The Swing Voters' Blessing

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Abstract

Two candidates commit to policy platforms before an election takes place. All voters care about the quality of the candidates as well as the policies they offer. However, the quality differences are only observable to a limited number of informed voters. I show that if all uninformed voters are fully rational, they follow a strategy of making their voting decisions dependent only on the position of their own policy bliss point relative to the median bliss point. As in the standard case with only informed voters, the candidate who is preferred by the median voter wins. In equilibrium, this is the higher quality candidate and the policy implemented is the same as if all voters had been fully informed. I show that the existence of boundedly rational uninformed 'swing voters' increases the welfare of the majority of voters. These swing voters do not consider the fact that their vote influences their utility only when their vote is pivotal. Consequently, they always support the candidate whose policy platform they prefer. In this scenario, the winning high quality candidate's policy is closer to the median voter's bliss point. This 'Swing Voters' Blessing' increases the welfare of the majority of voters.
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1 Introduction

It is widely believed that a lack of relevant information and bounded rationality limit the ability of voters to make the reasoned choices that are required for democratic decision-making to reach its full potential. This scepticism can be found among political economists and political scientists[1] as well as in the general public and has led to the development of the relatively new field of behavioral political economy.[2] However, as pointed out by Ashworth and Bueno De Mesquita (2014), even if voters are not fully rational or informed it would be premature to conclude elections lead to less desirable results compared to a world inhabited by fully informed and rational voters. The reason is the strategic interaction between politicians and voters and the adjustments politicians make when dealing with a boundedly rational electorate instead of a fully rational one. While this strategic interaction between voters and politicians does not guarantee that boundedly rational or uninformed voters lead to more desirable results, Ashworth and Bueno De Mesquita (2014) show in several models that sometimes increased voter competence improves voter welfare and sometimes increased voter competence decreases voter welfare.

I provide a model in which a larger number of boundedly rational uninformed voters (given fixed size and distribution of policy preferences in the electorate) leads to a desirable increase in political competition between two candidates that is shown to be advantageous for the majority of voters.[3] In addition to being an interesting result in itself, this increased competition effect also supports the view that the interaction between boundedly rational voters and politicians deserves more attention than it has so far received in the literature on behavioral political economy.

Specifically, I combine the information aggregation with the preference aggregation aspects of elections. In contrast to previous papers by Feddersen and Pesendorfer (1997, 1999) that also combine information aggregation with preference aggregation, I allow policy platforms to be freely decided by the candidates. Thus, the model presented here is one of the first attempts to combine information aggregation with political competition. To keep the analysis of a model with the additional aspect of political competition tractable, I need a simpler information structure than Feddersen

[1] Two influential works in this spirit are Campbell et al. (1960) and Bartels (1996). Lupia and McCubbins (1998), on the other hand, put much more confidence in the ability of voters to make reasonable decision with limited information. An excellent recent overview of this literature and debate is provided in the introduction of Ashworth and Bueno De Mesquita (2014).

[2] While the rational choice approach never dominated political science, in political economics the standard economic tools prevailed for a long time. Only relatively recently ideas from behavioral economics were introduced into the field of political economy. Schnellenbach and Schubert (2015) provide an overview of this emerging field of behavioral political economy.

[3] Besides of the importance of the interaction between politicians and boundedly rational voter, the modeling approach has little in common with the models provided in Ashworth and Bueno De Mesquita (2014).

and Pesendorfer (1997, 1999). Consequently, some of the voters are fully informed about every relevant aspect of the candidates.

Just as in the information aggregation literature, there is a dimension on which voters agree when they are fully informed and, as in the preference aggregation literature, there is a policy dimension over which voters disagree. An election with quality or valence[4] differences between two ideological candidates takes place. These candidates can commit to policy platforms before the election is held. Imperfect information plays a crucial role because the quality difference is not observed by all voters. However, given the true quality difference, voters agree on which candidate they prefer to win the election for a given policy position. Voters prefer the candidate who is ideologically further away from their ideological bliss point if his quality advantage over the other candidate is sufficiently large.

That the electorate is better informed about the positions of the candidates than about their quality seems plausible. The quality of a candidate is much more difficult to evaluate than a candidate's policy positions because policies are discussed in public debates and reported in the media. While the media often also comments on the quality of a candidate, voters know that such reports are likely to be influenced by partisan considerations. They thus often lack credibility.

The first part of the paper ignores behavioral aspects and thus provides a benchmark result for all results that are derived later. I show that if uninformed voters follow a simple equilibrium strategy of basing their voting decisions on their own ideological position relative to that of the median voter, the candidate who is preferred by the informed median voter wins. An uninformed voter whose bliss point is to the right of the median voter's bliss point votes for the candidate with the right position, and uninformed voters whose bliss point is to the left of the median voter's bliss point votes for the candidate with the left position. Thus, the uninformed voters effectively ignore the policy platforms of the candidates when voting, but they never abstain because they would otherwise lose influence on policy.

As an example, consider the problem of an uninformed conservative voter deciding between Republican Mitt Romney and Democrat Barack Obama in the 2012 United States presidential election. Obama's unobserved quality advantage[5] could

[4]In the political science literature, quality differences between politicians are often referred to as valence differences. For an early use of the term 'valence' in the literature, see Stokes (1963). I will stick to the use of the term 'quality' for the reminder of the paper.

[5]While even not so well informed voters might have formed a more accurate assessment of

potentially be so large that the uninformed conservative voter would prefer him as President if she were fully informed. However, in this case, Obama would not need the conservative voter's support to win the election because his great appeal to informed voters would ensure his victory even without her vote. The election is only a close call as long as Mitt Romney has a relatively high quality as compared to Obama. Therefore, the conservative voter knows that she prefers Romney in case her vote is pivotal and she rationally votes for him.

Uncertainty among uninformed voters makes no difference for the implemented policy, compared to a situation where all voters are fully informed. The candidate with the support of the median voter wins in both cases. In equilibrium, this is the candidate with the quality advantage. He announces the platform that is as close as possible to his own bliss point without giving the other candidate the opportunity to win the support of the median voter. If the median voter is uninformed, the results for the informed median voter case provide a good approximation for the uninformed median case, as long as informed voters are located close to the median voter.

In the second part of the paper, I introduce unsophisticated swing voters into my analysis. These uninformed voters do not take into account that their vote makes a difference only if the election is decided by just one vote and they are pivotal. As a consequence, they vote for the candidate they prefer given the unconditional distribution of the quality difference. Because they can only observe the different policy platforms of the candidates, their decision is always in favor of the candidate whose policy platform is ideologically closer to their own preferences. The term "swing voter" is thus used in the sense in which it is usually used in the political science literature: Swing voters are voters who are not firmly committed to a party or candidate, but who can be convinced to vote for either, in our case by offering a policy platform that is attractive to the voter.[6] In my model this happen to be the uninformed voters who do not take into account that their vote matters only when it is pivotal.

Feddersen and Pesendorfer (1996), on the other hand, define a swing voter as "an

Obama's performance during his first term, the difference to Romney might still have been difficult to assess.

[6] To give just one example for this use of the term in the political science literature: "In simple terms, a swing voter is, as the name implies, a voter who could go either way: a voter who is not so solidly committed to one candidate or the other as to make all efforts at persuasion futile. (Mayer 2007)

agent whose vote determines the outcome of an election". Thus, if a candidate wins with just one vote, all voters who voted for him are "swing voters" in the sense of Feddersen and Pesendorfer (1996). While these two definitions seem to have little in common, a pivotal vote that is cast without conditioning on being a pivotal voter and that results in the swing voters' curse in the sense of Feddersen and Pesendorfer (1996) can only be cast by the voters whom I refer to as swing voters. Consequently, although the definition of the term "swing voter" differs, the term "swing voters' curse" nonetheless refers to the same phenomenon. What I call the swing voters' blessing results from the same kind of bounded rationality that leads to the curse in Feddersen and Pesendorfer (1996) if it exists in the electorate. In the terminology introduced by Austen-Smith and Banks (1996), the swing voters in my model vote "sincerely", not "strategically". The fully rational uninformed voters, on the other hand, make their decision only dependent on their position relative to the median voter. This voting behavior is, in effect, similar to having a party affiliation. While this is not part of the model, it is obvious that if the left candidate were running for a left party and the right candidate were running for a right party, an uninformed voter who conditions her voting decision on being pivotal would support the same party independently of the chosen platforms.

It turns out that the majority of voters are better off, in expectation, if boundedly rational uninformed voters exist. This somewhat surprising result can be interpreted as an example of the second-best principle: Introducing an additional distortion into a model may bring the equilibrium closer to the equilibrium without distortion and increase welfare rather than reducing it further (Lipsey and Lancaster 1956). The existing quality differences between candidates "distort" political competition on the policy dimension and lead to results that are different from normal Downsian Competition. The additional distortion of boundedly rational voting brings the results closer to Downsian competition. But just as Downsian competition will not necessarily lead to welfare maximization, there is no guarantee that swing voters bring the outcome closer to the utilitarian optimum.

It is illuminating to consider the consequences of swing voters in the Obama versus Romney example. A swing voter with a bliss point close to, but left of the median voter votes for the centrist Romney if Obama chooses a policy platform too far left. The existence of such voters forces Obama to stay closer to the median voter to win the election.

Unsophisticated voters make behavioral voting decisions, but this turns out to be a blessing and not a curse because of the rational response of the politicians. Unsophisticated voters can play a strategy that a rational voter could not commit to because it would not be time-consistent to do so and she would want to deviate after the candidates have chosen their positions. No unsophisticated swing voter needs to regret her vote because the candidate with quality advantage wins nonetheless. Her vote could only make her worse off if it were not foreseen by the candidates. But because the candidates know about the existence of swing voters, they adjust their positions. The candidate with the quality advantage wins, but with a more moderate policy position than in the case of full rationality. I call this force of moderation the "Swing Voters' Blessing".

1.1 Literature

When most political economists model elections, the focus is on aggregating individual preferences. Voters disagree on questions of distribution or ideology and elections are a way of deciding which policies are implemented. This literature goes back to the seminal contributions of Black (1948) and Downs (1957).[7] Here, the problem is that voters want different things and an election decides whose preferences prevail. If candidates can commit to policy platforms, as is often assumed in the literature, an election becomes a way of aggregating conflicting preferences.

A different approach to modeling voting and elections goes back to the Jury Theorem by the Marquis de Condorcet (1785). The idea is to model elections as an information aggregation device.[8] Voters' interests and preferences are aligned and if all voters were fully informed they would support the same proposition or candidate. Here, the problem is not that voters want different things, but that limited information creates uncertainty about the consequences of a particular election outcome. Therefore, voters who maximize their expected utility need to understand that their vote has an impact on the election results only if both sides obtain exactly half of the votes and their vote is pivotal for the outcome of the election (Austen-Smith and Banks 1996; Feddersen and Pesendorfer 1996, 1997). Voters who do not consider this when making their voting decision can suffer from what Feddersen and Pesendorfer

[7]For an overview of this literature, see Persson and Tabellini (2000).

[8]Condorcet himself was more interested in the verdict of a jury in a court. For an overview of the information aggregation approach, see Piketty (1999).

(1996) call "the swing voter's curse". Whenever such a voter actually decides an election with her vote, it is likely to turn out that her voting decision makes her worse off. Feddersen and Pesendorfer (1999) combine motives from the information aggregation with the preference aggregation literature in an attempt to explain abstentions in a setup where voters' interests are not perfectly aligned. Their main example is a plebiscite over the decision of whether to build a bridge. None of their voters are fully informed and the policy options are exogenously given. Feddersen and Pesendorfer also mention the example of different candidates for office, but what is missing to make the model in Feddersen and Pesendorfer an adequate framework for the analysis of elections is a stage of the game in which candidates or parties endogenously decide on policy positions. With exogenous policy proposals the swing voters' blessing cannot occur.

My model is similar to that of Groseclose (2001) in combining a policy dimension with a candidate quality dimension. However, I focus on uncertainty in the electorate about the quality of the politicians, while Groseclose focuses on uncertainty among candidates about the preferences of the electorate.

In a series of papers by McKelvey and Ordeshook (1985, 1986), uninformed voters use a sequence of opinion polls to infer the truth about candidate positions. However, McKelvey and Ordeshook ignore the strategic aspects of being a pivotal voter that are central to my basic model. Voters simply try to vote for their favorite candidate given their best estimate of the candidates' positions just as is done by the swing voters in the generalization of my model. If the McKelvey and Ordeshook model were formulated as a game, an uninformed voter would have to condition her estimate of the candidates' positions on herself being pivotal. Moreover, the answers to opinion poll questions may be given strategically. McKelvey's and Ordeshook's assumptions could nonetheless be a good description of how boundedly rational voters actually make their voting decision, but there is no discussion of this issue in their papers, while I compare the results with fully rational voters to those with boundedly rational voters in my model explicitly.

Another paper in the same tradition is Cukierman (1991) whose model is very similar to mine with respect to voters' preferences and information. In contrast to the papers by McKelvey and Ordeshook, voters do not only care about policy, but also about quality. Just as in my approach, some of the voters do not directly observe quality. However, as in the McKelvey and Ordeshook approach, uninformed voters try to gauge some information from opinion polls and, once more, their voting decisions lack game-theoretic foundations.

An idea related to mine can be found in the paper by Bond and Eraslan (2010). These authors endogenize proposals in a Feddersen-Pesendorfer setup. However, they do not model political competition, but rather decision making within a committee as in Feddersen and Pesendorfer (1998), and there is only one offer by an agenda setter, not two offers by competing candidates. Just as in my setup, however, endogenizing positions leads to important differences in the results.

The number of papers that combine competition between candidates and information aggregation is fairly small. I am aware of two examples. In Gul and Pesendorfer (2009), two candidates compete on two dimensions, a policy dimension and personality preference dimension. In contrast to my setup, voters agree on the policy dimension, but disagree on their personality preferences. Moreover, uninformed voters do not observe the policy platforms of the candidates, but all voters observe their own personality preference for one of the candidates. Although by assumption policy is more important than personality, Gul and Pesendorfer show that a candidate with a personality advantage can get elected with partisan policies. Counterintuitively, this is especially true for candidates who care mostly about winning office. While the setup is different from the one presented here, both models have one important result in common: When an election decides over more than one policy dimension and candidates are strategic, voting conditioning on being pivotal, while rational, can decrease welfare and is even disadvantageous for the rational voter herself.

McMurray (2016a, 2016b) has, in two related articles, provided some interesting work that is based on the idea that all voters would agree on an optimal policy if they were fully informed. Consequently, being conservative or liberal is not based on selfish preferences, but on private signals about what policies are welfare maximizing and information aggregation is taking place on the policy dimension. Moreover, some platform divergence becomes desirable from the voters' point of view. McMurray (2016b) also considers strategic platform choice by the candidates. However, because here the policy preferences of voters are not based on fundamentals but on limited information, the results can not be compared to my setup in a meaningful way.

1.2 Structure of the paper

The paper proceeds as follows. In Section 2, the model is described. Section 2.1 provides an analysis for the case in which all uninformed voters are sophisticated. In Section 3, the voting behavior of the swing voters is described. The equilibrium when all uninformed voters are swing voters is presented in Section 3.2 and Section 3.3 contains the most general version of the analysis with all three types of voters.

Generalizations of the utility function are provided in Appendix A and the welfare implications of swing voters are discussed in Appendix B. Appendix C contains some of the proofs.

2 The model

Consider a polity with a one-dimensional ideological policy space on the real line $[0, 1]$, two candidates L and R and an odd number N of voters denoted by $i = 1, 2, 3, ...n$. Candidates have quality q_L and q_R, respectively, and a bliss point for implemented policy b_L and b_R, respectively. The candidates' utility is decreasing in the distance of implemented policy to their bliss point and it is given by:

$$U_J(p) = -(p - b_J)^2, \tag{1}$$

with $J = L, R$, and where p is implemented policy.

Just as the candidates, every voter i has a bliss point b_i on the policy space. I assume that all bliss points are distinct and no two voters have exactly the same preferences.[9] Besides the policy dimension, voters care about the quality of candidates and voter i has the utility function:

$$U_i(b_i, p, q) = -(p - b_i)^2 + q, \tag{2}$$

where $q \in \{q_L, q_R\}$ is the quality of the candidate who wins the election.[10] Voters are ordered by their bliss points so that $b_1 < b_2 < b_3$ and so on. The median bliss point of the voters is denoted by b_m with $m = \frac{N+1}{2}$. I assume that $b_L \leq b_m \leq b_R$

[9]The assumption that no two voters have exactly the same bliss point is a mild one given that the probability of two voters having exactly the same position is 0 if all of them are drawn from a continuous distribution function. It considerably simplifies the notation.

[10]This kind of preferences can be called "one and a half dimensional" (Groseclose 2007).

and call candidate L the left and candidate R the right candidate. The difference in quality of the two candidates is denoted by the variable $v = q_R - q_L$, which hence measures the quality advantage of the right candidate. If the left candidate has a quality advantage, v takes a negative value. The values of q_R and q_L are drawn from a continuous distribution function with support on the whole real line before the candidates announce their policy platforms.[11] The cumulative distribution of v is given by the function $G(v)$. The corresponding probability density function is given by $g(v)$. All players, voters as well as candidates, know the basic structure of the game including the policy preferences of the candidates as well as the distribution of the bliss points of the voters. Some of the voters, the informed voters (their number is $N_I \geq 1$), can observe the realization of the random variable v and the policy platforms offered by the candidates before they make their voting decision. The uninformed voters (their number is $N_U \geq 0$) only observe the policy platforms before they cast their votes. Depending on how they make their voting decisions, I will distinguish two different groups of uninformed voters. Sophisticated uninformed voters who try to cast their votes optimally conditioning on being pivotal in the election are denoted by the subscript 'Pi' (their number is $N_{Pi} \geq 0$). Boundedly rational "swing voters", on the other hand, are denoted by the subscript 'Sw' (their number is $N_{Sw} \geq 0$). Because all uninformed voters belong two one of the two groups, by definition $N_{Pi} + N_{Sw} = N_U$ holds.

Whenever I talk about a specific type of voters, I follow the convention of ordering the members of the type from the left to the right. For example, b_1^U denotes the leftmost uninformed voter.[12]

The sequence of moves as shown in Figure 1 is the following: First, nature chooses q_R and q_L. Second, both candidates commit to a policy platform p_L, $p_R \in [0, 1]$ after observing the quality difference v. Third, an election in which every voter casts at most one vote, either in favor of candidate L or in favor of candidate R, are held. Abstentions are possible. Fourth, the candidate who wins the majority of votes wins and his announced policy platform is implemented. If both candidates achieve the same number of votes, a coin is tossed and each candidate is declared winner with a

[11] The assumption of support on the whole real line is stronger than strictly necessary. However, it is easy to interpret and ensures that the quality as well as the policy dimension can both have a significant influence on a voter's utility.

[12] We would, for example, have $b_1^U = b_3$ if neither the voter with bliss point b_1 nor the voter with bliss point b_2 are uninformed, but the voter with bliss point b_3 is.

chance of 50%. Therefore, $p = p_L$ and $q = q_L$ if candidate L wins and $p = p_R$ and $q = q_R$ if candidate R wins.

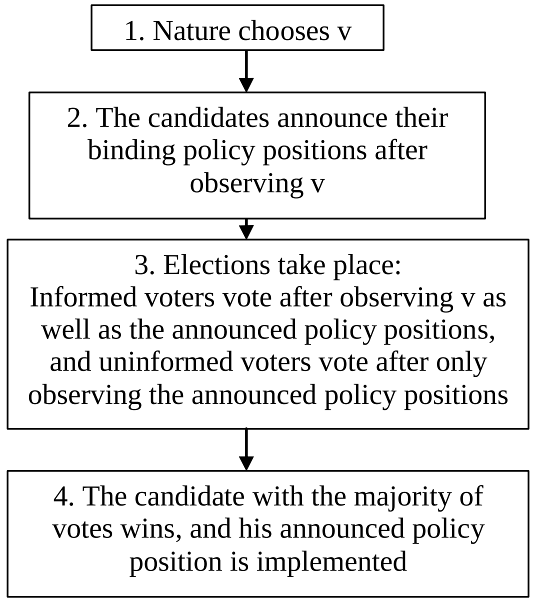

Figure 1: Sequence of moves

The equilibrium concept used for the analysis is Nash equilibrium. However, only the informed and the sophisticated uninformed voters are treated as players, while the strategy of the boundedly rational uninformed voters will be taken as given.

2.1 Solving the model with sophisticated uninformed voters

For now, I assume that there are only sophisticate uninformed voters ($N_U = N_{Pi}$). I begin my analysis at the last stage of the game and solve the problem of the voters after observing the platforms of the candidates. Then, I solve the problem of the candidates when announcing their policy platforms and show the policy that is implemented in this Nash equilibrium.

2.1.1 Informed voters

I consider only equilibria in which informed voters play the weakly dominant strategy of always voting for the candidate whom they favor. It is possible to determine who is the rightmost informed voter weakly in favor of the candidate with the left policy position. Specifically, the cutoff point is the bliss point b^* that makes a voter indifferent between the two candidates. Equating the utility of voting for the left candidate and voting for the right candidate gives:

$$\Delta U(b^*, p_L, p_R, q_L, q_R) = U(b^*, p_L, q_L) - U(b^*, p_R, q_R) = -(p_L - b^*)^2 + (p_R - b^*)^2 - v = 0. \tag{3}$$

The cutoff point b^* exists for any v as long as $p_L \neq p_R$ and it is uniquely given by:

$$b^*(p_L, p_R, v) = \frac{p_L + p_R}{2} - \frac{v}{2(p_R - p_L)} \text{ for } p_R \neq p_L. \tag{4}$$

All voters with a bliss point to the left of b^* prefer the candidate with the left position, while all voters with a bliss point to the right of b^* prefer the candidate with the right position.[13] The right candidate could, in principle, be located at the left position (if $p_R < p_L$). The intuition of equation 4 is straightforward. If $v = 0$, the cutoff point is midway between the policy position of the two candidates. A positive v makes the right candidate more attractive and therefore shifts the cutoff point to the left for given policy positions as long as $p_R > p_L$.

The cutoff point between preferred candidates is the same for informed and uninformed voters. The difference between the two types of voters is that uninformed voters do not know where b^* is located since they do not know the quality difference v. However, for informed voters, the voting decision only depends on b^* and therefore $b_I^*(p_L, p_R, v) = b^*(p_L, p_R, v)$, where b_I^* denotes the cutoff point between informed voters who vote for the left position and informed voters who vote for the right position. If an informed voter is located exactly at b_I^* she is indifferent. In all equilibria presented in this paper, such an indifferent voter turns out to vote in favor of the candidate with quality advantage.

The cutoff point b^* can be located outside the policy space $[0, 1]$. Whenever this is the case, either all or none of the informed voters vote either for the left or for the right position. If $p_L = p_R$ and $v \neq 0$, no value of b solves equation (3) because all informed voters prefer the candidate who has the quality advantage and vote

[13] This can be seen from the derivative of the difference in utility from the left candidate's position and the right candidate's position, with respect to a voter's bliss point:

$$d\frac{\Delta U(b, p_L, p_R)}{db} = -2(p_R - p_L) \quad \begin{matrix} < 0 \text{ if } & p_R > p_L \\ > 0 \text{ if } & p_R < p_L \end{matrix} \quad .$$

.

for him. Therefore, $b^* = b_I^* = -\infty$ if $p_L = p_R$ and $v > 0$, and $b^* = b_I^* = \infty$ if $p_L = p_R$ and $v < 0$. If $p_L = p_R$ and $v = 0$, equation (3) holds for arbitrary values of b since all informed voters are indifferent between the candidates independently of their respective bliss points. Without loss of generality, I make the assumption that in this case, all informed voters give their vote to the left candidate L and $b_I^* = -\infty$.

2.1.2 Sophisticated uninformed voters

The problem of an uninformed voter with bliss point b is that she does not know which candidate she favors, because she is not able to observe the quality difference v. Let l_{Pi} be the number of votes for the left policy position by uninformed voters.[14]

The strategies of the voters constitutes an equilibrium if none of the voters has an incentive to deviate, given the strategies of the other players and her information. Due to the strategy of the informed voters, this implies that, in equilibrium, none of the uninformed voters would prefer to shift the position of the decisive informed voter by changing her own voting decision. If the median voter is informed[15], a simple strategy fulfills this condition if it is followed by all uninformed voters: Let $b_{Pi}^*(p_L, p_R)$ be the cutoff point for uninformed voters: i.e. all uninformed voters with $b < b_{Pi}^*(p_L, p_R)$ support the candidate with the left position and all uninformed voters with $b > b_{Pi}^*(p_L, p_R)$ support the candidate with the right position. Specifically, the condition holds with $b_{Pi}^*(p_L, p_R) = b_m$ as the cutoff point. All uninformed voters with a bliss point to the left (right) of the median voter vote for the candidate with the left (right) policy position. Only if both candidates choose the same policy position, the uninformed voters abstain. The position of the cutoff point is independent of the policy platforms that the candidates announce.[16] Moreover, with this cutoff point, the median voter turns out to be decisive as in standard models without uninformed voters. If both candidates announce the same policy position, uninformed voters abstain.

Lemma 1 *If the cutoff point for all uninformed voters is $b_{Pi}^*(p_L, p_R) = b_m$ for all combinations of p_L and p_R with $p_L \neq p_R$ and the uninformed voters abstain when $p_L = p_R$, the candidate preferred by the informed median voter wins the election.*

[14] I call p_L the left position when $p_L \leq p_R$, and call p_R the left position when $p_L > p_R$.

[15] Section 2.1.6 analyzes the case of an uninformed median voter.

[16] Because in theory the right candidate could play the left policy position, the candidate whom a voter supports in the election is not completely independent of the policy positions.

Proof. Assume $p_L \neq p_R$ and the median voter votes for the candidate with the left policy position. Then $b^* \geq b_m$ and that all informed voters with b_i such that $b_i < b_m$ vote for the candidate with the left policy position. Because the cutoff point for uninformed voters is $b^*_{Pi}(p_L, p_R) = b_m$, all uninformed voters with b_i such that $b_i < b_m$ vote for the candidate with the left policy position. Thus, all voters with $b \leq b_m$ vote for the candidate with the left policy position who wins the election. From a symmetric argument follows that if the median voter votes for the candidate with the right policy position, the right candidate wins. If $p_L = p_R$, the uninformed voters abstain and the candidate with higher quality wins with the vote of all informed voters. Thus, the candidate with the support of the median voter always wins. ■

Given this Lemma, it is straightforward to prove that the cutoff point $b^*_{Pi}(p_L, p_R) = b_m$ describes an optimal strategy for the uninformed voters:

Lemma 2 *The cutoff point $b^*_{Pi}(p_L, p_R) = b_m$ for all combinations of p_L and p_R with $p_L \neq p_R$ and abstention when $p_L = p_R$ characterizes an optimal strategy for an uninformed voter given that informed voters play the weakly dominant strategy characterized by the cutoff point $b^*_I(p_L, p_R, v)$ and that all other uninformed voters use the same cutoff point. As in standard models with full information, the preferences of the median voter decide the election.*

Proof. First we deal with the case $p_L \neq p_R$. Consider of an uninformed voter with her bliss point b_l to the left of b_m ($b_l < b_m$). Since such a voter votes for the left policy position, her alternative is voting for the right position or abstaining. Given equilibrium strategies by all voters there are no abstentions and one of the candidate achieves a majority. The only situation in which the uninformed voters influences the outcome is when the candidate with the left position wins against the candidate with the right position but achieves only a majority of one vote. We know from Lemma 1 that the left candidate wins only if $b^* \geq b_m > b_l$. It follows that an abstention or a vote for the candidate with the right policy position could only make the uninformed voter worse off by leading to the victory of a candidate she would not support if she were fully informed. An analogous argument can be applied to show that a voter whose bliss point is to the right of b_m can never be better off voting for the left position, given the strategies of the other voters.

If $p_L = p_R$, the uninformed voters abstain and the high quality candidate who is preferred by the median voter and all uninformed voters wins. Thus, abstaining must be optimal. ■

The proof of Lemma 2 explains the notation b^*_{Pi} : If all uninformed voters choose this cutoff point, they vote for the candidate whom they prefer whenever they are pivotal.

2.1.3 Intuition for the uninformed voters' strategy

To provide further intuition for the uninformed voters' strategy that will be useful in the rest of the paper, it is helpful to reinterpret the voting strategy of the uninformed as a way of 'appointing' the decisive informed voter.[17]

Let $F_I(b)$ be the number of informed voters with a bliss point smaller than or equal to b, $F_{Pi}(b)$ be the number of uninformed voters with a bliss point smaller than or equal to b, $F_I^{-1}(x)$ the bliss point of the informed voter with the x_{th} lowest bliss point b among the informed voters' bliss points, and let l_{Pi} be the number of votes for the left policy position by uninformed voters. I call p_L the left position when $p_L < p_R$, and call p_R the left position when $p_L > p_R$. Then I refer to:

$$b_I^d(l_{Pi}) = F_I^{-1}\left(\frac{N+1}{2} - l_{Pi}\right) \tag{5}$$

as the bliss point of the decisive informed voter given l_{Pi}.[18] Given the votes of the uninformed voters and the fact that the informed voters follows their weakly dominant strategy, whoever is the candidate preferred by the informed voter with bliss point $b_I^d(l_{Pi})$ wins the election. The reason is that when the decisive voter votes left (right), all informed voters with bliss point further to the left (right) also vote left (right) and together with the votes by uninformed voters this is sufficient for a left (right) majority. With the median bliss point b_m as cutoff point for the uninformed voters, we have $l_{Pi} = F_{Pi}(b_m)$ and thus $b_I^d(F_{Pi}(b_m)) = b_I^d(\frac{N+1}{2} - F_I(b_m)) = F_I^{-1}(F_I(b_m)) = b_m$.

[17] The analogy with delegation the decision to an appointed informed voter seems somewhat flawed because all voters, informed and uninformed, vote at the same point of time. However, if the uninformed voters cast their votes before the informed ones the game would have exactly the same solution.

[18] I distinguish between "decisive voters" and "pivotal voters". A voter is pivotal if the winner of the elections wins with one vote and would lose if a pivotal voter changed her vote. All voters who vote for the winner in an election that is decided by one vote are therefore pivotal. If the majority is larger, there are no pivotal voters. A voter is "decisive" if the candidate whom she prefers wins the elections given the preferences of all voters. In a standard Downsian model, the decisive voter is the median voter with the median bliss point.

The first equality follows directly from the definition of the median voter's bliss point b_m: $\frac{N+1}{2} = F_I(b_m) + F_{Pi}(b_m)$, and the second equality follows from the definition of b_I^d given in equation (5). The third equality follows from the fact that, by assumption, an informed voter with bliss point b_m exists. This result confirms what we have already learned from Lemma 2. All uninformed voters prefer a decisive informed voter with preferences as close to their own bliss point as possible. To achieve this aim, they vote left (right) if their bliss point is to the left (right) of the bliss point of the decisive informed voter. In this way, they attempt to pull the position of the decisive informed voter closer to their own bliss point.

It is noteworthy that the strategy of the uninformed voters is optimal independently of the strategies of the candidates. The uninformed voters ensure that they vote for their favorite (under full information) candidate whenever they are pivotal. They realize that it is not important for whom they vote, as long as their vote does not change the election outcome. If an uninformed voter follows the strategy of only making her decision dependent on her position relative to the median bliss point, she can be certain of never voting against the candidate whose election maximizes her utility when she could decide it in his favor. Thus, she can avoid becoming a victim of the swing voter's curse. Whenever they are pivotal, uninformed voters manage to make the same voting decision as if they had full information.

2.1.4 The candidates

The candidates need the support of the decisive informed voter to win, and the decisive informed voter turns out to be the median voter. The candidate with a quality advantage can win by offering the bliss point of the median voter as the policy proposal. However, he can do considerably better by moving as close as possible to his own bliss point without endangering his election victory.[19] For brevity, I restrict my proofs to the case $v > 0$ for the whole paper. The case $v \leq 0$ is symmetric and thus of no additional value. Whenever $v > 0$ and the following three conditions hold

[19] An interesting aspect of the result is that usual Downsian Competition results do not hold. Due to the additional valence dimension, the winner of the elections does not implement the most preferred policy of the median voter. This is the case despite the fact that Black's theorem (Black 1948) applies to the model and the majority's preferences are identical to those of the median voter (Groseclose 2007). The reason for the discrepancy is that (with the exception of $v = 0$) the median policy is not on offer in combination with the high quality candidate because it is not in the interest of the winning candidate to make it available. Black's theorem holds, but the Downsian version of the median voter theorem does not.

(and the voters play their optimal strategies as derived above) the positions p_L^* and p_R^* are consistent with a Nash equilibrium becausef none of the players has a deviation that would make her better off:

1. The right candidate wins.
2. The right candidate would lose with any position p_R' for which $b_R > p_R' > p_R^*$ holds.
3. Against p_R^* the left candidate cannot win with any position $p_L' < p_R^*$.

Proposition 1 *Together with the cutoff point $b_{Pi}^*(p_L, p_R) = b_m$ for uninformed voters and the weakly dominant strategy of informed voters, the following policy platforms of the candidates constitute an equilibrium of the game:*

$$\left.\begin{array}{l} p_R^* = \min(b_R, b_m + v^{0.5}) \\ p_L^* = b_m \end{array}\right\} \text{ if } v > 0, \qquad \left.\begin{array}{l} p_R^* = b_m \\ p_L^* = \max(b_L, b_m - (-v)^{0.5}) \end{array}\right\} \text{ if } v \leq 0, \tag{6}$$

and the implemented policy is:

$$p^* = \begin{cases} \min(b_R, b_m + v^{0.5}) & \text{if } v > 0 \\ \max(b_L, b_m - (-v)^{0.5}) & \text{if } v \leq 0 \end{cases}. \tag{7}$$

Proof. Proof for the case $v > 0$: The three conditions hold because:

1. The right candidate wins because the median voter is at least indifferent between both candidates: $-(p_R^* - b_m)^2 + v \geq -(p_L^* - b_m)^2$.
2. Either $p_R^* = b_R$ or $-(p_R^* - b_m)^2 + v = -(p_L^* - b_m)^2$ and right would lose with any $p_R' > p_R^*$.
3. $p_L \neq b_m$ implies that $-(p_R^* - b_m)^2 + v \geq 0 > -(p_L - b_m)^2$ and the right candidate wins.

■

2.1.5 Discussion of the equilibrium

The equilibrium given in Proposition 1 is not unique. This is not surprising given that implausible equilibria with voter coordination exist even in models with fully informed voters. A trivial example would be all voters always voting for the same candidate. Since none of the voters is pivotal, this constitutes an equilibrium if the winning candidate announces his bliss point as the policy platform (the other candidate can announce an arbitrary policy position). More examples of additional Nash equilibria are given in Section 3. While the motivation behind Section 3 is the analysis of behavioral voting, it turns out that, surprisingly, the resulting strategy profiles are all consistent with Nash equilibria in which all voters vote optimally.

Nonetheless, there are several arguments why an electorate consisting of only rational uninformed voters can be expected to coordinate on the strategy that is described by the cutoff point $b^*_{Pi}(p_L, p_R) = b_m$. I state them in order of their importance:

1. Section 2.1.3 demonstrates that if all uninformed voters vote to influence the identity of the decisive informed voter to their own advantage and, moreover, assume all other uninformed voters to do the same, the result is the cutoff point $b^*_{Pi}(p_L, p_R) = b_m$.

2. It is the unique equilibrium in which all uninformed voters manage to vote as if they were informed in equilibrium (as long as none of the cadidates can win with choosing his bliss point). This uniqueness is easy to see: If all voters vote as if they were fully informed in equilibrium, the equilibrium positions of the candidates are the same as if all voters were actually fully informed. Because all voter being informed is a case covered by Proposition 1, the unique equilibrium policy platforms consistent with only informed voters are given by equation 6. But given these platforms, we know that the voting decision of uninformed voters who vote as if they were informed is described by the cutoff point $b^*_{Pi}(p_L, p_R) = b_m$ (again as long as none of the cadidates can win with choosing his bliss point).

3. If an uninformed voter turned into an informed voter, her strategy would still be optimal and she would have no reason to change her voting decision. This is somewhat surprising because an informed voter does not vote in the same way as an uninformed voter when candidates play out-of-equilibrium positions.

> However, it is easy to see that all informed voters, with the exception of the median voter, could just take b_m as cutoff instead of playing their weakly dominating strategy. This would not have any consequences for the optimal decision of the candidates (or be inconsistent with a Nash equilibrium) what explains the result.

It follows that there is no additional advantage for the sophisticated uninformed voters in learning about the candidates quality from the policy positions. Thus, more sophisticated solution concepts, for example Bayesian Nash equilibrium, would lead to few additional insights: On the equilibrium path it is straightforward to derive beliefs that are consistent with equilibrium from the policy positions of the candidates, but these beliefs would not influence the voting decision of the uniformed because on the equilibrium path they already vote in the same way as informed voters. And while the equilibrium, as already discussed, is not unique, the arguments given above seem a more convincing equilibrium selection criterion than conceivable restrictions on out-of-equilibrium beliefs that could alternatively be used to select one equilibrium of the game.

Two more interesting feature of the equilibrium should be pointed out. First, while I have assumed that all voters know the bliss points of all other voters, for the analysis with only sophisticated uninformed voters all these uninformed voters need to know is the position of the median voter. Second, even the knowledge of the policy platforms is redundant: While in principle nothing forces the right candidate to take the right policy position and the left candidate to take the left policy position, they clearly have no incentive to do otherwise. Thus, all the sophisticated uninformed voters need to know to follow the equilibrium strategy is their position relative to the median voter.

Appendix A generalizes the utility function of the candidates as well as the voters.

2.1.6 The case of an uninformed median voter

If the median voter is not informed, but all other voters follow the strategies derived in Section 2.1, she is forced to decide between a decisive informed voter with a bliss point to the left or to the right of her own bliss point. Therefore, she does not have the possibility to make a decision that is optimal for all possible beliefs about the true value of v. Nonetheless, if she follows the simple strategy to vote in favor of the policy position closest to her bliss point, this leads to an election outcome in which the candidate whom she would prefer if she were fully informed wins. This is the case although the median voter votes against him. The reason is that the higher-quality candidate who wins the election adjusts his position to win the election, even without the support of the uninformed median voter. I assume that the uninformed median voter votes for the left policy position if both candidates have the same distance from her bliss point. Only if both candidates offer exactly the same policy position she abstains.

Given the vote of the uninformed median voter, the decisive informed voter has the bliss point:

$$b_I^d = \begin{cases} b_l = F_I^{-1}(\frac{N+1}{2} - F_{Pi}(b_m)) & \text{if } |p_L - b_m| \leq |p_R - b_m| \\ b_r = F_I^{-1}(\frac{N+1}{2} - (F_{Pi}(b_m) - 1)) & \text{if } |p_L - b_m| > |p_R - b_m| \end{cases}. \tag{8}$$

The informed voter with bliss point b_l is the one with the bliss point closest to the left of the median bliss point, and the informed voter with bliss point b_r is the informed voter closest to the right of the median bliss point.

The position of the decisive voter given in (8) leads to the following strategies of the candidates:

Proposition 2 *The candidates' strategies in the case of an uninformed median voter are:*

$$\left.\begin{array}{r} p_L^* = \max(b_m - \frac{v}{4(b_m - b_l)}, b_l) \\ p_R^* = \min(b_R, b_l + (v + (b_l - p_L^*)^2)^{0.5}) \end{array}\right\} \text{ if } v > 0$$
$$, \tag{9}$$
$$\left.\begin{array}{r} p_R^* = \min(b_m + \frac{-v}{4(b_r - b_m)}, b_r) \\ p_L^* = \max(b_L, b_r - (-v + (b_r - p_R^*)^2)^{0.5}) \end{array}\right\} \text{ if } v \leq 0$$

and implemented policy is:

$$p^* = \begin{cases} p_R^* & \text{if } v > 0 \\ p_L^* & \text{if } v \leq 0 \end{cases}. \tag{10}$$

Proof. See the Appendix C ■

The intuition for the strategy of the median voter is simple. She punishes the candidate who deviates further from her ideal point. Since in equilibrium the candidate with the quality advantage adjusts his position in a way that ensures his victory, a situation in which the median voter regrets her vote ex post cannot occur. The candidate with quality advantage chooses his platform in a way that brings him as close as possible to his bliss point without losing the election. The candidate with quality disadvantage chooses his platform so that he defeats the winning candidate if the latter chooses a platform even closer to his own bliss point.

It is remarkable that an uninformed median voter is actually better off as compared to the game in which she is informed. Her lack of information makes the threat to vote against the high quality candidate when he takes an extreme position credible.

Let $\varepsilon = \max(b_m - b_l, b_r - b_m)$ be the maximum distance of the median voter to an informed voter on either side. For $\varepsilon \to 0$, the strategies and the implemented policy given by (9) and (10) converge to the solution with an informed median given in (6) and (7).[20] Thus, as long as informed voters are located "close" to the uninformed median voter, candidates' strategies for the case of the informed median provide a good approximation in the case of an uninformed median.

3 Swing voters

The equilibrium strategy for uninformed voters derived in Section 2.1.2 is relatively simple. Nevertheless, it requires a certain level of sophistication of the uninformed voters as well as knowledge of the position relative to the median voter. Relaxing this sophistication requirement allows the reader and future empirical researchers to decide if they are indeed an attribute of a typical electorate. Moreover, modeling less sophisticated voters implies interesting effects on political competition that run counter to the common expectations regarding the effects of a less sophisticated and informed electorate. Specifically, I show that such an electorate actually leads to increased electoral control in the sense of forcing the winning candidate to a policy closer to the bliss point of the median voter. This increases not only the welfare of the median voter, but of a majority of all voters.

[20] I show this for the case $v > 0$: Because $b_l < b_m$ by definition, it follows that for any v if we choose ε small enough $p_L^* = \max(b_m - \frac{v}{4(b_m - b_l)}, b_l) = b_l$. Moreover, b_l converges to b_m when ε goes to 0 and thus p_L^* converges also to b_m and $p_R^* = \min(b_R, b_l + (v + (b_l - p_L^*)^2)^{0.5})$ converges to $\min(b_R, b_m + v^{0.5})$.

3.1 The voting decision of swing voters

The swing voters vote without considering the fact that being the pivotal voter reveals information about the quality of the candidates. Instead, they calculate their expected welfare given the policy platforms of the candidates and their a priori belief of the distribution of v. Therefore, they have the cutoff point $b^*_{Sw}(p_L, p_R) = \frac{p_L+p_R}{2} - \frac{E(v)}{2(p_R-p_L)}$, which reduces to $b^*_{Sw}(p_L, p_R) = \frac{p_L+p_R}{2}$ under the assumption that $E(v) = 0$ which I make from now on. All swing voters with a bliss point to the left of this cutoff point vote for the left policy position, all swing voters with a bliss point to the right of this cutoff point vote for the right policy position. If both candidates choose the same policy position, the swing voters abstain.

Assumption 1 *I assume that a swing voter with bliss point $b^*_{Sw}(p_L, p_R)$ votes for the left policy position if $b^*_{Sw}(p_L, p_R) \geq b_m$ and for the right policy position if $b^*_{Sw}(p_L, p_R) < b_m$. Only if both candidates announce identical policy positions, the swing voters abstain.*

3.2 The game when all uninformed voters are swing voters

First, I analyze the game under the assumption that all uninformed voters are swing voters. This is sufficient to understand the intuition behind the results in Section 3.3, where I solve the most general version of the game with both sophisticated uninformed voters and swing voters. Qualitatively, the results are the same.

3.2.1 The candidates' problem

I solve the problem for the case $v > 0$, the case $v < 0$ has a symmetric solution. The left candidate cannot stop the high quality right candidate from achieving a majority. However, he can force the right candidate to stay on a relatively central position. With uninformed swing voters, the candidates face a trade-off between votes by informed and uninformed voters. Consequently, what kind of majority of uninformed and informed voters the left candidate tries to achieve depends on the details of the distribution of both types of voters. The minimum and the maximum number of informed voters i needed in a possible majority of one vote for the left candidate depends on the total number of informed and uninformed voters:

$$\begin{aligned} i_{\min} &= \max(0, \frac{N+1}{2} - N_{Sw}), \\ i_{\max} &= F_I(b_m). \end{aligned} \tag{11}$$

The lower limit of informed voters voting for the left candidate when he achieves a majority, $i_{\min}$, follows from the necessity to achieve a majority with the help of at most N_{Sw} uninformed swing voters. The upper limit of informed voters, $i_{\max}$, necessary to achieve the minimum required majority for the left candidate follows from the fact that if the left candidate gets the vote of an informed voter, he also gets all votes by uninformed voters who have bliss points further left. Consequently, the rightmost informed voter the left candidate would possibly want to target is either the median voter or, if the median voter is uninformed, the rightmost informed voter to the left of the median voter. To find the equilibrium, one first calculates the positions of the left candidate p_L^i with $i = i_{\min}, i_{\min}+1, ..., i_{\max}$ that force the right candidate to take a position as far left as possible. This position is denoted by p_R^i and is the rightmost position (or, if it is further left, the right candidate's bliss point) that does not allows the left candidate to achieve majority consisting of i informed and at least $\frac{N+1}{2} - i$ uninformed voters. The equilibrium policy platforms are the leftmost p_R^i and the corresponding position(s) p_L^i.

Proposition 3 *If we have only informed and swing voters the equilibrium positions of the candidates in case $v > 0$ are given by:*

$$\begin{aligned} p_L^* &= p_L^{i^*} \text{ with } i^* = \arg\min_i(p_R^i), \\ p^* &= p_R^* = \min_i(p_R^i), \end{aligned} \tag{12}$$

and for $i = i_{\min}, i_{\min}+1, ..., i_{\max}$:

$$\begin{aligned} p_L^0 &= b^{Sw}_{\frac{N+1}{2}} \text{ if } i_{\min} = 0, \text{ otherwise } p_L^0 \text{ does not exist}, \\ p_L^i &= \max(b^{Sw}_{\frac{N+1}{2}-i} - \frac{v}{4(b^{Sw}_{\frac{N+1}{2}-i} - b_i^I)}, b_i^I) \text{ for all } i \geq 1 \text{ and } b_i^I < b_m, \\ p_L^{i_{\max}} &= b^I_{i_{\max}} \text{ if } b^I_{i_{\max}} = b_m. \end{aligned} \tag{13}$$

$$\begin{aligned} p_R^0 &= p_L^0 = b^{Sw}_{\frac{N+1}{2}} \text{ if } i_{\min} = 0, \text{ otherwise } p_R^0 \text{ does not exist}, \\ p_R^i &= \min(b_R, b_i^I + (v + (b_i^I - p_L^i)^2)^{0.5}) \text{ for all } i \geq 1. \end{aligned} \tag{14}$$

Proof. See the Appendix C ■

One remarkable fact should be pointed out: While the strategy of the swing voters is taken as given and these voters are not considered as players when deriving the equilibrium, their strategy is nonetheless entirely consistent with a Nash equilibrium in which we consider them as fully rational and payoff maximizing players. Their cutoff point is (given $v > 0$) to the right of the cutoff point of the informed voters, thus all of them who vote for the winning candidate also prefer the winning candidate to win. This rules out that they support the 'wrong' candidate when they are pivotal and consequently they play a best reply to the other players' strategies.

3.2.2 The swing voters' blessing

The exact solution to the candidates' problem depends on the details of the distribution. Nonetheless, it is possible to give an important result about the differences in outcomes with and without unsophisticated "swing voters". I compare the equilibrium policy with only swing voters and only sophisticated voters for a given distribution of uniformed and informed voters. As before, let Let $F_I(b)$ be the number of informed voters with a bliss point smaller than or equal to b and $F_j(b)$ with $j = Sw, Pi$ be the number of uninformed voters with a bliss point smaller than or equal to b. In this section, I use the notation $p_j^*(Pi)$ respectively $p_j^*(Sw)$ for the equilibrium policy positions to clearly distinguish the equilibrium with sophisticated uninformed voters (Pi) and swing voters (Sw).

Proposition 4 (The Swing Voters' Blessing) *Take $F_I(b)$ and $F_j(b)$ with $j = Sw, Pi$ as given. The equilibrium policy with only swing voters ($j = Sw$) is located between the equilibrium policy of the game with only sophisticated uninformed voters ($j = Pi$) and the bliss point of the median voter. Thus, for given v, the majority of voters is weakly better off if the uninformed voters are swing voters.*

Proof. If the high quality candidate chooses the median position he cannot be defeated. If the other candidate chooses a different position, the high quality candidate wins the median voter's vote and either every voter to the left or every voter to the right of the median voter. If the other candidate also chooses the median position, the uninformed voters abstain and the high quality candidate wins with the votes of all informed voters. It follows that the equilibrium policy is either at the median position or closer to the high quality candidate's bliss point. Let $p_L^*(Pi)$ and $p_R^*(Pi)$ be the equilibrium policies when all uninformed voters are sophisticated. Then if $v > 0$, $b_{Sw}^*(p_L^*(Pi), p_R^*(Pi)) = \frac{b_m + p_R^*(Pi)}{2} > b_m = b_{Pi}^*$ and if $v < 0$, then $b_{Sw}^*(p_L^*(Pi), p_R^*(Pi)) = \frac{p_L^*(Pi) + b_m}{2} < b_m = b_{Pi}^*$. Thus, if the uninformed voters are swing voters, at most the same number of them vote for the high quality candidate if he chooses the equilibrium position for the case of sophisticated uninformed voters $p^*(Pi)$ and the low quality candidate chooses b_m. Thus, if the high quality candidate has a bliss point different from $p^*(Pi)$, any position further away from the bliss point of the median voter and closer to his bliss point leads to a victory of the low quality candidate, otherwise $p_L^*(Pi)$ and $p_R^*(Pi)$ cannot be equilibrium positions for the case of sophisticated uninformed voters. It follows that the high quality candidate achieves a policy that is at least as close to his bliss point when the uninformed voters are sophisticated as when they are swing voters. That the majority of voters is better off follows because either all voters to the left of the median or all voters to the right of the median are better off whenever policies closer to the median voter's bliss point are implemented. ■

Proposition 4 states formally what I call the swing voters' blessing: Swing voters lead to a policy that is closer to the preferred policy of the median voter and as a result the majority of voters is (weakly) better off. From comparing Propositions 1 and 3 follows that in general bounded rationality of the uninformed voters changes equilibrium policy and thus leads to policies closer to the median voter's preferences.

Suppose we have only one uninformed voter in the whole electorate with bliss point b_1^j with $j = Sw, Pi$. For the example, I assume $v > 0$ and that $b_1^j > b_m$. The equilibrium positions in case of a sophisticated uninformed voter is given by Proposition 1 as:

$$\begin{aligned} p_L^*(Pi) &= b_m, \\ p_R^*(Pi) &= \min(b_R, b_m + v^{0.5}) \end{aligned} \tag{15}$$

and we consider the case $\left|b_1^j - p_L^*\right| < \left|b_1^j - p_R^*\right|$. The sophisticated uninformed voter votes right although the left candidate takes a position closer to her bliss point because her bliss point is to the right of the median voter's bliss point and the right candidate wins with a majority of one vote: Every voter to the right of the median voter and the median voter vote for him, every voter to the left of the median voter votes for the left candidate. Now let this compare to the situation where the uninformed voter with bliss point b_1^j is a swing voter. If both candidates chose the same positions as in the case of a sophisticated uninformed voter, the left candidate would win because now the swing voter votes for the left candidate who is offering a position closer to her preferences. The swing voter and all informed voter to the left of the median together form a majority of one, so that the right candidate moves towards the median from position p_R^* to position p_R' to win one additional vote. This vote comes either the informed voter next to the median voter on the median voter's left side or from the swing voter. This is the "swing voters' blessing", the right candidate is forced to choose a more central position and thus, the median voter and all voters to the left of the median are better off. This result is in stark contrast to Feddersen and Pesendorfer (1996) who find a "swing voter's curse". When policies are exogenously given as in Feddersen and Pesendorfer whenever swing voters actually decide the election the wrong candidate (from the swing voter's perspective) wins. The reason that this does not happen here is that the candidates' positions are endogenous.[21] The median voter and in addition at least all voters to the left of the median voter are better off. A more detailed welfare analysis (in expectation as well as ex post) can be found in Appendix B.

3.3 The model with all three types of voters

This section generalizes the analysis of the two special cases of either only sophisticated or only swing voters to a situation in which both groups of voters exist. If swing voters are around, the optimal strategy of sophisticated uninformed voters is not a straightforward rule anymore, but it depends on the voting decisions of the swing voters. Thus, the demands for sophisticated uninformed voters are higher than for the sophisticated uninformed voters in Section 2. In addition, they also need more detailed knowledge of the distribution of voters to implement their voting strategy

[21] The left candidate can usually choose a policy position that is better than $p_L = b_m$. If the uninformed voter is a swing voter, the exact solution can be derived from Proposition 3.

successfully.

It turns out that the results are qualitatively the same when there are only swing voters around. For a given distribution of voters, having more of them being unsophisticated can only lead to more central equilibrium policies. Again, I find the 'Swing Voters' Blessing'.

3.3.1 The problem of sophisticated uninformed voters

The decisive informed voter (if she exists and not either the right or the left candidate wins already at least $\frac{N+1}{2}$ uninformed voters) now has the bliss point:

$$b_I^d(p_L, p_R) = F_I^{-1}\left(\frac{N+1}{2} - l_{Pi}(p_L, p_R) - l_{Sw}(p_L, p_R)\right), \tag{16}$$

where $l_{Pi}(p_L, p_R)$ is the number of sophisticated uninformed voters and $l_{Sw}(p_L, p_R)$ the number of swing voters voting in favor of the left policy position. We follow the same reasoning that explains the cutoff point b_m in Lemma 2 for the case of only sophisticated uninformed voters. This leads to the conclusion that if all sophisticated uninformed voters vote for the left position if their bliss point is smaller than b_I^d, and for the right position if their bliss point is larger than b_I^d, their strategies constitute an optimal reply to the strategies of the other voters for arbitrary combinations of p_L, p_R and v. In this way they can pull the bliss point of the decisive voter closer to their own bliss point. This gives the second condition:

$$l_{Pi}(p_L, p_R) = F_{Pi}(b_I^d(p_L, p_R). \tag{17}$$

If conditions (16) and (17) hold, all sophisticated uninformed voters vote optimally independently of the strategies of the candidates. However, just as in the case with only sophisticated uninformed voters when the median is uninformed, it is sometimes impossible for a sophisticated uninformed voter to make her position only dependent on her own position relative to that of the decisive informed voter. The reason is that her own decision changes the decisive informed voter's identity in such a way that condition 17 can never hold given the voting decision of the other voters. Consider the following cutoff point between voting left and right for sophisticated uninformed voters:

$$b_{Pi}^*(p_L, p_R) = F_R^{-1}\left(\frac{N+1}{2} - l_{Sw}(\frac{p_L + p_R}{2})\right), \tag{18}$$

where $F_R(b) = F_I(b) + F_{Pi}(b)$ is the cumulative distribution function of fully rational voters (voters who are either informed or sophisticated uninformed), and $F_R^{-1}(x)$ gives the fully rational voter with the x_{th} smallest bliss point b among all rational voters. If the fully rational voter at $b^*_{Pi}(p_L, p_R)$ is informed, she is decisive because if she votes left (right), all informed and sophisticated uninformed voters to the left (right) of her vote left (right). Together with the swing voters who vote left (right), this constitutes a majority. Moreover, (17) holds and all sophisticated uninformed voters maximize their utility with their votes even when candidates choose out-of-equilibrium positions. If no swing voters exist, $b^*_{Pi} = F_R^{-1}\left(\frac{N+1}{2}\right)$ is the bliss point of the median voter. This shows that the analysis in Section 2 is a special case of the generalized analysis here. If either $l_{Sw}(\frac{p_L+p_R}{2}) \geq \frac{N+1}{2}$ (first case) or $N_R = N_I + N_{Pi} < \left(\frac{N+1}{2} - l_{Sw}(\frac{p_L+p_R}{2})\right)$ (second case), b^*_{Pi} does not exist because the swing voters' votes already lead to a majority of the left candidate (first case) or the right candidate (second case). I assume that in the first case all sophisticated uninformed voters vote right and in the second case left.

If the sophisticated voter with bliss point $b^*_{Pi}(p_L, p_R)$ exists and is uninformed, she faces a situation similar to that of the uninformed median voter in Section 2.1.6. If she votes for the left candidate, the bliss point of the decisive informed voter is located to the left of her bliss point, and if she votes for the right candidate, the bliss point of the decisive informed voter is located to the right of her bliss point. I assume that she votes for the candidate whose position is closer to her own bliss point. Similarly to the case of an uninformed median voter, this turns out to be consistent with an equilibrium. The reason is once more that the candidates adjust their positions to the voters' strategies and the candidate with quality advantage wins. If both candidates have the same distance from b^*_{Pi}, I assume that a sophisticated uninformed voter with this bliss point votes left if $\frac{p_L+p_R}{2} \geq b_m$ and right if $\frac{p_L+p_R}{2} < b_m$. The analysis of the uninformed median voter in Section 2.1.6 can be interpreted as a special case of the more general setup here. Given this assumption, the decisive informed voter has the bliss point:

$$b_I^d(p_L,p_R)=\begin{cases} b_{Pi}^*(p_L,p_R) & \text{if } b_{Pi}^*(p_L,p_R)\in B_I \\ F_I^{-1}(F_I(b_{Pi}^*(p_L,p_R))) & \text{if } b_{Pi}^*\in B_{Pi} \text{ and } \frac{p_L+p_R}{2}>b_{Pi}^* \\ F_I^{-1}(F_I(b_{Pi}^*(p_L,p_R))) & \text{if } b_{Pi}^*\in B_{Pi} \text{ and } \frac{p_L+p_R}{2}=b_{Pi}^* \text{ and } \frac{p_L+p_R}{2}\geq b_m \\ F_I^{-1}(F_I(b_{Pi}^*(p_L,p_R))+1) & \text{if } b_{Pi}^*\in B_{Pi} \text{ and } \frac{p_L+p_R}{2}=b_{Pi}^* \text{ and } \frac{p_L+p_R}{2}< b_m \\ F_I^{-1}(F_I(b_{Pi}^*(p_L,p_R))+1) & \text{if } b_{Pi}^*\in B_{Pi} \text{ and } \frac{p_L+p_R}{2}<b_{Pi}^*, \end{cases} \tag{19}$$

where B_I is the set of bliss points of informed voters and B_{Pi} the set of bliss points of sophisticated uninformed voters. Thus, $F_I^{-1}(F_I(b_{Pi}^*(p_L,p_R)))$ is the bliss point of the informed voter next to b_{Pi}^* on the left of b_{Pi}^* if $b_{Pi}^*\in B_{Pi}$ and $F_I^{-1}(F_I(b_{Pi}^*(p_L,p_R)+1))$ is the bliss point of the informed voter next to b_{Pi}^* on the right of b_{Pi}^* if $b_{Pi}^*\in B_{Pi}$.

3.3.2 The candidates' problem with all three types of voters

Now I show the optimal positions for the candidates when both types of uninformed voters, sophisticated ones as well as unsophisticated ones, exist. Again, I only solve the problem for the case $v>0$ because the solution for the case $v<0$ is symmetric. The problem is similar to the problem without sophisticated voters but somewhat more complicated because the decision of the sophisticated voters has to be considered.

The minimum and the maximum number of informed voters i needed in a possible majority of one vote for the left candidate depends on the distribution of all three types of voters:

$$\begin{aligned} i_{\min} &= F_I(F_R^{-1}(\frac{N+1}{2}-N_{Sw})) \text{ with } F_I(F_R^{-1}(x))=0 \text{ if } x\leq 0, \\ i_{\max} &= F_I(b_m). \end{aligned} \tag{20}$$

Again, the lower limit of informed voters voting for the left candidate when he achieves a majority, $i_{\min}$, follows from the necessity to achieve a majority with the help of at most N_{Sw} uninformed swing voters, this time also adjusting for the voting decision of the sophisticated uninformed voters. The upper limit of informed voters, $i_{\max}$, necessary to achieve the minimum required majority for the left candidate, follows from the fact that if the left candidate gets the vote of an informed voter, he also gets all votes by uninformed voters (sophisticated or not) who have bliss points further left. Just as in the case with only swing voters, the rightmost informed voter the left candidate would possibly want to target is either the median voter or, if the median voter is uninformed, the rightmost informed voter to the left of the median voter.

Proposition 5 *If we have all three types of voters, the equilibrium positions of the candidates if $v > 0$ are given by:*

$$\begin{aligned} p_L^* &= p_L^{i^*} \textit{ with } i^* = \arg\min_i (p_R^i), \\ p^* &= p_R^* = \min_i (p_R^i), \end{aligned} \tag{21}$$

and for $i = i_{\min}, i_{\min}+1, ..., i_{\max}$:

$$\begin{aligned} p_L^0 &= b^{Sw}_{\frac{N+1}{2}-(F_R(b_1^I)-1)} \textit{ if } i_{\min} = 0,\ b_1^I \textit{ exists and } b_1^I \leq b_m,\ \textit{otherwise } p_L^0 \textit{ does not exist.} \\ p_L^i &= \max(b^{Sw}_{\frac{N+1}{2}-(F_R(b_{i+1}^I)-1)} - \frac{v}{4(b^{Sw}_{\frac{N+1}{2}-(F_R(b_{i+1}^I)-1)} - b_i^I)}, b_i^I) \textit{ for all } i > 0 \textit{ and } i_{\min} \leq i < i_{\max}, \\ p_L^{i_{\max}} &= \max(b_m - \frac{v}{4(b_m - b_{i_{\max}}^I)}, b_{i_{\max}}^I) \textit{ if } b_{i_{\max}}^I < b_m, \\ p_L^{i_{\max}} &= b_m \textit{ if } b_{i_{\max}}^I = b_m \textit{ or } i_{\max} = 0. \end{aligned} \tag{22}$$

The corresponding policy positions of the right candidate are:

$$\begin{aligned} p_R^0 &= p_L^0 = b^{Sw}_{\frac{N+1}{2}-(F_R(b_1^I)-1)} \textit{ if } i_{\min} = 0,\ b_1^I \textit{ exists and } b_1^I \leq b_m, \\ p_R^0 &= p_L^0 = b_m \textit{ if } i_{\max} = 0, \\ p_R^i &= \min(b_R, b_i^I + (v + (b_i^I - p_L^i)^2)^{0.5}) \textit{ for all } i \geq 1. \end{aligned} \tag{23}$$

Proof. See the Appendix C ■

The candidates' equilibrium positions given in Proposition 5 contain all candidate equilibrium positions derived so far as a special cases (Propositions 1, 2 and 3). The uninformed median voter in Section 2.1.6 votes optimally given the analysis of the voting decision of a sophisticated uninformed voters in Section 3.3.1.

Just as was the case with only swing voters in Section, the behavioral strategy of the swing voters is consistent with a Nash equilibrium even if we consider them as players. Their cutoff point is (given $v > 0$) to the right of the cutoff point of the informed voters. All swing voters who support the winning candidate prefer the winning candidate to win. Consequently, they play a best reply to the other players' strategies.

3.3.3 The swing voters' blessing II

Now I generalize the "swing voters' blessing" result to the general case and consider all three types of voters. This time, I consider the possibility that only the identity of some voter is switched while Proposition 4 only compared the case of only sophisticated uninformed with the case of only swing voters. Moreover, I also consider the possibility that some informed voters could become uninformed. Proposition 6 implies Proposition 4.

Proposition 6 (The Generalized Swing Voters' Blessing) *Take the distribution of voters $F(b)$ as given. For a given v, turning either a voter from being informed to being uninformed sophisticated or from uninformed sophisticated into a swing voter does either not change the equilibrium policy or leads to a policy closer to the median voter's bliss point.*

Proof. See the Appendix C ■

It follows directly from proposition 6 that turning an informed voter into a swing voter can only lead to a policy closer to the median voter's preferences because this is exactly the same as first turning the informed voter into a sophisticated uninformed voter and then in a second step turning this sophisticated uninformed into a swing voter. As long as individual changes have effects in the same direction one can simply add them up. In the same way one can also use the Proposition to show that Proposition 6 implies Proposition 4.

We have already discussed an example of turning an informed voter into an uninformed sophisticated voter having an effect on the equilibrium policy position: This is what we observed comparing the case of an informed median voter to an uninformed median voter when all uninformed voters are sophisticated. As a result, policy moves closer to the median voter's bliss point for all $v \neq 0$.

4 Conclusion

This paper combines elements of the two approaches in political economics that interpret elections as preference aggregation and information aggregation, respectively.

I merge a Downsian model with voter disagreement on policy on a left-right scale, with a model of voter agreement over the quality of political candidates, which is not observable to all voters.

A lack of information on the part of some voters about the quality of politicians is shown to have no consequences at all if every uninformed voter is rational. But if there are some boundedly rational swing voters, a lack of information increases electoral control, in the sense of pulling the implemented policy closer to the preferences of the median voter. This surprising result arises because boundedly rational voters support whoever offers them a policy closer to their own bliss point. They do not consider the fact that their vote is only important in a close election with both candidates obtaining exactly half of the votes. This voting strategy works as a commitment device, forcing the winning candidate to moderate his policy position. The larger the group of swing voters is, the stronger is the favorable effect. Boundedly rational swing voters turn out to be a blessing, not a curse.

One important reason why behavioral voting never leads to the swing voters' curse in the setup is a lack of uncertainty over the preferences of the voters. In addition, the candidates are extremely well informed about the distribution of swing voters in the electorate. Left for future research is the introduction of uncertainty into the model. Conceivable is, for example, a setup in which the candidates do not know the exact distribution of the voters or are uncertain over the share of swing voters in the population. In this way, it might be possible to construct a model in which the swing voters have a desirable effect on political competition, as in the model presented here, while the swing voter's curse could nonetheless occur with positive probability in equilibrium. This could also allow for electoral surprises and victories by the lower quality candidate that are observed occasionally.

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Appendix A
Generalizing the utility functions

In the baseline model discussed so far, the utility functions of the voters as well as of the candidates are chosen to be as simple as possible. This section shows that the results are quite robust to the choice of the utility functions.

The utility function of the voters

First, consider the utility function of the voters given in (2). The proofs in Section 2 are based on the fact that there is a single cutoff point between informed voters who prefer the left candidate and informed voters who prefer the right candidate. Consequently, all proofs hold without any major modification if there is at most one cutoff point or all informed voters prefer the same candidate. To show that a more general function leads to the same type of equilibria as in Section 2, I only need to show that the assumptions about functional form imply a unique cutoff point.

A more general utility function that depends only on distance and the quality of politicians is:

$$U_i(p, b_i) = u(d_i, q), \tag{2'}$$

with $d_i = |b_i - p|$. If $u(d_i, q) = -d_i^2 + q$, (2') is identical to (2).

Sufficient restrictions on the utility function for having a unique cutoff point are that the following derivatives exist and fulfill the conditions:

$$\begin{array}{ll} (a) & u_d(d, q) \leq 0, \\ (b) & u_{dd}(d, q) < 0, \\ (c) & u_q(d, q) \geq 0, \\ (d) & u_{qd}(d, q) \leq 0. \end{array}$$

Condition (a) naturally follows from defining the point b_i is the bliss point of voter i. Condition (b) is somewhat stronger, but nonetheless standard. A voter suffers less from departing from her ideal point b to some alternative policy p' than from departing the same distance $|b-p'|$ away from p' to a policy p'' which has the distance $2|b-p'|$

from b. Without this restriction, for example, a high-quality Democratic candidate could be preferred by Democrats as well as very conservative voters, while moderate Republicans would prefer the low-quality Republican candidate. This would lead to two cutoff points. Condition (c) implies that voters never feel worse off with a higher-quality candidate ceteris paribus. It is necessary to ensure that, for example, very conservative voters do not prefer a low-quality Democrat to a high-quality moderate Republican. Condition (d) helps to rule out cases of a very conservative voter preferring a high-quality Democrat to a moderate Republican even if the latter is preferred by moderate Republican voters.

Lemma 3 *Given the conditions on its derivatives, the generalized utility function $u(d_i, q)$ leads to at most one cutoff point in b for a given combination of q_L, q_R, p_L and p_R.*

Proof. Assume that $p_R \geq p_L$, as is always the case in any equilibrium (the proof is analogous for $p_R < p_L$). Then, there are two possibilities, $q_R \geq q_L$ and $q_R < q_L$. If $q_R \geq q_L$, then either every voter prefers right (and the unique cutoff point is $b^* = 0$), or there is at least one value $b \in [0, 1]$ that solves $u(|b - p_L|, q_L) = u(|b - p_R|, q_R)$. The latter follows from the mean value theorem because u is continuous in d (this is implied by the fact that u has a derivative with respect to d), and therefore also in b (because d is a continuous function of b). Let b^* denote the largest b that solves the equation. From $q_R \geq q_L$, it follows that $b^* \leq \frac{p_L+p_R}{2}$, because a higher-quality candidate is always preferred if he is located closer to a voter's bliss point. From this and the fact that b^* is the rightmost bliss point with $u(|b-p_L|, q_L) = u(|b-p_R|, q_R)$, it follows that all voters to the right of b^* prefer right. If $b^* > p_L$, all voters with a bliss point b such that $p_L \leq b < b^*$ must prefer left because their bliss point is closer to p_L and further away from p_R than for the indifferent voter with bliss point b^*. Voters with $b < \min(p_L, b^*)$ must have a preference for left because the two assumptions $u_{dd}(d, q) < 0$ and $u_{qd}(d, q) \leq 0$ ensure that $u(|b-p_L|, q_L) < u(|b-p_R|, q_R)$ everywhere to the left of p_L. Therefore, there can be only one cutoff point and all voters with a bliss point to the left of b^* prefer left.

An analogous argument can be given to show that in the case of $q_R < q_L$, the bliss point is also unique. ■

With the help of Lemma 3 all proofs in Section 1 can be applied to the case of the generalized utility function.

The utility function of the candidates

What about the utility function of the candidates given in (1)?

Candidates are assumed to care neither about winning the office nor about the quality of the winner. Both assumptions can be relaxed, because there is no uncertainty about the winner in the equilibrium of the model. Consider first the case that winning office implies additional utility for the winning candidate. Because the high quality candidate always wins the election in equilibrium, additional utility from winning office can not give him incentives to choose a different policy position. The same is true for the low quality candidate: There is no possibility for him to win the election with a different policy platform, so he has no reason to deviate. This is also true if the candidates, just as the voters, are better off when the candidate who wins office is of higher quality. While the lower quality candidate might now actually be better off losing the election, there is still no incentive for him to deviate from the equilibrium strategies. Thus, the strategies given in Section 2 continue to constitute an equilibrium when the utility of the candidates depends on the quality of the winner of the election or on winning the election.

Appendix B
Welfare analysis

In this section, I show the welfare impact of having swing voters in the electorate and, as a consequence, policies that are at least weakly closer to the median voter's bliss point. As already explained in the main text, ex post, a majority of voters must be weakly better off because a policy that is closer to the median bliss point is closer to the majority of voters. In addition, I show that a (possibly different) majority of voters is also better off in expectation (before v is determined).

Take $g(v)$ as given. Let again $p'(v)$ be an equilibrium policy and $p''(v)$ a different one resulting from the same distribution of bliss points $F(b)$, but with some informed voters instead of sophisticated uninformed voters and/or some sophisticated uninformed voters instead of swing voters. From Proposition 6, we know that the policy $p'(v)$ is at least as close to the median bliss point as the policy $p''(v)$. Thus, $(p''(v) - b_m)^2 \geq (p'(v) - b_m)^2$ for any difference in quality v. Therefore, the median voter must be (weakly) better off with policy $p'(v)$ for every value of v. Conditioning on v (ex-post), the majority of voters must be better off with $p'(v)$ instead of $p''(v)$.

If $v > 0$ ($v \leq 0$), all voters to the left (right) of the median bliss point are better off with $p'(v)$ since the implemented policy is closer to their bliss point. The median is better of in both cases, too, and consequently a majority of all voters is.

A similar result is now derived for expected utility. In an equilibrium with policy $p(v)$, the expected utility (before nature chooses the quality of candidates) of a voter with bliss point b is :

$$E[U(p,b)] = \int_{-\infty}^{\infty} -(p(v)-b)^2 g(v)dv + E[\max(q_L, q_R)], \tag{24}$$

where the first term is the utility from implemented policy dependent on the quality difference and the second part is the utility from the quality or quality of the winner of the election. Since the candidate with a quality advantage wins in equilibrium, the quality of the winner is the larger of the two candidates' qualities, q_R or q_L.

The difference in ex ante expected utility from the different equilibrium policies $p''(v)$ and $p'(v)$ for a voter with bliss point b is therefore:

$$\Delta E(U,b) = E[U(p'',b)] - E[U(p',b)] = \int_{-\infty}^{\infty} (-p''(v)^2 + p'(v)^2 + 2b(p''(v) - p'(v)))g(v)dv. \tag{25}$$

We know that the difference is nonpositive for the median voter because we know that she is weakly better off with $p'(v)$:

$$\Delta E(U, b_m) = \int_{-\infty}^{\infty} (-p''(v)^2 + p'(v)^2 + 2b_m(p''(v) - p'(v)))g(v)dv \leq 0 \tag{26}$$

If $\int_{-\infty}^{\infty}(p''(v) - p'(v)))g(v)dv > 0$, all voters with $b < b_m$ are better off with $p'(v)$ in expectation, and if $\int_{-\infty}^{\infty}(p''(v) - p'(v)))g(v)dv < 0$, all voters with $b > b_m$ better off with $p'(v)$ in expectation. Together with the median voter, either group constitutes a majority and therefore, the majority of voters is better off with $p'(v)$.

If the expected value of $p'(v)$ is the same as the expected value of $p''(v)$, all voters are better off in expectation. In this case, the volatility of policy decreases, which is good for all voters because they are risk averse, while the expected policy remains the same.

Appendix C - Proofs

Proofs Section 2

Proof Proposition 2. Again, I show only the case $v > 0$ and use the three sufficient conditions for an equilibrium stated in Section 2.1.4:

1. The right candidate wins because given the policy platforms p_L^* and p_R^*, the informed voter with bliss point b_l is either indifferent between the candidates or prefers the right candidate: $-(b_l - p_R^*)^2 + v \geq -(b_l - b_l - (v + (b_l - p_L^*)^2)^{0.5})^2 + v = -(v + (p_L^* - b_l)^2) + v = -(p_L^* - b_m)^2$. If the informed voter with bliss point b_l is either indifferent between the candidates or prefers the right candidate, all informed voter to the right of him also prefer the right candidate. Thus, all voters to the right of the median and one informed voter to the left of the median form a majority for the right candidate who wins the election.

2. The right candidate would lose with any position p'_R for which $b_R > p'_R > p_R^*$ holds because in case $p_R^* \neq b_R$ we have $-(b_l - p_R^*)^2 + v = -(p_L^* - b_m)^2$ and it follows that the right candidate would not have the support of the informed voter with bliss point b_l for any position $p_R > p_R^*$. Thus, to form a majority he would need the support of the uninformed median voter. If $p_L^* = b_m - \frac{v}{4(b_m - b_l)}$, then $p_R^* = b_l + (v + (b_l - b_m + \frac{v}{4(b_m - b_l)})^2)^{0.5} = b_m + \frac{v}{4(b_m - b_l)}$. If $p_L^* = b_l \Rightarrow p_R^* = b_l + v^{0.5} \geq 2b_m - b_l$ (where the last inequality is due to the fact that $p_L^* = b_l \ \Rightarrow v \geq 4(b_m - b_l)^2$). In both cases $|p_R^* - b_m| \geq |p_L^* - b_m|$, and therefore for any position $p_R > p_R^*$, the median voter votes for the left candidate. Thus, for any $p_R > p_R^*$, the decisive informed voter is the voter with bliss point b_L who votes for the left candidate, and the left candidate wins.

3. Against p_R^* the left candidate cannot win with any position $p'_L < p_R^*$. This condition holds although the left candidate can win the informed voter with bliss point b_l by choosing a position slightly to the left of of p_L^* as long as $p_L^* > b_l$. However, with any position $p'_L < p_L^*$ against p_R^*, the left candidate cannot win the vote of the uninformed median voter who is either indifferent between p_L^* and p_R^* (if $p_R^* < b_R$) or prefers p_R^* to p_L^* (if $p_R^* = b_R$). This implies that all voters at and to the right of the median policy bliss point vote for the right candidate who wins the election against any $p'_L < p_L^*$. The left candidate cannot achieve any additional votes by informed voters by choosing a position p'_L further right such that $p_L^* < p'_L < p_R^*$ either. This follows from the fact that given the policy platforms p_L^* and p_R^*, the informed voter

with bliss point b_l is either indifferent between the candidates or prefers the right candidate as established above. This implies that for any position p_L' such that $p_L^* < p_L' < p_R^*$, the informed voter with bliss point b_l prefers the right candidate with platform p_R^*. Consequently, for any p_L' such that $p_L^* < p_L' < p_R^*$, the cutoff point $b^*(p_L', p_R^*, v)$ is to the left of $b_l \Rightarrow$ no informed voter with a bliss point to the right of b_l votes for the left candidate. ■

Proofs Section 3

Proof Proposition 3. Again, I show only the case $v > 0$ and use the three sufficient conditions for an equilibrium stated in Section 2.1.4.

First, we find the policy position for the left candidate that makes it as difficult as possible for right candidate to achieve a majority in spite of left trying to achieve a majority consisting of i informed and at least $max(\frac{N+1}{2} - i, 0)$ uninformed voters. These policy positions p_L^i with $i = i_{\min}, i_{\min} + 1, ..., i_{\max}$ are given by:

$$
\begin{aligned}
p_L^0 &= b^{Sw}_{\frac{N+1}{2}} \text{ if } i_{\min} = 0, \text{ otherwise } p_L^0 \text{ does not exist,} \\
p_L^i &= \max(b^{Sw}_{\frac{N+1}{2}-i} - \frac{v}{4(b^{Sw}_{\frac{N+1}{2}-i} - b_i^I)}, b_i^I) \text{ for all } i \geq 1 \text{ and } b_i^I < b_m, \\
p_L^{i_{\max}} &= b^I_{i_{\max}} \text{ if } b^I_{i_{\max}} = b_m.
\end{aligned}
$$

The corresponding solutions for the right candidate's problem are given by:

$$
\begin{aligned}
p_R^0 &= p_L^0 = b^{Sw}_{\frac{N+1}{2}} \text{ if } i_{\min} = 0, \text{ otherwise } p_R^0 \text{ does not exist,} \\
p_R^i &= \min(b_R, b_i^I + (v + (b_i^I - p_L^i)^2)^{0.5}) \text{ for all } i \geq 1.
\end{aligned}
$$

That the policy position $b^{Sw}_{\frac{N+1}{2}-i} - \frac{v}{4(b^{Sw}_{\frac{N+1}{2}-i} - b_i^I)}$ makes it as difficult as possible for the right candidate to stop left from achieving a majority consisting of i votes by informed and $(\frac{N+1}{2} - i)$ votes by uninformed voters follows from an examination of the right candidate's best reply in the cases in which $p_L^i = b^{Sw}_{\frac{N+1}{2}-i} - \frac{v}{4(b^{Sw}_{\frac{N+1}{2}-i} - b_i^I)}$:

$$p_R^i = \min(b_R, b^{Sw}_{\frac{N+1}{2}-i} + \frac{v}{4(b^{Sw}_{\frac{N+1}{2}-i} - b_i^I)}).$$

If p_R^i is to the left of his bliss point b_R, it is the point closest to his policy bliss point that the right candidate can choose and still win the election taking the position of the left candidate p_L^i as given. The left candidate wins the vote of the uninformed voter with bliss point $b^{Sw}_{\frac{N+1}{2}-i}$ which has the same distance to both candidates (because of $b^*_{Sw}(p_L, p_R) = b^{Sw}_{\frac{N+1}{2}-i} \geq b_m$ and Assumption 1), but not the vote of the i^{th} informed voter who is indifferent between both candidates. If the left candidate chose a position slightly to the left, he could win the informed voter with bliss point b_i^I, but would in return lose the uninformed voter with bliss point $b^{Pi}_{\frac{N+1}{2}-i}$ and thus could not win the election. Any policy position p_L close to p_L^i would either make it easier for the right candidate to win the informed voter with bliss point b_i^I or the uninformed voter $b^{Sw}_{\frac{N+1}{2}-i}$ and thus would allow the right candidate to win the election with a position somewhat further to the right.

In cases in which $b^{Sw}_{\frac{N+1}{2}-i} - \frac{v}{4(b^{Sw}_{\frac{N+1}{2}-i} - b_i^I)} < b_i^I$ we find $p_L^i = b_i^I$. The reason that the left candidate does not choose a position to the left of b_i^I when fighting for a majority with i informed voters is that such a position would be less attractive for the informed voter with bliss point b_i^I as well as the uninformed voter with bliss point $b^{Sw}_{\frac{N+1}{2}-i}$ and thus makes it easier for the right candidate to stop left from achieving a majority consisting of i informed and $\frac{N+1}{2} - i$ uninformed voters. Again, the right candidate chooses the policy p_R^i as close as possible to his bliss point without losing the informed voter with bliss point b_i^I. In case $p_L^i = b_i^I$, it is possible that the left candidate would achieve a majority against p_R^i if enough uninformed voters vote for him. However, below it is shown that in this case left would decide to fight for a different majority with a different p_L^i and consequently the selection of the equilibrium policy platforms p_L^* and p_R^* is not influenced when we just ignore this fact when calculating it.

If $b^I_{i_{\max}} = b_m$, the left candidate wins a majority whenever he wins the informed voter with bliss point $b^I_{i_{\max}}$. In this case $b^{Sw}_{\frac{N+1}{2}-i}$ is by definition of b_m located to the left of $b^I_{i_{\max}}$ and all uninformed voters with a bliss point to the left of an informed voter who votes left also vote left. Thus, in this case the policy position that makes it as difficult as possible for the right candidate to stop left from winning a majority consisting of $i_{\max}$ informed and $(\frac{N+1}{2} - i_{\max})$ uninformed voters is $b^I_{i_{\max}} = b_m$.

If $N_{Sw} \geq \frac{N+1}{2}$ and thus $i_{\min} = 0$, the left candidate could achieve a majority without any support by informed voters by winning the $\frac{N+1}{2}$ rightmost uninformed voters. In this case, one additional possible combination of equilibrium policies is that both candidates choose $b^{Sw}_{\frac{N+1}{2}}$, the uninformed voters abstain and the right candidate wins with the votes of the informed voters. If the right candidate chose any $p_R >$

p_R^0, right would lose because at least $\frac{N+1}{2}$ uninformed voters would vote left. This completes the list of possible optimal policies for the left candidate and the replies of the right candidate.

Given the potentially optimal policy platforms for the left candidate and corresponding policy platforms of the right candidate, it is optimal for the left candidate to choose to fight for the majority that forces the right candidate to choose a position closest to the center to stop the left candidate from achieving it and thus:

$$\begin{aligned} p_L^* &= p_L^{i^*} \text{ with } i^* = \arg\min_i(p_R^i), \\ p^* &= p_R^* = \min_i(p_R^i), \end{aligned}$$

are the equilibrium policy positions of the candidates (The optimal position of the left candidate is not necessarily unique). The right candidate's optimal policy p_R^* wins the election against p_L^*. We know already that this is the case if $i^* = 0$. If $i^* \neq 0$ by construction of $p_R^* = p_R^{i^*}$, right achieves at least $N_I - i^* + 1$ votes by informed voters.

Moreover, he also gets at least $N_{Sw} - (\frac{N+1}{2} - i^*)$ votes by uninformed voters. If i^* such that $p_L^{i^*} = b^{Sw}_{\frac{N+1}{2}-i^*} - \frac{v}{4(b^{Sw}_{\frac{N+1}{2}-i^*} - b^I_{i^*})}$ right wins $N_{Sw} - (\frac{N+1}{2} - i^*)$ votes by uninformed voters by the construction of $p_L^{i^*}$ and $p_R^{i^*}$. The remaining possibility is that $p_L^{i^*} = b^I_{i^*}$. Two subcases have to be considered:

1. subcase: If $p_L^{i^*} \geq p_L^{i^*-1}$, $p_R^{i^*} > p_R^{i^*-1}$ by construction of $p_R^{i^*}$. This is a contradiction because it implies $p_R^* \neq \min_i(p_R^i)$

2. subcase: If $p_L^{i^*} < p_L^{i^*-1}$, this implies that $b^I_{i^*-1} < p_L^{i^*-1}$ and thus by construction of $p_L^{i^*-1}$ and $p_R^{i^*-1}$, $b^{Pi}_{\frac{N+1}{2}-(i^*-1)} = \frac{p_L^{i^*-1}+p_R^{i^*-1}}{2}$. Moreover, $p_R^* = \min_i(p_R^i)$ implies $p_R^{i^*} \leq p_R^{i^*-1}$. $b^{Pi}_{\frac{N+1}{2}-(i^*-1)} = \frac{p_L^{i^*-1}+p_R^{i^*-1}}{2}$, $p_R^{i^*} \leq p_R^{i^*-1}$ and $p_L^{i^*} < p_L^{i^*-1}$ together imply that the right candidate wins the uninformed voter with bliss point $b^{Pi}_{\frac{N+1}{2}-(i^*-1)}$ given the policy positions $p_R^{i^*}$ and $p_L^{i^*}$ and thus achieves a majority consisting of $N_I - i^* + 1$ informed and $N_{Pi} - \frac{N+1}{2} + i^*$ uninformed voters.

If $p_R^* < b_R$, the right candidate would lose against p_L^* with any $p'_R > p_R^*$. In case $i^* = 0$ this is trivial because left would achieve a majority consisting of swing voters. In all cases $i^* > 0$, by construction of p_L^* and p_R^* and the fact that $p_R^* < b_R$ the right candidate loses the support of the $i's$ leftmost informed voter by moving right and thus his majority. The left candidate can not win against p_R^* with any $p'_L < p_R^*$. This follows from the fact that to have any chance to win i informed voters, he needs to take a position to the left of p_L^i because p_L^i wins only $(i-1)$ informed voters against p_R^i and consequently the same number or less against $p_R^* \leq p_R^i$. But even if the left candidates manages to win i informed voters this way, he can never achieve the necessary additional $\frac{N+1}{2} - i$ votes from uninformed voters. To see this, first note that $p_R^* \leq p_R^i$ implies that the right candidate wins at least as many votes from uninformed voters with p_R^* as with any other position p_R^i (or the election with the votes of the informed voters if $p_R^* = p_L^*$). Moreover, by construction p_R^i wins at least $N_{Sw} - (\frac{N+1}{2} - i)$ uninformed voters against any $p_L' < p_L^i$ for all cases in which $p_L^i > b_i^I$. When $p_L^i = b_i^I$, on the other hand, the left candidate can not win i informed voters against p_R^* because he cannot even win them against $p_R^i > p_R^*$. ■

Proof Proposition 5. As in the case with only swing voters in Proposition 3, the left candidate can try to achieve a majority by targeting different combinations of votes by informed and swing voters to achieve a majority. In the case with all three types of voters, it is in addition necessary to calculate how many sophisticated uninformed voters vote for the left candidate given the positions of the candidates and the votes of the swing voters. The minimum and the maximum necessary number of informed voters i in a possible majority for the left candidate are:

$$\begin{aligned} i_{\min} &= F_I(F_R^{-1}(\frac{N+1}{2} - N_{Sw})) \text{ with } F_I(F_R^{-1}(x)) = 0 \text{ if } x \leq 0, \\ i_{\max} &= F_I(b_m)). \end{aligned}$$

To see this we consider two cases:

First case: $i < i_{\max}$. When exactly $\frac{N+1}{2} - (F_R(b_{i+1}^I) - 1)$ swing voters vote left, then the cutoff point for sophisticated uninformed voters is $b_{Pi}^* = F_R^{-1}\left(F_R(b_{i+1}^I) - 1\right)$ by equation 18 and $b_{Pi}^* = F_R^{-1}\left(F_R(b_{i+1}^I) - 1\right) < b_m$ because $b_{i+1}^I \leq b_m$ for $i < i_{\max}$. Consequently, if the left candidate wins $\frac{N+1}{2} - (F_R(b_{i+1}^I) - 1)$ swing voters, he wins the election if and only if he wins at least i informed voters to win altogether at least $F_R(b_{i+1}^I) - 1$ rational voters and thus a majority. The reason he wins at least at least $(F_R(b_{i+1}^I) - 1)$ sophisticated voters is that the sophisticated uninformed voters who are to the left (right) of the informed voter with bliss point b_{i+1}^I vote left (right). The sophisticated uninformed voters who have bliss points to the right of b_i^I have a bliss point to the right of b_{Pi}^* and the sophisticated uninformed voters who have bliss points to the left of b_i^I have a bliss point to the left of b_{Pi}^* or at b_{Pi}^*. The sophisticated uninformed voter who is located at the cutoff point b_{Pi}^* votes left because $\frac{p_L + p_R}{2} \geq b_m$

($\frac{p_L+p_R}{2} \geq b_m$ follows from the fact that exactly $\frac{N+1}{2} - (F_R(b^I_{i+1}) - 1)$ swing voters vote left and $b^I_{i+1} \leq b_m$).

Second case: $i = i_{\max}$. When exactly $\frac{N+1}{2} - F_R(b_m)$ swing voters vote left, then the cutoff point for sophisticated uninformed voters is $b^*_{Pi} = F_R^{-1}(F_R(b_m)) \leq b_m$ by equation 18. Consequently, if the left candidate has the support of the median voter and the informed voter with bliss point $b^I_{i_{\max}}$ (who might or might not be the median voter), he wins the election. In this case all swing voters at and to the left of the median position vote for the left candidate, and in addition a sufficient number of sophisticated uninformed voters. One of the latter can be the median voter. In that case, the left candidate has to target this sophisticated uninformed voter at the median position specifically because $b^*_{Pi} = b_m$. Targeting an informed voter to the right of $b^I_{i_{\max}}$, on the other hand, cannot be optimal because whenever the left candidate wins the informed voter with $b^I_{i_{\max}}$, this implies that the left candidate wins more votes than necessary for a majority and could also win with a position further to the left.

Using these results, the potentially optimal positions for the left candidate for $i = i_{\min}, i_{\min}+1, ..., i_{\max}$ are given by:

$$\begin{aligned} p^*_L &= p^{i^*}_L \text{ with } i^* = \arg\min_i(p^i_R), \\ p^* &= p^*_R = \min_i(p^i_R), \end{aligned}$$

with:

$$\begin{aligned} i_{\min} &= F_I(F_R^{-1}(\frac{N+1}{2} - N_{Sw})) \text{ with } F_I(F_R^{-1}(x)) = 0 \text{ if } x \leq 0, \\ i_{\max} &= F_I(b_m)). \end{aligned}$$

and for $i = i_{\min}, i_{\min}+1, ..., i_{\max}$:

$$\begin{aligned} p^0_L &= b^{Sw}_{\frac{N+1}{2}-(F_R(b^I_1)-1)} \text{ if } i_{\min} = 0,\ b^I_1 \text{ exists and } b^I_1 \leq b_m, \\ p^i_L &= \max(b^{Sw}_{\frac{N+1}{2}-(F_R(b^I_{i+1})-1)} - \frac{v}{4(b^{Sw}_{\frac{N+1}{2}-(F_R(b^I_{i+1})-1)} - b^I_i)}, b^I_i) \text{ for all } i > 0 \text{ and } i_{\min} \leq i < i_{\max}, \\ p^{i_{\max}}_L &= \max(b_m - \frac{v}{4(b_m - b^I_{i_{\max}})}, b^I_{i_{\max}}) \text{ if } b^I_{i_{\max}} < b_m, \\ p^{i_{\max}}_L &= b_m \text{ if } b^I_{i_{\max}} = b_m \text{ or } i_{\max} = 0. \end{aligned}$$

The corresponding policy positions of the right candidate are:

$$\begin{aligned} p_R^0 &= p_L^0 = b^{Sw}_{\frac{N+1}{2}-(F_R(b_1^I)-1)} \text{ if } i_{\min} = 0,\, b_1^I \text{ exists and } b_1^I \leq b_m, \\ p_R^0 &= p_L^0 = b_m \text{ if } i_{\max} = 0, \\ p_R^i &= \min(b_R, b_i^I + (v + (b_i^I - p_L^i)^2)^{0.5}) \text{ for all } i \geq 1. \end{aligned} \tag{27}$$

Taking account of the results with respect to the voting of sophisticated uninformed voters, the rest of the proof follows along the lines of the proof of Proposition 3 and is therefore skipped. ■

Proof Proposition 6. I consider the case $v > 0$, The argument for the case $v < 0$ is analogous.

Let B be the set of all bliss points and B_I, B_{Pi} and B_{Sw} the sets of the bliss points of the informed, the sophisticated uninformed and the swing voters so that $B = B_I \cup B_{Pi} \cup B_{Sw}$. If the high quality candidate chooses the median position, he cannot be defeated because if the other candidate chooses a different position he wins the median voter's vote and either every voter to the left or every voter to the right of the median voter. If the other candidate also chooses the median position, the uninformed voters abstain and he wins with the votes of all informed voters. It follows that the equilibrium policy is either at the median position or closer to the high quality candidate' s bliss point.

Now, I show that taking the overall set of bliss points B as given, having sophisticated uninformed voters (case $'$) instead of informed voters (case $''$) at some bliss points ($B' = B''$, $B'_I \subsetneq B''_I$, $B''_{Pi} \subsetneq B'_{Pi}$, $B'_{Sw} = B''_{Sw}$) leads to equilibrium policies as close or closer to the median bliss point for all values of v.

From Proposition 5, it can be seen that $|b_m - p_R| \geq |b_m - p_L|$ in any equilibrium with $v > 0$. The cutoff point for sophisticated uninformed voters $b^*_{Pi}(p_L, p_R) = F_R^{-1}\left(\frac{N+1}{2} - l_{Sw}(\frac{p_L+p_R}{2})\right)$ is independent of the distribution of informed and sophisticated uninformed voters within the given distribution of the rational voters. From $p_R \geq b_m$ and $|b_m - p_R| \geq |b_m - p_L|$, it follows that $b^*_{Sw} \geq b_m$. Therefore, all swing voter at and to the left of the median bliss point vote for the left candidate (if the median voter is a swing voter this happens by Assumption 1) and $l_{Sw}(\frac{p_L+p_R}{2}) \geq F_{Sw}(b_m)$.

Using equation (18), I derive:

$$\begin{aligned} b^*_{Pi}(p_L, p_R) &= F_R^{-1}\left(\frac{N+1}{2} - l_{Sw}(\frac{p_L+p_R}{2})\right) \\ &= F_R^{-1}\left(F_R(b_m) + F_{Sw}(b_m) - l_{Sw}(\frac{p_L+p_R}{2})\right) \\ &\leq F_R^{-1}(F_R(b_m)) \leq b_m. \end{aligned}$$

It follows that $b^*_{Pi}(p_L, p_R) \leq b^*_{Sw} = \frac{p_L+p_R}{2}$, and therefore the voter with bliss point b^*_{Pi} votes left if she is uninformed. The decisive informed voter is thus given by $b_I^{d\prime\prime}(p_L, p_R) = F_I^{\prime\prime-1}(F_I^{\prime\prime}(b^*_{Pi}(p_L, p_R)))$ respectively $b_I^{d\prime}(p_L, p_R) = F_I^{\prime-1}(F_I^{\prime}(b^*_{Pi}(p_L, p_R)))$. From the fact that there are more informed voters in case ($''$) than in case ($'$), it follows that $F_I^{\prime}(b) \leq F_I^{\prime\prime}(b)$ which in turn implies that $F_I^{\prime-1}(F_I^{\prime}(b)) \leq F_I^{\prime\prime-1}(F_I^{\prime\prime}(b))$ for all b. Therefore, $b_I^{d\prime} \leq b_I^{\prime\prime d}$ and every position p_R that wins given $(B_I^{\prime}, B_{Pi}^{\prime}, B_{Sw}^{\prime}, p_L)$ wins also given $(B_I^{\prime\prime}, B_{Pi}^{\prime\prime}, B_{Sw}^{\prime\prime}, p_L)$, but not vice versa. This implies that $|p^{*\prime}(v) - b_m| \leq |p^{*\prime\prime}(v) - b_m|$.

Now, I show that taking the overall set of bliss points B as given, having swing voters (case$'$) instead of sophisticated uninformed voters (case$''$) at some bliss points ($B' = B''$, $B_I' = B_I''$, $B_{Pi}' \subsetneq B_{Pi}''$, $B_{Sw}'' \subsetneq B_{Sw}'$) leads to equilibrium policies as close or closer to the median bliss point for all values of v. The informed voters make the same voting decision for given p_L, p_R and v for both $(B_I'', B_{Pi}'', B_{Sw}'')$ and (B_I', B_{Pi}', B_{Sw}'). From

$$b^*_{Pi}(p_L, p_R) \leq F_R^{-1}(F_R(b_m)) \leq b_m,$$

follows that $b^*_{Pi}(p_L, b_m) \leq b_m \leq b^*_{Sw}$ for (B_I', B_{Pi}', B_{Sw}') as well as $(B_I'', B_{Pi}'', B_{Sw}'')$. This is sufficient to rule out that in equilibrium an uniformed voter who votes left in case$'$ votes right in case$''$.

It follows that more swing voters lead to policies weakly closer to the bliss point of the median voter. ■

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