Section 2, namely sampling of preferences of others, it would seem that larger values for m are appropriate. An individual voter might be expected to interact with a large number of people during day-to-day interaction, yielding a large m . This may be misleading, however. Even if the number of individuals is observed is large, the *effective* value for m will be rather lower. I offer two reasons here. First, the observation of the preferences of others is likely to occur with noise. Second, and most importantly, if a voter interacts with individuals whose preferences are correlated, then the observation of additional voters is likely to add little extra information. I address this second issue formally in Section 6. To cope with these issues, I can check the plausibility of m by computing the *accuracy* of beliefs.

¹⁰This is an application of the equilibrium solution from Myatt (2002). See Appendix A.4 for details.



(a) The Impact of Strategic Voting



(b) Accuracy of Voter Beliefs

FIGURE 1. Strategic Voting in the New York Senatorial Election

I define the accuracy of beliefs as the probability that the informative signal correctly identifies the leading challenger. Continue to assume (without loss of generality) that $\eta > 0$. A signal indicates the correct leader when δ_i . This occurs with probability $\alpha = \Pr[\delta_i \geq 0] = \Phi((\sqrt{m}/\xi)\eta) = \Phi(\sqrt{m}\Phi^{-1}(\pi))$. This last formula allows me to cross-check m against the accuracy of beliefs. For instance:

$$m = 25 \Rightarrow \alpha = \Phi(\sqrt{m}\Phi^{-1}(\pi)) = \begin{cases} 0.599 & \pi = 0.52 \\ 0.692 & \pi = 0.54 \\ 0.775 & \pi = 0.56 \end{cases}$$

with further values illustrated in Figure 1(b). The calibration exercise demonstrates that if the outcome of the New York senatorial election is to be consistent with the present model then either the true value for π must be relatively close to $1/2$ or the information available to voters must not identify the challenger with very high probability. In fact, I can calculate the parameter π that is consistent with the data by using Equation 6. Doing so with $m = 25$ yields $\pi = 0.528$. This suggests that, absent strategic voting, Ottinger's true support may have been closer to $0.528 \times 61\% \approx 32.2\%$. Of course, the value of $m = 25$ implies that voters' beliefs were not particularly accurate, and hence this "inversion" procedure is subject to the critique that an instrumentally rational theory requires voters to have relatively "fuzzy" beliefs. I turn attention to this issue in the next section.

6. COMMUNITY SAMPLING AND FUZZY BELIEFS

The calibration exercise for the New York senatorial election suggests that the present theory is consistent with observed data only when there are small amounts of information available to voters. If I were to introduce the possibility of opinion polls, then the probability that a voter will be able to identify the lead challenger will be relatively large. In such situations, therefore, the theory may well predict too much strategic voting, leading me to question the assumption of instrumental rationality.

Turning to other scenarios, however, this is not necessarily the case. The plurality rule is used in the parliamentary constituencies of the United Kingdom. At a constituency level, opinion polls are not typically available, and hence a voter must learn of the constituency situation via social communication.¹¹ If I am to take seriously the sampling procedure described in Section 2, then I must also recognize that voters are likely to communicate with other individuals who are similar to them. I formalize this idea with a notion of *community communication*. Suppose that each individual belongs to a community, and that a fraction ω of her idiosyncratic component is shared with all individuals in the community.

¹¹As highlighted in Myatt (2002), for 1997 UK General Election, Evans, Curtice and Norris (1998) note that 47 nationwide opinion polls were conducted during the election campaign. By contrast, only 29 polls were conducted in 26 different constituencies at a constituency level, out of a total of 659 constituencies.

This is formalized as follows:

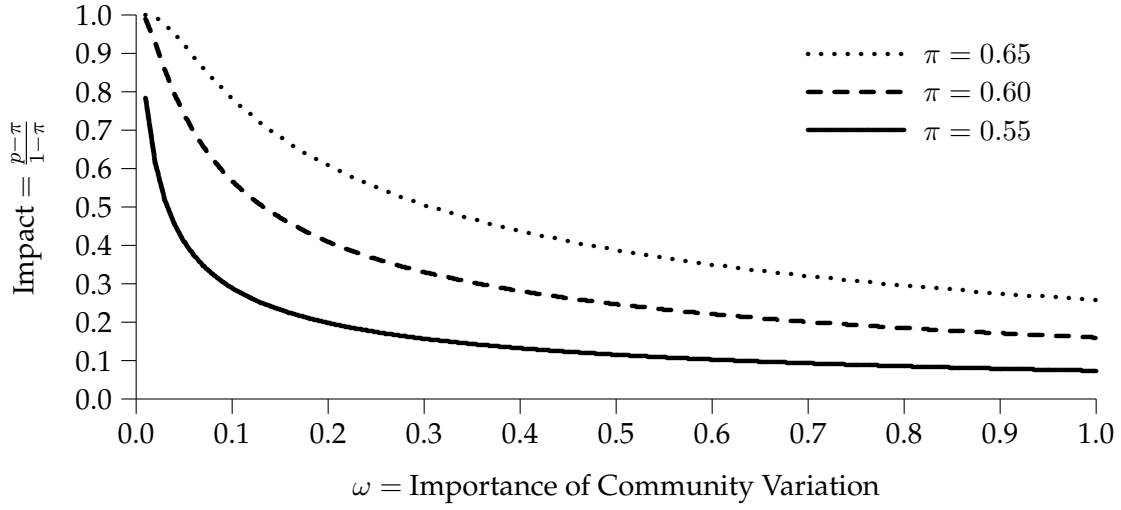
$$\varepsilon_i = \theta + \tilde{\varepsilon}_i \quad \Rightarrow \quad \tilde{u}_i = \eta + \theta + \tilde{\varepsilon}_i \quad \text{where} \quad \begin{aligned} \text{var}[\theta | \eta] &= \omega \xi^2 \\ \text{var}[\tilde{\varepsilon}_i | \eta] &= (1 - \omega) \xi^2 \end{aligned}$$

Thus preferences are equal to a common component across the constituency, plus a community component and then a further individual component. The parameter ω represents the relative importance of the community effect. This specification may seem reasonable; after all, the political preferences of the electorate may well be affected by events at a community level. Now, suppose that a voter is only able to sample the preferences of individuals from her own community. Since θ is common to every sample member, it cannot be averaged out. This means that $\text{var}[\delta_i | \eta] \geq \text{var}[\theta | \eta]$. In fact, the best that a voter can do is to identify perfectly the typical member of her community. This would be equivalent to the observation of $\eta + \theta$, and hence a signal $\delta_i = \eta + \theta$. In this case:

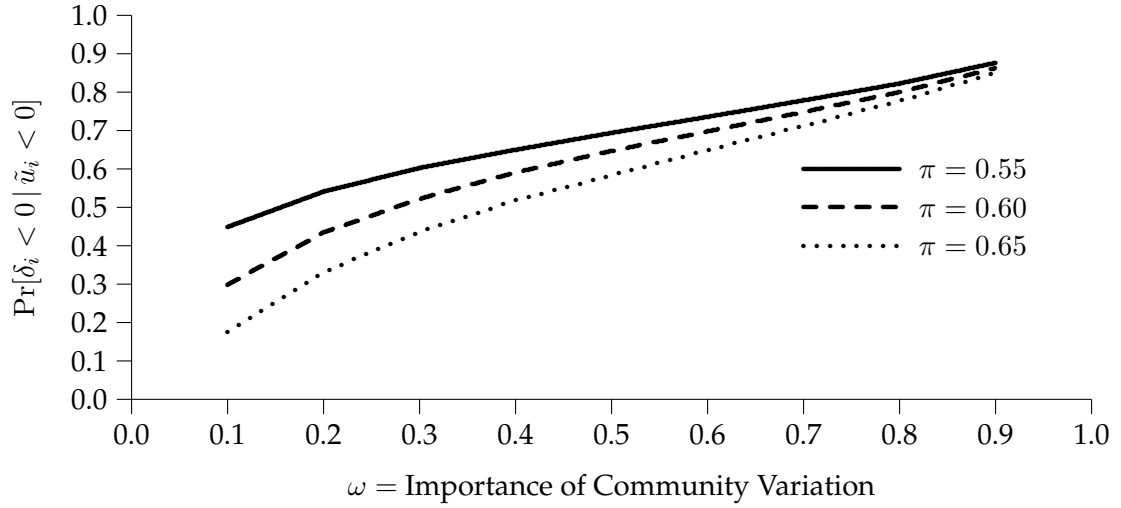
$$\text{var}[\delta_i | \eta] = \text{var}[\theta | \eta] = \omega \xi^2 \quad \Rightarrow \quad m = \frac{\text{var}[\delta_i | \eta]}{\xi^2} = \frac{1}{\omega}$$

It follows that there is an upper bound on the precision of information available to a voter. For instance, if $\omega = 0.2$ so that 20% of individual preference variation is due to variation across communities, then $m \leq 5$. This analysis suggests that appropriate values for m might well be very low indeed. In Figure 2(a) I plot the impact of strategic voting against the importance of community variation ω . By inspection, even if a small element of community variation dramatically reduces the impact of strategic voting.

The presence of community variation has additional implications for the pattern of correlation between a voter's preferences and her opinions. Suppose that candidate 1 is the true leading challenger (i.e. $\eta > 0$) but that a particular voter i prefers candidate 2, so that $\tilde{u}_i < 0$. When ω is large, so that the individual variation is small relative to community variation, then it is highly likely that voter i is drawn from a community where $\eta + \theta < 0$. If her opinions are based on the observation of her community (so that $\delta_i = \eta + \theta$ as above) then she will believe that her candidate 2 is the leading challenger. In other words, for large ω , voters are likely to live in communities where their opinions are shared, and



(a) Impact



(b) Incidence of Mistaken Beliefs

FIGURE 2. Strategic Voting and Community Variation

hence any information on the constituency situation will be highly correlated with their own preferences. To express this formally, I may examine:

$$\Pr[\delta_i < 0 | \tilde{u}_i < 0] = \frac{1}{1 - \pi} \int_{\Phi^{-1}(\pi)/\sqrt{\omega}}^{\infty} \Phi\left(\frac{z\sqrt{\omega} - \Phi^{-1}(\pi)}{\sqrt{1 - \omega}}\right) d\Phi(z) \quad (8)$$

This is a probability that a voter's signal indicates that candidate 2 is the lead challenger given that she prefers candidate 2. The equality is derived in Appendix A.5. I plot this probability against ω in Figure 2(b). Since I have, without loss of generality, specified

$\pi > 1/2 \Leftrightarrow \eta > 0$, this is equivalent to the probability that a supporter of the trailing challenger is mistaken in her beliefs of this candidate's likely success. By inspection, for large ω this probability is quite high — it may even exceed $1/2$. I make two observations. First, this shows that the an exaggerated belief in the likely success of a preferred candidate is in no way irrational. In fact, voters form their opinions in a way that is entirely rational — it is merely a consequence of the fact that preferences and information are highly correlated. Second, it suggests that if community variation is large then one might expect to see a large incidence of mistaken beliefs in the support of preferred candidates.

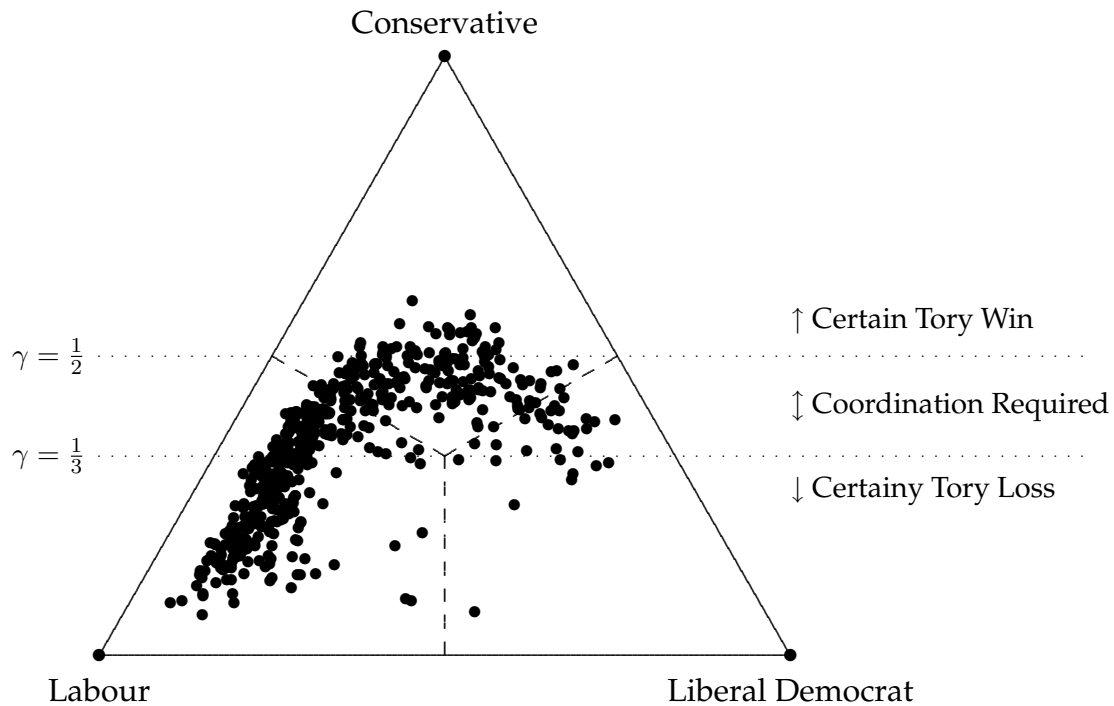
7. APPLICATION: BRITISH GENERAL ELECTION 1997

The Duvergerian equilibria of the Cox-Palfrey framework predict the strict bipartism at the constituency level — all voters coordinate behind two leading candidates. The 1970 New York election provides a counter-example to both this and Cox's (1994) non-Duvergerian equilibria. The data's rejection of Cox-Palfrey framework is more widespread, however, and the 1997 British General Election provides an illustration.¹² Three major political parties (Conservative, Labour and Liberal Democrat) competed throughout 527 English parliamentary constituencies. In Figure 3 I use barycentric coordinates to plot their relative vote shares. It would appear that complete bipartite outcomes are absent. This appeal to the data might suggest a lack of instrumental rationality within the English electorate since the degree of strategic voting is rather less than a formal theory might predict. Alternatively, there may point to weaknesses in the specifications of existing formal theories that drive their strictly Duvergerian predictions.¹³

Using the idea of community communication, I now consider calibrations of the model with rather less information, corresponding to a lower values of m . Naturally, lower values of m lead to lower accuracy, and hence voters find it harder to identify the true

¹²Analysis of strategic voting in Britain is provided by Johnston and Pattie (1991), Lanoue and Bowler (1992) and Niemi, Whitten, and Franklin (1992) *inter alia*. New research, based on British Election Study data and analyzing standard intuitive predictions, the bimodality hypothesis of Cox (1994) and the predictions of this paper is reported by Myatt and Fisher (2002).

¹³Inspection of the Figure 3 also rules out non-Duvergerian equilibria, where there is a tie for second place.



The relative vote shares for the three major parties for 527 English constituencies are plotted using a *barycentric* or *simplex* plot. The three corners of the simplex represent 100% vote shares for the labelled party. A bullet point “•” indicates a constituency. Its location on the graph is a weighted average of the three extreme points, with weights corresponding to the relative vote shares of the major parties. The sides of the simplex (solid lines) represent points where only two parties receive votes. The hatched lines represent points where two parties tie for the lead, and hence separate the “win zones” for each party. The dotted lines delineate the constituencies in which the Conservative party polled between $1/3$ and $1/2$ of the votes for major parties. These are the 270 constituencies in which coordination of anti-Conservative voters is required to avoid a Tory win.

FIGURE 3. British General Election 1997

leading challenger to the disliked incumbent. To take an example, suppose that $\omega = 1/5$ or equivalently $m = 5$. If $\pi = 0.635$, then a voter correctly identifies the leading challenger with probability 78%, and hence 22% of the electorate are mistaken in their perception of the leading challenger. Does this resonate with empirical observation? To assess this, I may turn to the 1997 British Election Survey. Fisher (2000, p. 6) comments that 68.5% of those voters who expected their preferred party to come second actually found that it came third. This suggests that British voters may have rather inaccurate opinions of their constituency situation. More interestingly, he finds that roughly half of those whose

	Actual	$\omega = 0.05$	$\omega = 0.1$	$\omega = 0.2$	$\omega = 0.3$	$\omega = 0.4$	$\omega = 0.5$
Lab>Con>Lib	118	57	70	82	105	105	105
Con>Lab>Lib	73	134	121	109	86	86	86
Con>Lib>Lab	54	70	68	65	65	63	59
Lib>Con>Lab	25	9	11	14	14	16	20
Con \rightarrow Lab	-	61	48	36	13	13	13
Con \rightarrow Lib	-	16	14	11	11	9	5
Con Seats Lost	-	77	62	47	24	22	18
Impact	-	35.8%	31.9%	26.3%	21.9%	18.1%	14.6%

The first four rows of the table classify the 270 seats according to the relative vote shares of the three main parties. I have excluded constituencies in which the Conservative party came third, hence there are four possible configurations. The first column gives the classification according to the actual results. The remaining columns give the results when the strategic voting element is removed, for values of ω from 0.05 to 0.5 (and hence m from 2 to 20). The fifth, sixth and seventh rows give the number of seats lost by the Conservatives due to strategic switching. The final row gives the probability of a strategic vote by a typical member of the risk population — someone who prefers the trailing challenger and who is equipped with a correct signal realization indicating the constituency situation (Equation 3).

TABLE 2. Inverted Election Results: British General Election 1997

preferred party came third expected it to come second. This coincides rather closely with the analysis of Section 6 — see Figure 2(b). It would appear, therefore, that a situation in which voters' beliefs are somewhat "fuzzy" due to significant community-specific effects in preferences generates (at first blush) the kind of results observed in survey data.

Employing these ideas, I turn again the data displayed in Figure 3. As a calibration exercise, I consider the 270 constituencies where the Conservatives polled between $1/3$ and $1/2$ of the vote, and identify them as unpopular incumbents.¹⁴ For each constituency, I calculate appropriate values for γ and p . For a variety of values of ω (and hence m) I calculate b and, using Equation 6, "invert" the election result to obtain π and hence the notional true level of support for each challenging candidate. Following this, I am then able to calculate the election results in the absence of any strategic voting.

¹⁴The implicit assumption is that all supporters of the Labour and Liberal Democrat parties rank the Conservative party last. Of course, this is not actually the case, and in fact a significant proportion of Liberal Democrat voters ranked the Labour party last in 1997. Nevertheless, this simplification is used in order to generate a "ball park" figure for the amount of strategic voting that is consistent with the patterns observed.

Of course, this procedure is very much a “back of the envelope” calibration exercise, and should be seen as nothing more than indicative. Nevertheless, the results are interesting, and given in Table 2. For $\omega = 0.2$, so that community variation accounts for 20% of the idiosyncratic variation of voter preferences, the results suggest that the Conservative party lost 47 seats due to strategic voting towards the Labour and Liberal Democrat parties. Furthermore, this same parameter choice suggests that, according to formal theory, strategic voting affected around 26% of the “risk population” of trailing candidate supporters. This matches well with the empirical estimates of Fisher (2000). He estimates (again using BES data) that 24.4% of voters in the risk population of third party supporters voted strategically in the 1997 British General Election.¹⁵ The overall incidence of strategic voting from a calibrated model appears to be about right.

This final calibration exercise demonstrates that the Myatt (2002) theory can generate results that differ from initial intuition and yet are potentially consistent with observed behavior. The predicted impact of strategic voting is consistent with aggregate statistics from the United Kingdom. Furthermore, the comparative static results of Section 4 are confirmed by Fisher’s (2000) analysis of survey data. Careful consideration of instrumental rationality and voters’ information yields a realistic characterization of the impact of strategic voting.

APPENDIX A. OMITTED PROOFS AND EXTENSIONS

A.1. Sampling, Signals and Preferences.

In Section 2 I suggested that the informative signal may be viewed as the sampling of m individuals. To see this, index such individuals by k . If \tilde{u}_k is observed for each member of the sample, then it is straightforward to show that by Bayesian updating the posterior belief over η satisfies $\eta \sim N(\delta_i, \xi^2/m)$ where $\delta_i = [\sum_{k=1}^m \tilde{u}_k] / m$. This means that, conditional on η , private signal realizations follow the distribution in Equation 1. Of course,

¹⁵This impact figure was calculated across all constituencies and not just those considered here.

individual i 's own preferences must be contained within the sample. This means that:

$$\text{cov}[\tilde{u}_i, \delta_i | \eta] = \text{E} \left[\frac{\varepsilon_i^2}{m} \right] = \frac{\xi^2}{m} \quad \Rightarrow \quad \rho = \frac{\text{cov}[\tilde{u}_i, \delta_i | \eta]}{\sqrt{\text{var}[\tilde{u}_i | \eta] \text{var}[\delta_i | \eta]}} = \frac{1}{\sqrt{m}}$$

The covariance between δ_i and \tilde{u}_i is useful for generating the variance of linear combinations of the informative signal and preferences. For instance:

$$\text{var}[b\delta_i + \tilde{u}_i | \eta] = b^2 \text{var}[\delta_i | \eta] + \text{var}[\tilde{u}_i | \eta] + 2b \text{cov}[\tilde{u}_i, \delta_i | \eta] = \frac{\xi^2(b^2 + 2b + m)}{m}$$

This last expression is used to generate Equation 4. The normality of payoffs ensures that $b\delta_i + \tilde{u}_i \sim N((1+b)\eta, \text{var}[b\delta_i + \tilde{u}_i | \eta])$, and from this Equation 4 follows.

When calculating the impact of strategic voting (via Equation 3) I “equipped” a voter with an accurate signal realization $\delta_i = \eta$, and then calculated the probability that she votes for candidate 1. This satisfied $p = \Phi((1+b)\Phi^{-1}(\pi))$. A slightly different result is obtained when I consider her behavior conditional on her actually receiving a signal realization $\delta_i = \eta$. This is because her preferences form part of the signal, and hence, conditional on $\delta_i = \eta$, it is no longer the case that $\tilde{u}_i \sim N(\eta, \xi^2)$. In fact, Bayesian updating following observation of $\delta_i = \eta$ yields:

$$\tilde{u}_i | \eta, \delta_i = \eta \sim N \left(\eta, \frac{\xi^2(m-1)}{m} \right) \quad \Rightarrow \quad p = \Phi \left(\sqrt{\frac{m}{m-1}} \frac{(1+b)\eta}{\xi} \right)$$

which is a slight modification to Equation 3.

A.2. Specification of the Idiosyncrasy Parameter.

The parameter ξ^2 may be generated in a number of different ways. One way is to specify two different quantiles for voters with different intensity of preference. For instance, a voter prefers candidate 1 when $u_1 \geq u_2$, and hence I may define $\pi(1) = \Pr[u_1 \geq u_2] = \Phi(\eta/\xi)$. A voter prefers candidate 1 k as much as candidate 2 (relative to the disliked status quo) when $u_1 \geq ku_2 \leftrightarrow \tilde{u} \geq \log k$, yielding $\pi(k) = \Pr[u_1 \geq ku_2] = \Phi((\eta - \log k)/\xi)$.

These two equations are sufficient to tie down both η and ξ^2 :

$$\begin{aligned}\pi(k) = \Phi((\eta - \log k)/\xi) &\Rightarrow \xi\Phi^{-1}(\pi(k)) = \eta - \log k = \xi\Phi^{-1}(\pi(1)) - \log k \\ &\Rightarrow \xi = \frac{\log k}{\Phi^{-1}(\pi(1)) - \Phi^{-1}(\pi(k))}\end{aligned}$$

To see this formula action, consider an electorate where a fraction $\pi = \pi(1) = 0.6$ of the electorate rank candidate 1 highest, and half of these (or a fraction $\pi(2) = 0.3$ of the electorate) prefer candidate 1 twice as much as candidate 2. Then:

$$\xi = \frac{\log 2}{\Phi^{-1}(0.6) - \Phi^{-1}(0.3)} = 0.891 \quad \Rightarrow \quad \xi^2 = 0.794$$

Using this formula, ξ^2 may also be specified by considering the median supporter of candidate 1. If the median supporter prefers candidate k times as much as candidate 2, then (by definition of being the median in this group) $\pi(k) = \pi(1)/2$. Hence $\xi = \log k / [\Phi^{-1}(\pi) - \Phi^{-1}(\pi/2)]$. When $\pi = 1/2$ this formula reduces to $\xi = -\log k / \Phi^{-1}(1/4)$. Illustrating this last formulation, consider a balanced constituency in which $\pi = 1/2$. Suppose that the median supporter of candidate 1 prefers her favored candidate twice as much as candidate 2. Then $\xi = 1.028$ and $\xi^2 = 1.056$. For $k = 1.5$ and $k = 2.5$ the outcomes are $\xi = 0.6$ and $\xi = 1.36$ respectively. Hence a range of $0.5 < \xi < 1.5$ might seem appropriate for the idiosyncrasy parameter.

A.3. Comparative Statics.

Proof of Proposition 2: By inspection γ is increasing in both w and d and π is increasing in d . Differentiate π with respect to w :

$$\frac{\partial \pi}{\partial w} = \frac{2(1 - w + d) - (2 - 2w - d)}{(2 - 2w - d)^2} = \frac{3d}{(2 - 2w - d)^2} > 0$$

and hence π is also increasing in w . □

A.4. Calibration of the New York Senatorial Election of 1970.

To generate Equation 7, I use the characterization of the equilibrium b from my companion paper (Myatt 2002, eq. 3):

$$b = \frac{2\Phi^{-1}(\gamma)\sqrt{\text{var}[b\delta_i + \tilde{u}_i | \eta]}}{(1+b)\text{var}[\delta_i | \eta]}$$

Obtaining the variance terms from Appendix A.1 and substituting I generate Equation 7.

A.5. Mistaken Opinions with Constituency Sampling.

I evaluate the probability that a voter both prefers candidate 2 and believes that candidate 2 is the leading challenger. Given that the signal is the identification of the average preference within a voter's community ($\delta_i = \eta + \theta$) it follows that $\tilde{u}_i = \delta_i + \tilde{\varepsilon}_i$. Hence:

$$\begin{aligned} \Pr[\delta_i < 0 \text{ and } \tilde{u}_i < 0 | \eta] &= \int_{-\infty}^0 \Pr[\tilde{\varepsilon}_i < -\delta_i | \delta_i] d\Phi\left(\frac{\delta_i - \eta}{\xi\sqrt{\omega}}\right) \\ &= \int_{-\infty}^0 \left[1 - \Phi\left(\frac{\delta_i}{\xi\sqrt{1-\omega}}\right)\right] d\Phi\left(\frac{\delta_i - \eta}{\xi\sqrt{\omega}}\right) \\ &= \int_{\eta/[\xi\sqrt{\omega}]}^{\infty} \Phi\left(\frac{z\xi\sqrt{\omega} - \eta}{\xi\sqrt{1-\omega}}\right) d\Phi(z) \\ &= \int_{\Phi^{-1}(\pi)/\sqrt{\omega}}^{\infty} \Phi\left(\frac{z\sqrt{\omega} - \Phi^{-1}(\pi)}{\sqrt{1-\omega}}\right) d\Phi(z) \end{aligned}$$

The first equality integrates over the range $\delta_i < 0$ with respect to the distribution of δ_i . The second equality incorporates the distribution of idiosyncratic preference conditional on δ_i . The third equality follows from a change of variable, and the final equality follows from $\eta = \xi\Phi^{-1}(\pi)$. A voter actually prefers candidate 2 with probability $1 - \pi$, and hence dividing through yields the conditional probability of Equation 8.

A.6. Calibration of the British General Election of 1997.

For this calibration exercise, I consider only the 529 English constituencies. The Speaker's seat and Tatton (where the Labour and Liberal Democrat parties pulled out as part of an anti-sleaze protest) are excluded, yielding 527 remaining constituencies. The three leading candidates were then the three major political parties. Writing ψ_0 for the Conservative vote share among these three, I exclude $\psi_0 \geq 1/2$ (a certain Tory win) and $\psi_0 \leq 1/3$ (a

certain Tory loss). Within the remaining 270 constituencies I label the leading challenger as candidate 1 and the trailing challenger as candidate 2. This leads to $\gamma = \psi_0/(1 - \psi_0)$ and $p = \psi_1/(\psi_1 + \psi_2)$. Using $m = 1/\omega$, I calculate the appropriate response parameter b (actually evaluated at its upper bound) and consider a voter receiving an accurate signal realization in order to obtain a value for π . I use this to compute the “notional” outcome in the absence of strategic voting.

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