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Like biases and information in elections*

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Abstract

We model an election between two downsian candidates and a third deterministic one. There is uncertainty about the state of the world. Candidates receive signals on the state and propose a policy to implement. There are two types of voters: social concerned and biased. For both the cases in which the deterministic candidate is biased towards the policy preferred by the majority or the minority group, we characterize all the government structures (coalition governments) that allow for information transmission by the two candidates. Our results show that the third candidate helps to restore the informativeness of the electoral process and that, contrary to expected, information transmission occurs more frequently when the deterministic candidate is biased towards the policy preferred by the majority than when he is against it. Loosely put, the more populist this candidate, the better.

Keywords: Coalition governments; information transmission; heterogeneous voters; like biases
JEL: D72; D82

1 Introduction

Political parties are usually better informed than the voters about how the economy works. Both because they can easily access the advise of experts and because they have greater incentives to be informed, it is usual in the literature of political economy to consider models in which voters are uncertain as to the efficacy of different policies. This superior information of the candidates has been shown to provoke electoral results in which information is not always transmitted to the electorate but rather used for reelection purposes. Harrington (1993), Roemer (1994) and Schultz (1995, 1996, 2002) present the most classical examples.

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The interest of this question, rather than decreasing over time, has grown in importance, as it proves the existence of an increasing interest and growing literature on the policy distortions that arise when politicians have policy-relevant private information. Examples are Heidhues and Lagerlöf (2003), Felgenhauer (2012), Morelli and Weelden (2012), Loertscher (2012) or Kartik et al. (2013).[1] We contribute to this literature by proposing a model that studies the incentives of two office-motivated politicians to make informative speeches in the presence of a third deterministic candidate and heterogeneous voters.

To this aim, we consider an adaptation of the model proposed by Heidhues and Lagerlöf (2003), in which candidates receive imperfect and correlated signals on the state of the world, which is unknown to the votes.[2] Using as a motivating example the current economic downturn and the politicians incentives to inform the electorate in this context, we identify the two stages of the world with a *pro-fiscal* and a *pro-austerity* situation. Similarly, the policies to be implemented can be one of two types, fiscal or austerity. We assume that the fiscal policy is the one that best fits the economy if the state is pro-fiscal, and that a policy implying cutbacks and other stiff measures is the appropriate one if the state is pro-austerity. Candidates observe the signals and propose the policies so as to win office.

We enrich the political arena by introducing a third politician that runs for office. This accounts for the fact that political competition is not always a matter of two. In contrast to the US, where only Democrats and Republicans seat in the Congress, European countries exhibit a more varied political arena, where smaller third parties not only enjoy seats in the legislature but have sometimes the key to form governments.[3] Empirical evidence shows that a common feature of minority parties is that they usually have a well defined ideology, to which they stick firmly. Arguments such as that minority parties do not usually enter the government

[1] Whereas the dominant trend in this literature is to identify the reasons that lead to the inefficiency, authors like Martinelli (2001) and Laslier and der Straeten (2004) posse a more optimistic view, and propose models where transmission of private information can occur. Here it proves crucial to the result the fact that voters do also have private information about the policy-relevant state variable.

[2] Whereas previous models in the literature focused on situations in which information is either exclusive to one candidate (Harrington (1993) and Schultz (2002)), or is equally accessed by the two politicians (Roemer (1994) and Schultz (1995, 1996)), Heidhues and Lagerlöf (2003) propose the first model that considers the effects of the dispersion of information between the candidates on their incentives to make informative speeches. This apparently minor feature, together with the competitive nature of the electoral processes, results in bayesian voters penalizing the candidates that contradict the electorate's priors. As a result, the authors show that if the voters' prior is biased in favor of a policy, no full revelation by the two candidates exists in pure strategies, and that the most reasonable equilibrium (Pareto superior) is the popular beliefs one.

[3] The feature of no party wining an absolute majority of seats is the norm in countries where legislatures are elected by proportional representation. This is the case in countries like Austria, Finland, Israel, German (Bundestag), Greece or Spain. But from time to time it also happens to be the case in countries with a more stable two-party system, as in the UK. The reader may probably remember the last general election in the UK, held in 2010, which yield the Conservatives as the largest single party with, however, not enough seats to form a majority government. The 57 seats of the Liberal Democrats turned out to be decisive in determining who entered government.

or that when they do, their extremist help them bias the policy towards their preferred ideology, points to the same direction: Minority parties are usually less pragmatic than the dominant ones, and so propose policies that do not always vary with the economic situation.[4] Based on this evidence, we propose a model with two office-motivated political parties and a third deterministic one, which is considered to have a preferred policy, the fiscal one, that he always proposes. We show that the third candidate turns crucial to the results, and helps to restore the informativeness of the electoral process.

Our second ingredient helps us to go further in this respect and to answer the question of whether this important role of the third party is inherent in his assumed deterministic behavior or it has to be with him being biased in favor of a particular policy. To answer this question, we consider heterogeneous voters. In particular, we consider that voters can be either of two types: social concerned or biased. We assume that biased voters have a preferred policy (the fiscal one) that they always vote for. On the contrary, social concerned voters want the policy implemented to correspond to the state of the world. Hence, they would support austerity (fiscal) measures if they believed the state of the economy to be pro-austerity (pro-fiscal). To make the analysis interesting, we assume that the group of social concerned voters is more populated than that of the biased voters.

The game is as follows. Politicians receive the signals on the state of the world and propose the policies to implement if elected. As usual, a strict majority of votes is required to govern. This means that if no candidate wins an absolute majority, a coalition government must form. Knowing this, the voters observe the politicians platforms and update beliefs. Then, taking into account the effects of their voting behavior on the electoral outcomes, they cast their vote for the candidate/s that best fits their interest. Last, the winning (coalition of) candidate(s) implements its policy.

Our interest is to analyze whether the electoral process is informative. Thus, we focus on equilibria in which the two strategic candidates reveal their information to the electorate. The analysis proceed as follows. We first study which are the government structures (coalition governments) that could form in equilibrium. Here we obtain that only politically-akin coalitions form, which means that a government never hosts two candidates proposing different policies. The reason being that the policy implemented by a coalition is assumed to be a convex combination of the policies proposed by the politicians in the coalition. Hence, the decisive group of voters can always vote in such a way that their preferred policy wins with a strict majority, therefore preventing a non-ideologically-akin coalition to form. Then, we go backwards and for those government structures that could form in equilibrium, we analyze whether there is an equilibrium in which candidates transmit their information to the voters. Our results show that the existence of a third

[4] Examples are Front National in France (which gathered a 13.6% of the votes in the first round of the 2012 Presidential election in France, with a clear extreme right ideology), Die Linke in Germany (the fourth largest party in Germany, which has been labeled as far-left), or Izquierda Unida in Spain (third national party in the country, with an official eurocommunism ideology).

candidate helps to restore information transmission. Moreover, we obtain that as important as the existence of this third candidate, it is that he is biased in the right direction, which is shown to be the policy preferred by the majority of the electorate. Otherwise, the size of the government structures that allow for information transmission shrinks sharply. The shadow to this result comes when we look into the composition of the governments that sustain full revelation. Here, we obtain that a coalition of the two office-motivated candidates never wins office. Even more, our results show that when for a particular platform profile one strategic candidate wins office, the options for the other office-motivated candidate to enter the government just vanishes, and that this is so for any platform profile that can be observed from a particular equilibrium configuration. As for the deterministic candidate, we obtain that when he supports the policy preferred by the majority of the electorate, he wins office under numerous government structures; and that this is never the case when he caters the minority group. Hence, information comes at a price: That of allowing the deterministic candidate to enter the government.

Finally, we relax each of the two main features of the model: three candidates and heterogeneous voters. Our analysis of the game with two candidates extends the work by Heidhues and Lagerlöf (2003) by considering two types of voters. Our results in this case show that voter heterogeneity helps us also to overcome the negative result in Heidhues and Lagerlöf (2003), and yields instead equilibria with information transmission. These equilibria require, however, of an electorate with opposing biases and with an specific voting behavior. Otherwise, the incentives to go for the electorate's prior dominates and so prevents any information disclosure. On the other hand, the case with one type (social concerned) of voters, analyzes a situation that is very much in line with the one considered by Felgenhauer (2012).[5] Similarly to us, he also obtains that this candidate restores efficiency. Despite this similar result, even the simplified version of our model (one type of voter) yields new insights on a three-candidates set-up. For example, we provide a full characterization of all the government structures that may allow for information transmission and all the equilibria in which the electoral process is indeed informative. As a result, we can show that any situation in which the two strategic candidates have positive chances of winning office is, necessarily, uninformative. On top of these results, the introduction of heterogeneous voters yields new interesting conclusions, as it is that as important as the existence of the third candidate it is that he is biased towards the most popular belief. Loosely put, the more populist this candidate, the better.

The remainder of the paper is organized as follows. Next section describes the model. Section 3 analyzes the voting behavior and the resulting government structures, accounting for the possibility of coalitions. Given these government structures, Section 4 analyzes whether there are equilibria where the two downsian

[5] Cummins and Nyman (2005) analyze a set-up with more than two experts, where they all have superior information to the decision maker and act strategically. This is in contrast to Felgenhauer (2012) and the present paper, where the third expert is assumed to be deterministic.

candidates fully reveal their information. Section 5 presents a discussion, where we examine the implications that the main two features of the model have for the results. Finally, Section 6 concludes.

2 The model

An election is to be held. There are three political candidates and a unit mass of votes. There are two stages of the world, w_F and w_A. To facilitate the reading and motivate our analysis with the current economic downturn, thorough the paper w_F refers to an economic situation where "fiscal policies are the appropriate measures to bring back economic growth" and w_A to one where "austerity measures are first to be implemented if we want the economy to recover from the economic recesion". Let q be the prior probability that the state is w_F, i.e., $P(w = w_F) = q \in (0, 1)$.

The candidates: Candidates are labeled 1, 2 and 3. Candidates 1 and 2 are downsian and want to get into office. Candidate 3 is considered to have a preferred policy which he always proposes. There are two policy alternatives F and A, where F stands for "fiscal policies" and A for "austerity measures". We assume F is the correct policy in state w_F and A is the correct one in state w_A. Candidates 1 and 2 choose the policy to propose so as to win office. Let $x_i \in \{F, A\}$ be the policy proposed by candidate i. Rents from office are K. Without loss of generality, we assume candidate 3 always proposes F.

The information structure of the candidates: Candidates 1 and 2 receive a signal $s_1, s_2 \in \{f, a\}$, on the state of the world.[6] Signals are correlated, with $\rho \in [0, 1)$ being a measure of the degree of correlation between the signals. Hence, the higher ρ, the greater the correlation. Additionally, signals are not perfectly informative about the state of the world. With probability $(1 - \varepsilon)$, a candidate's signal is equal to the state; with probability ε she receives an incorrect signal. We assume $\varepsilon \in (0, 1/2)$. Table 1 summarizes the signal technology.[7]

	$P(s_2 = j/w = w_j)$	$P(s_2 = k/w = w_j)$	Σ
$P(s_1 = j/w = w_j)$	$(1-\varepsilon)^2 + \rho\varepsilon(1-\varepsilon)$	$(1-\rho)\varepsilon(1-\varepsilon)$	$1-\varepsilon$
$P(s_1 = k/w = w_j)$	$(1-\rho)\varepsilon(1-\varepsilon)$	$\varepsilon^2 + \rho\varepsilon(1-\varepsilon)$	ε
Σ	$1-\varepsilon$	ε	1

Upon receiving a signal, candidates choose the policy to implement if elected.

The voters: There is a unit mass of voters. Voters can be one of two types, policy concerned or biased. A policy concerned voter, denoted by 4, wants the policy to be appropriate to the state. Her utility is $U_4(F, w_F) = U_4(A, w_A) = 1$ and

[6] This is the same as considering that all the three candidates observe a signal on the state. The reason being that the third candidate always proposes the very same policy, hence, whether he receives a signal or not, and which is the content of the signal, is totally irrelevant.

[7] The signal technology is the same as in Heidhues and Lagerlöf (2003).

$U_4(F, w_A) = U_4(A, w_F) = 0$. A biased voter, denoted by 5, always prefers fiscal policies to cutbacks and other stiff austerity measures. Her utility is $U_5(F, w_i) = 1$ and $U_5(A, w_i) = 0$, for $i \in \{F, A\}$. We assume that the fraction of voters who are policy concerned is $\beta \in (\frac{1}{2}, 1)$. This means that the median voter is a social concerned type.[8] The voters observe the platforms profile and choose the candidate/s for whom to vote.

The election and the government formation: A strict majority of votes is required to govern. Given a vector of vote shares $v = (v_1, v_2, v_3)$, with $v_1+v_2+v_3 = 1$, candidate $i \in \{1, 2, 3\}$ receives a strict majority of votes when $v_i > \sum v_j$, for $j \neq i$. In this case, he governs alone and gets the entire payoff K from holding office. The policy implemented in this case is x_i. In case no candidate wins such a majority, a coalition government must form. A coalition is denoted by C, where $C \in \{\{1, 2\}, \{1, 3\}, \{2, 3\}, \{1, 2, 3\}\}$. The rents K from holding office are in this case to be evenly distributed between the politicians in the coalition. For $C = \{i, j\}$, the policy implemented by the coalition is a convex combination of the policies proposed by the candidates in the coalition, i.e., $x^C = v_i x_i + v_j x_j$.[9]

The players strategies: Note that for the deterministic candidate, $x_3 = F$ always. Having this in mind, we restrict notation to exclusively account for the behavior of the two strategic candidates. We define σ_i^j as the probability that candidate $i \in \{1, 2\}$ proposes policy F after observing signal $j \in \{F, A\}$, and $\sigma_c = (\sigma_1^F, \sigma_1^A; \sigma_2^F, \sigma_2^A)$ as the vector of the equilibrium strategies for the (two strategic) candidates.[10] Similarly, from now on we refer to $(x_1, x_2) = (j, k)$, with $(j, k) \in \{F, A\}^2$, as a platforms profile.

Regarding voters, let $\sigma_{4,i}^{j,k}$ and $\sigma_{5,i}^{j,k}$ be the probability that a social concerned and biased voter, respectively, votes for $i \in \{1, 2, 3\}$, after having observed the policy proposals $(x_1, x_2) = (j, k)$, for $(j, k) \in \{F, A\}^2$. We assume symmetric voting among the social concerned voters, which means we focus on equilibria in which all the voters of this class use the same voting strategy. Note that this assumption simplifies the characterization of the voting profiles that sustain a particular electoral outcome and, since the median voter is a social concerned type, does not affect the electoral outcome (which candidate/s form government). Hence, it has no consequences for our results.

The equilibria: We are interested in analyzing the incentives of the two office-motivated candidates to make informative speeches. Thus, we focus on equilibria with full revelation. In the following, we say that an equilibrium is *fully revealing*

[8] Note that this is the most interesting scenario as otherwise, the only equilibrium would imply pandering at F.

[9] For the sake of exposition, we stick to this formulation, although the results of the paper are more general and hold for any weights in $(0, 1)$, and not necessarily for those that correspond to the vote shares.

[10] Generically, $\sigma_c = (\sigma_1^F, \sigma_1^A; \sigma_2^F, \sigma_2^A; \sigma_3^F, \sigma_3^A)$, with $(\sigma_3^F, \sigma_3^A) = (1, 1)$.

if the two strategic candidates perfectly signal their information at all stages of the nature. Note that if we restrict our attention to this class of equilibria, candidate $i \in \{1, 2\}$ has two strategies: (i) A faithful strategy, defined by $(\sigma_i^F, \sigma_i^A) = (1, 0)$, and (ii) a reversed strategy, defined by $(\sigma_i^F, \sigma_i^A) = (0, 1)$. Then, in the fully revealing class of equilibrium we focus on, the vector of the candidates' equilibrium strategies is $\sigma_c \in \{(1, 0; 1, 0), (1, 0; 0, 1), (0, 1; 1, 0), (0, 1; 0, 1)\}$.

The equilibrium concept that we use is the perfect Bayesian equilibrium. We solve the game by backwards induction. We proceed as follows. First, for a given platforms profile that corresponds to a particular class of the fully revealing equilibria, we analyze the equilibrium voting behavior and the resulting electoral outcomes. This allows us to know, for each of these platforms profiles, which is the resulting composition of the government. Then, we go backwards and for each of the possible composition of the government, we analyze the incentives of the (strategic) candidates to fully reveal their information to the electorate.

3 Voting behavior and electoral outcomes

Assuming that a fully revealing equilibrium is played in the first stage of the game, this section is devoted to the study of the government structures (composition of the government) that can result in equilibrium. Remember that for a politician to win office he must get an absolute majority of votes, and that if this does not occur, a coalition involving more than one candidate forms.

Prior to this analysis, it is useful to note that the biased voters have a state-independent preferred policy, F, which is always proposed in equilibrium (by at least the deterministic candidate), therefore which they always vote for. As for a social concerned voter, who wants the policy implemented to be appropriate to the state, choosing for whom to vote is a more sophisticated task. In particular, it requires: (i) to update beliefs about which policy is best, and (ii) to understand how her vote determines vote shares and therefore the electoral outcome and the implemented policy. Let us first analyze how beliefs are formed.

To this aim, first note that in a fully revealing equilibria, voters can always learn the content of the two candidates' signals. Thus, we define $\hat{q} = P(w_F/s_1, s_2)$ as the voters' posterior belief that the state is w_F, conditioned on candidates 1 and 2 observing signals s_1 and s_2, respectively. Now, there are two cases to distinguish, that correspond to the electorate's prior being biased towards either the fiscal policy ($q > 1/2$), or the austerity policy ($q < 1/2$).[11]

First, suppose $q > 1/2$. In this case, a social concerned voter with no other information than the prior, thinks that policy F is the best and then votes for F.

[11] There is a third case, that corresponds to the situation of a balanced prior ($q = 1/2$). Here, note that after two F (A) signals, the social concerned voters vote for F (A); and after two contradicting signals, any voting behavior is permitted. This is a therefore a situation where no popular belief exists, which alleviates the pandering problem and makes information transmission easier to sustain. The results for this case will appear as minor comments or footnotes in the text.

Now, let us first consider that the voter knew that the two candidates' signals say F. In this case, the voter would not change her belief but would be reinforced in her opinion that policy F is the best, i.e., $\hat{q} > 1/2$.[12] Now suppose the voter infers that one signal says F and the other A. It is clear that also in this case the voter prefers F, i.e., $\hat{q} > 1/2$, as signals cancel out and F is supported by the prior.[13] Last, suppose the social concerned voter infers that the two signals say A. Applying Bayes rule we obtain that $P(w = w_A/s_1 = A, s_2 = A) > P(w = w_F/s_1 = A, s_2 = A)$ if and only if $(1-q)[(1-\varepsilon)^2 + \rho\varepsilon(1-\varepsilon)] > q[\varepsilon^2 + \rho\varepsilon(1-\varepsilon)]$, which can be rewritten as $q < \widetilde{q} = \frac{(1-\varepsilon)[1-\varepsilon(1-\rho)]}{1-2\varepsilon(1-\varepsilon)(1-\rho)}$. In order for the problem to be interesting, when analyzing the case $q > 1/2$, we will assume that after two A signals, the social concerned voter changes her mind and votes for A. This means we assume $q \in (\frac{1}{2}, \widetilde{q})$.

Analogously, if $q < 1/2$, a social concerned voter with no other information than her prior would vote for policy A. Hence, again, Bayesian updating results in the social concerned voter voting for A when she infers that at least one signal says A, and changing her mind and voting for F only when she learns that the two signals support F. This means in this case we assume $q \in (1-\widetilde{q}, \frac{1}{2})$.

Assumption 1. *A social concerned voter knowing that the two candidates' signals support her less preferred policy changes her mind and votes accordingly. This means our analysis assumes either* $q \in (1/2, \widetilde{q})$ *or* $q \in (1-\widetilde{q}, 1/2)$.

Note that for a given platform profile $(x_1, x_2) = (j, k)$, with $(j, k) \in \{F, A\}^2$, it could well happen that the policy that the social concerned voters consider to be the best is not proposed by the candidates. Since $x_3 = F$, this could only be the case if the voters observe $(x_1, x_2) = (F, F)$ and their updated belief supports the austerity path.[14] In this case, the voters are bound to elect a candidate that will implement their less preferred policy. Apart from this case, the policy considered to be the best is always an available option to the voters.

Let us now go into the analysis of the voting process and the formation of the government. Given that a strict majority of votes is required to govern, the resulting profile of vote shares $v = (v_1, v_2, v_3)$ translates into a particular composition of the government. For $(x_1, x_2) = (j, k)$, with $(j, k) \in \{F, A\}^2$, let $G^{x_1 x_2}$ denote the set of government compositions that can result in equilibrium, with $G^{x_1 x_2} \subset \{\{1\}, \{2\}, \{3\}, \{1, 2\}, \{1, 3\}, \{2, 3\}, \{1, 2, 3\}\}$, and let $g^{x_1 x_2}$ be an element of this set.

[12] Applying Bayes rule we observe that $P(w = w_F/s_1 = F, s_2 = F) > P(w = w_A/s_1 = F, s_2 = F)$ if and only if $q[(1-\varepsilon)^2 + \rho\varepsilon(1-\varepsilon)] > (1-q)[\varepsilon^2 + \rho\varepsilon(1-\varepsilon)]$, which always holds as $\varepsilon < 1/2$ and $q > 1/2$.

[13] By Bayes rule, $P(w = w_F/s_i = F, s_j = A) > P(w = w_A/s_i = F, s_j = A)$, for $i, j \in \{1, 2\}$, $i \neq j$, if and only if $q(1-\rho)\varepsilon(1-\varepsilon) > (1-q)(1-\rho)\varepsilon(1-\varepsilon)$, which always holds as $q > 1/2$.

[14] This occurs when either $q > 1/2$ and the two candidates use a reversed strategy, or $q < 1/2$ and there is at least one candidate using this strategy.

Assuming that a fully revealing equilibrium is played in the first stage, next result states which is the composition of the government that, for a particular platforms profile, can form in equilibrium.[15] We obtain that, in equilibrium, only politically-akin coalitions form, i.e., coalitions between candidates that propose the same policy. Note that this is the case even though our candidates are office-motivated and do not therefore care about the policy implemented. It is the assumption that the median voter is a social concerned type and the fact that she can always do better than allowing a non-akin-coalition to form, that drives this result.[16]

Proposition 1. *Given a platforms profile* $(x_1, x_2) = (j, k)$, *for* $(j, k) \in \{F, A\}^2$, *the set of government structures* $G^{x_1 x_2}$ *that can be sustained in equilibrium are:*

(i) For any $\hat{q} \in (0, 1)$, $G^{FF} = \{\{1\}, \{2\}, \{3\}, \{1, 2\}, \{1, 3\}, \{2, 3\}\}$.

(ii) If $\hat{q} < 1/2$, $G^{FA} = \{\{2\}\}$, *and if* $\hat{q} > 1/2$, $G^{FA} = \{\{1\}, \{3\}, \{1, 3\}\}$.

(iii) If $\hat{q} < 1/2$, $G^{AF} = \{\{1\}\}$, *and if* $\hat{q} > 1/2$, $G^{AF} = \{\{2\}, \{3\}, \{2, 3\}\}$.

(iiv) If $\hat{q} < 1/2$, $G^{AA} = \{\{1\}, \{2\}\}$, *and if* $\hat{q} > 1/2$, $G^{AA} = \{\{3\}\}$.

Proof. In the Appendix. □

From Proposition 1, we observe that except for the case in which the platforms profile is $(x_1, x_2) = (FF)$, the voters' behavior impose quite a lot of structure on the composition of the government and determines whether a candidate is to govern alone or a coalition of candidates wins office instead. Additionally, we observe that except for the same case, no coalition between the two strategic candidates can form in equilibrium. The reason to this appears straightforward in the case in which the two politicians propose different policies, but turns to be not so clear in the case in which they both support austerity measures. To see this point, note that in this case candidate 3 always gets the support of the biased voters, which means that for policy A to be implemented, the social concerned voters must assure that one of the strategic candidates gets an absolute majority of votes. This rules out the possibility of a coalition between the two office-motivated candidates.

[15]The analysis assumes $q \neq 1/2$. As for the case $q = 1/2$, the posterior on the state is either $\hat{q} > 1/2$, $\hat{q} < 1/2$ or $\hat{q} = 1/2$. Regarding the last case, an analogous argument to the one used in the text shows that for any platform profile $(x_1, x_2) = (j, k)$, for $(j, k) \in \{F, A\}^2$, $G^{jk} = \{\{1\}, \{2\}, \{3\}, \{1, 2\}, \{1, 3\}, \{2, 3\}\}$. Hence, under this assumption, in equilibrium, any coalition can form.

[16]The literature on coalition formation includes papers that consider ideological political parties, which suffer a disutility when the policy implemented by the coalition they belong to differs from their own preferred electoral position. See Austen-Smith and Banks (1988). This assumption is usually intended to reduce the number of coalitions that can form in equilibrium. The reader can note that this assumption will not play any role in this paper (in terms of reducing the number of coalitions) since, in equilibrium, only ideologically-akin coalitions get enough votes as to form a government. Hence, in this work we abstract from this type of consideration.

4 Information transmission

Now we know which electoral outcomes are compatible with each configuration of platforms profiles, we go backwards and analyze whether the resulting composition of the government allows for information transmission from the candidates to the voters. Our focus is on fully revealing equilibria.

Like biases

Let us start considering the case in which politicians know that fiscal policies are easier to reach and get the support of the electorate than cutbacks and other stiff austerity measures. In terms of our analysis this means we consider $P(w_F) = q > 1/2$, i.e., the prior about the state of the world says that fiscal policies are more appropriate than austerity measures to restore the economic growth. In this case, a social concerned voter with no other information than her prior prefers F to A. Note that in this case both biased and social concerned voters have the same like biases.

Perhaps somewhat surprising, our results show that there is information transmission in this case. More interestingly, we obtain that the number of government structures that allows for full revelation is here greater than in the case of opposing biases, which is analyzed next.

To see the intuition for this, a priori, counterintuitive result, note that in any case, strategic candidates have an incentive to bias their message towards the electorate's preferred policy, as this boots their chances of winning office. Since the electorate is more homogeneous in the case of like biases than in the case of opposing biases, the incentives to pander to F in the former case clearly far outweigh those to go for A in the second case. Note that an argument exclusively based on this first effect would yield the erroneous conclusion that opposing biases warmly foster information transmission. However, our results show the opposite. The reason being the existence of a deterministic candidate that always supports policy F. The effect of this third candidate is clear. Since there is a probability that, in equilibrium, this candidate receives some of the votes of those voting for F, the incentives of the strategic candidates to go for the fiscal policy are eroded. In the case of like biases, this second effect counterbalances and offsets the first one, hence allowing for information transmission under a wider range of government structures. In contrast, in the case of opposing biases, the first and the second effect goes in the same direction, making therefore information transmission difficult to sustain.

Let us now go into the analysis of the case of like biases. We here introduce an assumption that only applies in this case and that allows us to simplify the analysis of this scenario.

Assumption 2. *If* $g^{FA} = \{1\}$, *then* $g^{AF} = \{2\}$; *if* $g^{FA} = \{3\}$, *then* $g^{AF} = \{3\}$; *and if* $g^{FA} = \{1, 3\}$, *then* $g^{AF} = \{2, 3\}$.

Note that this assumption only restricts the voting behavior, and therefore the electoral outcomes, when the choice is between candidate 3 and either 1 or 2. Hence, the idea underlying it is that when having to choose between the deterministic and a particular strategic candidate, the social concerned voters treat the two strategic candidates identically. Roughly speaking, their choice in this case can be understood as either going for a deterministic or a strategic politician.

For $i, j \in \{F, A\}$, let us define $P_{i/j} = P(s_2 = i/s_1 = j) = P(s_1 = i/s_2 = j)$.

Proposition 2. *(Like biases) Consider $q \in (\frac{1}{2}, \widetilde{q})$. A fully revealing equilibrium exists if and only if either:*

(i) $\sigma_c = (1,0;1,0)$ *and either:*

- *(a)* $g^{FA} = g^{AF} = \{3\}$, $g^{AA} = g^{FF} = \{1\}$; *or*
- *(b)* $g^{FA} = g^{AF} = \{3\}$, $g^{AA} = \{1\}$, $g^{FF} = \{1,3\}$, *with* $P_{F/F} \geq 2P_{A/F}$; *or*
- *(c)* $g^{FA} = g^{AF} = \{3\}$, $g^{AA} = g^{FF} = \{2\}$; *or*
- *(d)* $g^{FA} = g^{AF} = \{3\}$, $g^{AA} = \{2\}$, $g^{FF} = \{2,3\}$, *with* $P_{F/F} \geq 2P_{A/F}$; *or*

(ii) $\sigma_c = (1,0;0,1)$, $g^{AF} = \{1\}$, $g^{AA} = \{3\}$ *and either:*

- *(a)* $g^{FF} = \{1\}$, $g^{FA} = \{3\}$; *or*
- *(b)* $g^{FF} = \{3\}$, $g^{FA} = \{1\}$; *or*
- *(c)* $g^{FF} = \{3\}$, $g^{FA} = \{1,3\}$, $P_{F/F} > 2P_{A/F}$; *or*
- *(d)* $g^{FF} = \{1,3\}$, $g^{FA} = \{1,3\}$; *or*
- *(e)* $g^{FF} = \{1,3\}$, $g^{FA} = \{1\}$, $P_{A/A} > 2P_{F/A}$; *or*

(iii) $\sigma_c = (0,1;1,0)$, $g^{FA} = \{2\}$, $g^{AA} = \{3\}$ *and either:*

- *(a)* $g^{FF} = \{2\}$, $g^{AF} = \{3\}$; *or*
- *(b)* $g^{FF} = \{3\}$, $g^{AF} = \{2\}$; *or*
- *(c)* $g^{FF} = \{3\}$, $g^{AF} = \{2,3\}$, $P_{F/F} > 2P_{A/F}$; *or*
- *(d)* $g^{FF} = \{2,3\}$, $g^{AF} = \{2,3\}$; *or*
- *(e)* $g^{FF} = \{2,3\}$, $g^{AF} = \{2\}$, $P_{A/A} > 2P_{F/A}$; *or*

(iv) $\sigma_c = (0,1;0,1)$ *and* $g^{AA} = g^{FA} = g^{AF} = g^{FF} = \{3\}$.

Proof. In the Appendix. □

Proposition 2 yields a number of remarkable comments. For example, we observe that it does not pay to a candidate to use a reversed strategy as, in this case, he never gets into office. This is so for candidate 1 in cases *(iii)* and *(iv)*, and for candidate 2 in cases *(ii)* and *(iv)*.

Additionally, we observe that no fully revealing equilibrium features the two strategic candidates entering office for a platforms profile. More precisely, there is no equilibrium with information transmission in which, for the same or even for different platforms profiles, the two office-motivated candidates can enter the government. Thus, our result shows that if a downsian candidate forms government for some platform profile, the other strategic candidate can never get elected. As a result, no coalition including the two office-motivated candidates is observed in equilibrium. Summarizing, full revelation of information is only possible if the political victory is, at a time, a matter of the deterministic and exclusively one of the strategic candidates.

Last, we observe that a necessary condition for some of the government structures to sustain information transmission is $P_{i/i} \geq 2P_{j/i}$. Since $P_{i/i}$ is increasing in ρ and decreasing in ε, and $P_{j/i}$ is decreasing in ρ and increasing in ε, we obtain that the higher the correlation between the candidates' signals (ρ) and the lower the signal's error (ε), the higher the number of the government structures that sustains information transmission. Next Corollary formalizes this idea.

Corollary 1. *The number of the government structures that allows for information transmission increases in:*
(i) the correlation between the candidates' signals,
(ii) the quality of the signals.

Proof. From the signal technology described in Table 1, we obtain $P_{i/i} = (1-\varepsilon)^2 + \varepsilon^2 + 2\rho\varepsilon(1-\varepsilon)$ and $P_{j/i} = 2(1-\rho)\varepsilon(1-\varepsilon)$. Since $\partial P_{i/i}/\partial\rho > 0$, $\partial P_{i/i}/\partial\varepsilon = 2(2\varepsilon - 1)(1-\rho) < 0$, $\partial P_{j/i}/\partial\rho < 0$ and $\partial P_{j/i}/\partial\varepsilon = 2(1-\rho)(1-2\varepsilon) > 0$, the proof follows. □

Opposing biases

Let us now consider the case of the social concerned voters ex ante thinking that austerity measures are more appropriate than fiscal policies to recover from the economic downturn. In terms of our analysis this means we consider $P(w_F) = q < 1/2$. In this case, there is an opposing bias between that of the social concerned and the biased voters.

As already pointed out, contrary to expected, we obtain that information transmission is here more difficult to sustain than in the case of like biases. Additionally, we obtain that the only fully revealing equilibrium that now exists requires one candidate to use a reversed strategy and the other a faithful one. As in the case of like biases, in this scenario too, the candidate using a reversed strategy never gets elected. Office is here reserved to the candidate that plays a faithful strategy who, as the next proposition states, always governs alone. An additional implication of this result is that, in a fully revealing equilibrium, candidate 3 never enters the government. This is in sharp contrast to the previous scenario, where the deterministic candidate wins office under numerous platforms profiles.

Proposition 3. *(Opposing biases) Consider* $q \in (1-\widetilde{q}, \frac{1}{2})$. *A fully revealing equilibrium exists if and only if either:*

(i) $\sigma_c = (1,0;0,1)$ *and* $g^{AA} = g^{AF} = g^{FA} = g^{FF} = \{1\}$*; or*

(ii) $\sigma_c = (0, 1; 1, 0)$ *and* $g^{AA} = g^{AF} = g^{FA} = g^{FF} = \{2\}$.

Proof. In the Appendix. □

Proposition 3 characterizes all the government structures that allow for information transmission.[17] A comparison with the results in Proposition 2 shows that introducing heterogeneity between the voters reduces the number of electoral outcomes that allows for information transmission during the electoral process. The reason being that the incentive to go for the electorate's prior, now A, is no longer counterbalanced but even reinforced by the existence of a deterministic candidate that supports the less popular policy F. It uncovers an important conclusion: It is neither the fact that voters are homogeneous, nor even the existence of a deterministic candidate, that facilitates information transmission by the office-motivated candidates. What it really matters is the bias of the deterministic candidate, that has to reflect the preferences of the majority group.

Following this argument, our model would predict the electoral process to be more informative in countries in which the deterministic candidate/s is biased towards the popular policy than in those in which these candidates support the policies preferred by minority groups. It is also important to realize that the informativeness of the electoral processes comes at a price. Namely, that for some platforms profile, the deterministic candidate may enter the government. Note that this does not mean that the policy implemented in this case is the inappropriate one. To see it, note that in any fully revealing equilibrium the social concerned voters are able to extract all the information contained in the candidates' signals. This, together with the fact that they want the policy implemented to be congruent with the state of the world, implies that the implemented policy is always the one that, in expected terms, best fits the state. Hence, the cost we refer to has to be with the more subtle aspect of being governed by a politician who is known that will never react to changes in the economic state, therefore that will persistently insist on the very same class of policies.[18]

5 Discussion

We now discuss how the two main assumptions we posit affect our results.

5.1 Two-candidate competition

We first relax the assumption of three candidates competing for office and analyze an scenario with two office-motivated candidates. Note that, in this case, there

[17]Note that these government structures are degenerate, in the sense they require the existence of an advantaged candidate who always wins with probability one.

[18]The analysis of this section is done for the cases in which the electorate's prior is biased in favor of one of the states. As for the case $q = 1/2$, as already pointed out, after two contradicting signals the posterior is $\hat{q} = 1/2$, which does not impose any limitation on the composition of the government. This means that, if $q = 1/2$, information transmission is easily attainable.

is no room for coalitions, as winning office is only a matter of getting more votes than your opponent. In this sense, we here consider candidates that maximize their number of votes.[19]

As in the main body of the paper, we posit two scenarios, like biases and opposing biases. Interestingly, our results now show that there is no information transmission in the case of like biases, but it does in the case of opposing biases.[20] Paradoxically, this is in contrast to the results in the previous section, where information was warmly foster in the scenario of like biases. This means that the results in the present set-up go much in line with the stark intuition that heterogeneity of voters reduces the incentives to go for the electorate's prior. In fact, this is the reason that explains the next result.

Proposition 4. *Suppose that $q \neq 1/2$. A fully revealing equilibrium exists if an only if $q < 1/2$, $\beta = 1/2$, $\sigma_{4,1}^{AF} = \sigma_{5,2}^{AF} = \sigma_{4,2}^{FA} = \sigma_{5,1}^{FA} = 1$, and either:*

(i) $\sigma_c = (1, 0; 1, 0)$ *and* $\sigma_{4,1}^{AA} = \sigma_{4,1}^{FF} = \sigma_{5,1}^{AA} = \sigma_{5,1}^{FF} = 1/2$*; or*

(ii) $\sigma_c = (0, 1; 0, 1)$ *and* $\sigma_{4,1}^{AA} = \sigma_{4,1}^{FF} = \sigma_{5,1}^{AA} = \sigma_{5,1}^{FF} = 1/2$.

Proof. In the Appendix. □

Proposition 4 shows that if there are only two candidates competing for office, the electoral process can only be informative if the electorate is composed of group of voters with opposing views. Otherwise, the incentive to go for the popular belief prevents any information flow. Note, however, that the equilibrium configurations that we obtain are quite fragile, in the sense that they require a very particular voting profiles. Namely, that after observing two identical policy proposals, the two types of voters vote for each candidate with equal probability. Additionally, they require that the two groups of voters are, in expected terms, equal in size. Despite this limitation, the relevance of this result is that it puts forth the role of voters heterogeneity in a context that, if not for this diversity, would be identical to that in Heidhues and Lagerlöf (2003). In this sense, our paper presents an extension to their work, not only for considering heterogeneity of voters, but for the introduction of the third candidate.

[19] The simpler set-up with only two politicians allows us to consider candidates that maximize their number of votes. Note that this is in contrast to the main body of the paper, where analytical results could only be obtained under the assumption that candidates maximize their probability of winning. Note, additionally, that under the new scenario, there is no longer a need to know which candidate wins for each platform profile. This allows us to relax the assumption that $\beta > 1/2$, and consider instead the more general case of $\beta \in (0, 1)$.

[20] As for the case $q = 1/2$, it can be shown that there is an equilibrium in which the two candidates use a faithful strategy, i.e., $\sigma_c = (1, 0; 1, 0)$. A necessary condition is required for this equilibrium to hold: $\sigma_{4,1}^{AF} + \sigma_{4,2}^{FA} = \frac{1}{\beta}$, hence $\sigma_{4,2}^{AF} + \sigma_{4,1}^{FA} = \frac{2\beta-1}{\beta}$, which further requires $\beta \geq 1/2$.

5.2 One type of voter

Let us now consider that voters are only of one type: social concerned. This means that the candidates know that all the voters would like the policy implemented to be appropriate to the state. This general interest on the well functioning of the economy could lead us to think that information transmission is here easier to be sustained than in the main body of the paper. Note, however, that voters do still have a prior on the state, which means that the candidates' incentive to go for the most popular policy is still at stake.

To be consistent with the main body of the paper, let us consider that the deterministic candidate is biased in favor of fiscal policies. Additionally, we assume $q > 1/2$, i.e., with no other information, voters think that fiscal policies are more appropriate than austerity measures to restore the economic activity.[21]

Our first result refers to the voting behavior and the resulting electoral outcomes in this scenario.

Proposition 5. *Given a platforms profile $(x_1, x_2) = (j, k)$, for $(j, k) \in \{F, A\}^2$, the government structures $G^{x_1 x_2}$ that can be sustained in equilibrium are:*

(i) For any $\hat{q} \in (0, 1)$, $G^{FF} = \{\{1\}, \{2\}, \{3\}, \{1, 2\}, \{1, 3\}, \{2, 3\}\}$.

(ii) If $\hat{q} < 1/2$, $G^{FA} = \{\{2\}\}$, and if $\hat{q} > 1/2$, $G^{FA} = \{\{1\}, \{3\}, \{1, 3\}\}$.

(iii) If $\hat{q} < 1/2$, $G^{AF} = \{\{1\}\}$, and if $\hat{q} > 1/2$, $G^{AF} = \{\{2\}, \{3\}, \{2, 3\}\}$.

(iiv) If $\hat{q} < 1/2$, $G^{AA} = \{\{1\}, \{2\}, \{1, 2\}\}$, and if $\hat{q} > 1/2$, $G^{AA} = \{\{3\}\}$.

A comparison between Propositions 1 and 5 above shows that for those platforms configuration for which $\hat{q} > 1/2$, nothing changes when moving from a scenario with two types of voters to one with a single type. The reason being that in this case, and in both scenarios, all the voters have a preference for the fiscal policy, so the number of groups is irrelevant to the result. In contrast, the case where $\hat{q} < 1/2$ illustrates a situation where opinions differ. Note, however, that despite the opposing views, if the austerity policy is exclusively proposed by one candidate, the equilibrium strategy of the median voter is, in both cases, unique. Namely, to vote for that candidate with probability one. This means that, also in this case, there is no difference between the two scenarios. The difference is thus to be found in the case left: The posterior favors the austerity policy, which happens to be the policy proposed by the two office-motivated candidates. In this case, and in contrast to the situation with two groups of voters, where no coalition between the two strategic candidates can form, we now obtain room for this coalition. The fact that no biased voters exist is crucial to this result.

[21]Note that if $q < 1/2$, there are incentives for the strategic candidates to pander to A. These incentives are even stronger than in Heidhues and Lagerlöf (2003), as the assumed biased for the deterministic candidate reduces the benefit of proposing F, which makes it even more profitable to go for the prior. As a result, we expect no equilibrium with full revelation in this case.

Taking into account that if $\hat{q} < 1/2$, $G^{AA} = \{\{1\},\{2\},\{1,2\}\}$ in the present case, we now go into the analysis of the corresponding information transmission game. We obtain that, additionally to the equilibria characterized in Proposition 2, there are two new government structures that allow for information transmission in this case. In these two new cases, the coalition $C = \{1,2\}$ wins office for some platforms profiles.

Proposition 6. *The following are the only two new government structures that sustain a fully revealing equilibrium:*

(i) $g^{FA} = \{1,3\}$, $g^{AF} = \{2,3\}$, $g^{AA} = \{1,2\}$, $g^{FF} = \{3\}$.

(ii) $g^{FA} = g^{AF} = \{3\}$, $g^{AA} = \{1,2\}$, $g^{FF} = \{1,2\}$.

The fully revealing equilibrium is of the class $\sigma_c = (1,0;1,0)$.

Proof. In the Appendix. □

Our analysis of one type of voter is a generalization of Felgenhauer (2012), who proposes an interesting model that shares with the present paper the idea of considering a third candidate and studying how the incentives to transmit information are shaped when a third uninformed politician enters the game. Despite the common inspiration, the analysis and the results in our paper differ substantially from those in Felgenhauer (2012). For example, we consider a more sophisticated signal technology, which allows us to study the importance of the signals' correlation and/or the signals' quality in the results, something that is not in Felgenhauer (2012). Additionally, we explicitly model the government formation process, which gives us a complete characterization of all the government structures that may allow for information transmission. This is an important point, as it allows us to later characterize all the government structures that do indeed embed information transmission. Note that this analysis yields interesting insights, as it is that there is no fully revealing equilibrium in which for the same, or even for different platforms profiles, the two strategic candidates have chances of winning office at the same time; as there is neither an equilibrium in which the two office-motivated politicians cohabit and form government. In a sense, what these findings suggests, is that for electoral campaigns to be informative, one of the strategic candidates must be superior, meaning that some exogenous reason enhances the attractiveness of one candidate over the other, which makes voters prefer him over his opponent. If, on the contrary, when indifferent, a voter may end up voting for any of the two office-motivated candidate, no information flows.

The existence of different groups of voters, which is neither in Felgenhauer (2012), yields some final and interesting insights. For example, it generates strategic voting between the two groups of voters. In particular, it obliges the majority group to carefully cast their vote and do it in such a way that their preferred option wins an absolute majority of votes.[22] Naturally, in the case all the voters are of one type, let us say, social concerned, strategic voting does not arise, which opens the possibility of a government including the two main candidates. More interestingly, the inclusion of two types of voters reveals that the electoral process is more likely to be informative in the case in which the deterministic candidate is biased towards the large group of the electorate, than when it supports a minority group. Hence, our analysis shows that it is not the mere inclusion of a third candidate that matters, but that this candidate caters to the right group of people.

6 Conclusion

In systems with a representative democracy, the question of whether the electoral process can aggregate the information the politicians have and transmit it to the voters is of primary importance. Previous works have shown that in the presence of asymmetric information between the political parties and the voters, the electoral process may fail to be informative. This is the case when the superior information the candidates have is dispersed (in the sense it is not perfectly correlated between them). In this scenario, the existing literature shows that there are strong incentives for politicians to go for the electorate's prior, which precludes information from being transmitted.

The present work extends the previous research in two directions: (i) It considers a third candidate, and (ii) it allows for heterogeneous voters. This analysis yields a stark and unexpected result. Namely, that this third candidate helps to restore the informativeness of the electoral process, specially, when it supports the view of the majority of the electorate. In this sense, the more populist this candidate, the better. Additionally, we obtain that there is no fully revealing equilibrium in which the two office-motivated candidates can enter the government for the same, or even for different, platforms profiles. This means that in equilibrium, the composition of this cabinet always puts one of the strategic candidates out of office. Note that if we look into the political arena of our countries, where parties use to alternate in office and where close elections are not once in a blue moon, this last result overshadows the previous positive idea that information can be restored. Nonetheless, it suggests that no revelation of information may occur in this case. To what extend this is a specific outcome of our set-up or it is instead a more general result is an open question that we think merits further research.

[22]More precisely, if the policies announced are such that the social concerned voters differ in their preferred option to that of the biased voters, strategic voting refers to the fact that the former voters are to vote for one of the austerity supporters with probability one. Otherwise, the politician proposing the fiscal policy may enter the government. Hence, even when the assumption that there is symmetric voting for the social concerned voters allows us to get rid of pivotal considerations within this group, strategic considerations within the two groups still remain.

7 Appendix

Proof of Proposition 1:

Proof. Prior to the analysis, note that the rents from office K are to be shared between the politicians in the government. This means that if for candidate i, $v_i > 1/2$, in equilibrium, he is going to govern alone, i.e., $G = \{\{i\}\}$. Analogously, if $max\{v_1, v_2, v_3\} < 1/2$, in equilibrium, only minimal winning coalitions form, i.e., $C = \{\{1,2\},\{1,3\},\{2,3\}\}$. Next, we analyze the four cases considered in the statement:

(i) Consider $(x_1, x_2) = (FF)$. In this case only fiscal policies are being proposed, therefore only fiscal policies can be implemented. Thus, if the posterior belief says that policy F is best, the payoff to the social concerned voter is 1, independently of her vote; whereas it is 0, independently of her vote, if the posterior says A. Hence, any strategy $(\sigma_{4,1}^{*FF}, \sigma_{4,2}^{*FF}, \sigma_{4,3}^{*FF}) \in [0,1]^3$, such that $\sum_{i=\{1,2,3\}} \sigma_{4,i}^{*FF} = 1$ is an equilibrium strategy profile for the social concerned voter. As for the biased voter, $(\sigma_{5,1}^{*FF}, \sigma_{5,2}^{*FF}, \sigma_{5,3}^{*FF}) \in [0,1]^3$, such that $\sum_{i=\{1,2,3\}} \sigma_{5,i}^{*FF} = 1$. Then, in equilibrium, one of the following voting profiles result:

- $v_i > 1/2$, for some $i \in \{1,2,3\}$. In this case, candidate i gets an absolute majority of votes and wins office with probability one. Formally, $G^{FF} = \{\{i\}\}$.
- $max\{v_1, v_2, v_3\} < 1/2$. In this case, for all $i, j, k \in \{1,2,3\}$, $v_i + v_j = v_i + (1 - v_i - v_k) = 1 - v_k > 1/2$. Hence, any coalition of any two candidates is a winning coalition and can therefore form a government. Formally, $G^{FF} = \{\{1,2\},\{1,3\},\{2,3\}\}$.
- $v_i = 1/2$, $v_j, v_k > 0$, for $i, j, k \in \{1,2,3\}$. In this case, $v_i + v_j > 1/2$, $v_i + v_k > 1/2$ and $v_j + v_k = 1/2$. Hence, only coalitions including candidate i are winning coalitions. Formally, $G^{FF} = \{\{i,j\},\{i,k\}\}$.[23]
- $v_i = v_j = 1/2$, $v_k = 0$, for $i, j, k \in \{1,2,3\}$. In this case, only $v_i + v_j > 1/2$. Then, $G^{FF} = \{\{i,j\}\}$.[24]

(ii) Consider $(x_1, x_2) = (FA)$. In this case $(\sigma_{5,1}^{*FA}, \sigma_{5,2}^{*FA}, \sigma_{5,3}^{*FA}) = (\varepsilon, 0, 1-\varepsilon)$, with $\varepsilon \in [0,1]$.

First, consider $\hat{q} < 1/2$, i.e., the voter's updated belief says that policy A is best. In this case, the payoff to a social concerned voter is $U_4(A, w_A) = 1$

[23] Note that if having half of the votes were sufficient to govern, we would have another possible electoral outcome, in which either candidate i would govern alone or a coalition between candidates j and k would do. Then, $G^{FF} = \{\{i,j\},\{i,k\},\{i \vee jk\}\}$.

[24] Again, if having half of the votes were sufficient to govern, the set of electoral outcomes would be $G^{FF} = \{\{i,j\},\{i \vee j\}\}$.

when the elected government consists of candidate 2 alone, whereas it is smaller otherwise.[25] Then, $(\sigma^{*FA}_{4,1}, \sigma^{*FA}_{4,2}, \sigma^{*FA}_{4,3})$ is an equilibrium strategy profile for the social concerned voter if and only if $\beta\sigma^{*FA}_{4,2} > \beta(\sigma^{*FA}_{4,1} + \sigma^{*FA}_{4,3}) + (1-\beta)$, i.e., $v_2 > v_1 + v_3$. Hence, $G^{FA} = \{\{2\}\}$.

Now, consider $\hat{q} > 1/2$. Here, if $G \in \{\{1\}, \{3\}, \{1,3\}\}$, the payoff to a social concerned voter is $U_4(F, w_F) = 1$, whereas it is smaller otherwise. Hence, the social concerned voter must prevent candidate 2 from getting into office. This means that her equilibrium strategy profile $(\sigma^{*FA}_{4,1}, \sigma^{*FA}_{4,2}, \sigma^{*FA}_{4,3})$ must satisfy that if neither candidate 1 nor 3 gets an absolute majority of votes, candidate 2 cannot form government. Mathematically, $v_2 + v_i < 1/2$, for $i \in \{1,3\}$, where, in our case $v_2 = \beta\sigma^{FA}_{4,2}$ and $v_i = \beta\sigma^{FA}_{4,i} + (1-\beta)\sigma^{FA}_{5,i}$. But for this to be true, $\sigma^{*FA}_{4,2} = 0$, as otherwise $v_2 + v_i = (1 - v_i - v_j) + v_i > 1/2$, given no candidate wins an absolute majority of votes. Thus, in equilibrium, $v_2 = 0$, and either candidate 1 or 3 gains a strict majority of votes and governs alone, or both candidates obtain half of the votes, in which case a coalition between these candidates must form.[26] Hence, $G^{FA} = \{\{1\}, \{3\}, \{1,3\}\}$.

(iii) Consider $(x_1, x_2) = (AF)$. Analogously to the previous case, we obtain that if the voter's updated belief says that policy A is best, $G^{AF} = \{\{1\}\}$; whereas if it says that policy F is best, $G^{AF} = \{\{2\}, \{3\}, \{2,3\}\}$.

(iv) Last, consider $(x_1, x_2) = (AA)$. In this case $(\sigma^{*AA}_{5,1}, \sigma^{*AA}_{5,2}, \sigma^{*AA}_{5,3}) = (0, 0, 1)$.

First, consider $\hat{q} < 1/2$. Here, if the resulting government is $G \in \{\{1\}, \{2\}, \{1,2\}\}$, the payoff to a social concerned voter is $U_4(A, w_A) = 1$, whereas it is smaller otherwise. This means that the social concerned voter must prevent candidate 3 from entering the government. Using an analogous argument to that used in case (ii) of the proof, it means that her equilibrium strategy profile $(\sigma^{*AA}_{4,1}, \sigma^{*AA}_{4,2}, \sigma^{*AA}_{4,3})$ must satisfy that if neither candidate 1 nor 2 gets an absolute majority of votes, candidate 3 cannot be pivotal. As shown before, it requires $\sigma^{*AA}_{4,3} = 0$. Note, however, that even if this holds, $v_3 = 1 - \beta > 0$, as candidate 3 gets in this case the votes of the biased voters. Hence, if no candidate gets an absolute majority of votes, candidate 3 could happen to enter the government. Then, the equilibrium strategy profile for the social concerned voter $(\sigma^{*AA}_{4,1}, \sigma^{*AA}_{4,2}, \sigma^{*AA}_{4,3})$ must satisfy either $\beta\sigma^{*AA}_{4,1} > 1/2$ or $\beta\sigma^{*AA}_{4,2} > 1/2$. Note that $\beta\sigma^{*AA}_{4,1} = 1/2$ (analogously, $\beta\sigma^{*AA}_{4,2} = 1/2$) is not possible in equilibrium. To see it, let us consider $\beta\sigma^{*AA}_{4,1} = 1/2$. In this case $v_1 + v_3 > 1/2$, which means that candidate 3 could eventually enter the

[25] The payoff to a social concerned voter would be either 0, if the resulting government implements policy F, or $\alpha \in (0,1)$, if the policy implemented by the resulting government is a convex combination of fiscal and austerity measures. Here, α corresponds to the probability that policy A is implemented.

[26] Given the assumption that a strict majority of votes is required to govern. If we were to relax this assumption and allow for a coin toss to decide who wins in this case, the set of electoral outcomes would be $G^{FA} = \{\{1\}, \{3\}, \{1,3\}, \{1 \vee 3\}\}$.

government, in which case the payoff to the social concerned voter would be smaller. Hence, $\beta\sigma^{*AA}_{4,1} > 1/2$ and therefore, $G^{AA} = \{\{1\},\{2\}\}$.

Last, consider $\hat{q} > 1/2$. In this case, the payoff to a social concerned voter is $U_4(F, w_F) = 1$ when the elected government consists of candidate 3 alone, and it is smaller otherwise. Then, $(\sigma^{*AA}_{4,1}, \sigma^{*AA}_{4,2}, \sigma^{*AA}_{4,3})$ is an equilibrium strategy profile for the social concerned voter if and only if $\beta\sigma^{*AA}_{4,3} + 1 - \beta > \beta(\sigma^{*AA}_{4,1} + \sigma^{*AA}_{4,2})$. Hence, $G^{AA} = \{\{3\}\}$. This completes the proof.

□

Proof of Proposition 2:

Proof. We have to analyze four cases:

(i) Let us conjecture an equilibrium in which $\sigma_c = (1, 0; 1, 0)$.

In equilibrium, choosing F when having observed F must be a best response for candidates 1 and 2, respectively:

$$P_{F/F}\begin{cases} K & \text{if } g^{FF} = \{1\} \\ K/2 & \text{if } g^{FF} \in \{\{1,2\},\{1,3\}\} \\ 0 & \text{if } g^{FF} \in \{\{2\},\{3\},\{2,3\}\} \end{cases} + P_{A/F}\begin{cases} K & \text{if } g^{FA} = \{1\} \\ K/2 & \text{if } g^{FA} = \{1,3\} \\ 0 & \text{if } g^{FA} = \{3\} \end{cases} \geq P_{A/F}\begin{cases} K & \text{if } g^{AA} = \{1\} \\ 0 & \text{if } g^{AA} = \{2\} \end{cases} \tag{1}$$

$$P_{F/F}\begin{cases} K & \text{if } g^{FF} = \{2\} \\ K/2 & \text{if } g^{FF} \in \{\{1,2\},\{2,3\}\} \\ 0 & \text{if } g^{FF} \in \{\{1\},\{3\},\{1,3\}\} \end{cases} + P_{A/F}\begin{cases} K & \text{if } g^{AF} = \{2\} \\ K/2 & \text{if } g^{AF} = \{2,3\} \\ 0 & \text{if } g^{AF} = \{3\} \end{cases} \geq P_{A/F}\begin{cases} K & \text{if } g^{AA} = \{2\} \\ 0 & \text{if } g^{AA} = \{1\} \end{cases} \tag{2}$$

Analogously, choosing A when having observed A must be a best response for candidates 1 and 2, respectively:

$$P_{A/A}\begin{cases} K & \text{if } g^{AA} = \{1\} \\ 0 & \text{if } g^{AA} = \{2\} \end{cases} \geq P_{A/A}\begin{cases} K & \text{if } g^{FA} = \{1\} \\ K/2 & \text{if } g^{FA} = \{1,3\} \\ 0 & \text{if } g^{FA} = \{3\} \end{cases} + P_{F/A}\begin{cases} K & \text{if } g^{FF} = \{1\} \\ K/2 & \text{if } g^{FF} \in \{\{1,2\},\{1,3\}\} \\ 0 & \text{if } g^{FF} \in \{\{2\},\{3\},\{2,3\}\} \end{cases} \tag{3}$$

$$P_{A/A}\begin{cases} K & \text{if } g^{AA} = \{2\} \\ 0 & \text{if } g^{AA} = \{1\} \end{cases} \geq P_{A/A}\begin{cases} K & \text{if } g^{AF} = \{2\} \\ K/2 & \text{if } g^{AF} = \{2,3\} \\ 0 & \text{if } g^{AF} = \{3\} \end{cases} + P_{F/A}\begin{cases} K & \text{if } g^{FF} = \{2\} \\ K/2 & \text{if } g^{FF} \in \{\{1,2\},\{2,3\}\} \\ 0 & \text{if } g^{FF} \in \{\{1\},\{3\},\{1,3\}\} \end{cases} \tag{4}$$

Now, let us first suppose $g^{FA} = \{1\}$. By Assumption 2, $g^{AF} = \{2\}$. In this case, a necessary condition for (3) to hold is $g^{AA} = \{1\}$, but then (4) cannot hold. Similarly, let us suppose $g^{FA} = \{1,3\}$. By Assumption 2, $g^{AF} = \{2,3\}$. Again, $g^{AA} = \{1\}$ is necessary for (3) to hold, but then (4) cannot hold. Hence, there is not an equilibrium of the types conjectured.

Last, let us suppose $g^{FA} = \{3\}$. By Assumption 2, $g^{AF} = \{3\}$. Here we have two cases: (a) Consider $g^{AA} = \{1\}$. A necessary condition for (4) to hold is $g^{FF} \in \{\{1\},\{3\},\{1,3\}\}$, and a necessary condition for (1) to hold is either $g^{FF} \in \{\{1,2\},\{1,3\}\}$ and $P_{F/F} \geq 2P_{A/F}$, or $g^{FF} = \{1\}$. Note that if $g^{FF} \in \{\{1\},\{1,3\}\}$, conditions (2) and (3) hold. Hence, if either $g^{FF} = \{13\}$ and $P_{F/F} \geq 2P_{A/F}$, or $g^{FF} = \{1\}$, there is an equilibrium of the type conjectured. (b) Analogously to the previous case, there is an equilibrium in which $g^{AA} = \{2\}$ and either $g^{FF} = \{2,3\}$ and $P_{F/F} \geq 2P_{A/F}$, or $g^{FF} = \{2\}$.

(ii) Let us conjecture an equilibrium in which $\sigma_c = (1,0;0,1)$.

In equilibrium, choosing F (A) when having observed F must be a best response for candidate 1 (2), respectively:

$$P_{F/F}\begin{cases} K & \text{if } g^{FA} = \{1\} \\ K/2 & \text{if } g^{FA} = \{1,3\} \\ 0 & \text{if } g^{FA} = \{3\} \end{cases} + P_{A/F}\begin{cases} K & \text{if } g^{FF} = \{1\} \\ K/2 & \text{if } g^{FF} \in \{\{1,2\},\{1,3\}\} \\ 0 & \text{if } g^{FF} \in \{\{2\},\{3\},\{2,3\}\} \end{cases} \geq P_{A/F}K \quad (5)$$

$$0 \geq P_{F/F}\begin{cases} K & \text{if } g^{FF} = \{2\} \\ K/2 & \text{if } g^{FF} \in \{\{1,2\},\{2,3\}\} \\ 0 & \text{if } g^{FF} \in \{\{1\},\{3\},\{1,3\}\} \end{cases} \quad (6)$$

Analogously, choosing A (F) when having observed A must be a best response for candidate 1 (2), respectively:

$$P_{A/A}K \geq P_{A/A}\begin{cases} K & \text{if } g^{FF} = \{1\} \\ K/2 & \text{if } g^{FF} \in \{\{1,2\},\{1,3\}\} \\ 0 & \text{if } g^{FF} \in \{\{2\},\{3\},\{2,3\}\} \end{cases} + P_{F/A}\begin{cases} K & \text{if } g^{FA} = \{1\} \\ K/2 & \text{if } g^{FA} = \{1,3\} \\ 0 & \text{if } g^{FA} = \{3\} \end{cases} \quad (7)$$

$$P_{F/A}\begin{cases} K & \text{if } g^{FF} = \{2\} \\ K/2 & \text{if } g^{FF} \in \{\{1,2\},\{2,3\}\} \\ 0 & \text{if } g^{FF} \in \{\{1\},\{3\},\{2,3\}\} \end{cases} \geq 0 \quad (8)$$

First, note that condition (8) always hold, and that a necessary condition for (6) to hold is $g^{FF} \in \{\{1\},\{3\},\{1,3\}\}$.

Then, let us first consider $g^{FF} = \{1\}$. In this case, a necessary condition for (7) to hold is $g^{FA} = \{3\}$, in which case (5) holds. Hence, there is an equilibrium of the type conjectured.

Second, let us consider $g^{FF} = \{3\}$. A necessary condition for (5) to hold is either $g^{FA} = \{1,3\}$ and $P_{F/F} > 2P_{A/F}$, or $g^{FA} = \{1\}$. Note that in both cases condition (7) holds. Hence, there is an equilibrium of the type conjectured.

Last, let us consider $g^{FF} = \{1,3\}$. Again, a necessary condition for (5) to hold is either $g^{FA} = \{1,3\}$ or $g^{FA} = \{1\}$. (a) If $g^{FA} = \{1\}$, a necessary condition for (7) to hold is $P_{A/A} > 2P_{F/A}$. Hence, there is an equilibrium of the type conjectured. (b) If $g^{FA} = \{1,3\}$, (7) always hold. Hence, there is an equilibrium of the type conjectured.

(iii) The case $\sigma_c = (0,1;1,0)$ is analogous to the previous one.

(iv) Last, let us conjecture an equilibrium in which $\sigma_c = (0,1;0,1)$.
In equilibrium, choosing A when having observed F must be a best response for candidates 1 and 2, respectively:

$$0 \geq P_{F/F} \begin{cases} K & \text{if } g^{FA} = \{1\} \\ K/2 & \text{if } g^{FA} = \{1,3\} \\ 0 & \text{if } g^{FA} = \{3\} \end{cases} + P_{A/F} \begin{cases} K & \text{if } g^{FF} = \{1\} \\ K/2 & \text{if } g^{FF} \in \{\{1,2\},\{1,3\}\} \\ 0 & \text{if } g^{FF} \in \{\{2\},\{3\},\{2,3\}\} \end{cases} \tag{9}$$

$$0 \geq P_{F/F} \begin{cases} K & \text{if } g^{AF} = \{2\} \\ K/2 & \text{if } g^{AF} = \{2,3\} \\ 0 & \text{if } g^{AF} = \{3\} \end{cases} + P_{A/F} \begin{cases} K & \text{if } g^{FF} = \{2\} \\ K/2 & \text{if } g^{FF} \in \{\{1,2\},\{2,3\}\} \\ 0 & \text{if } g^{FF} \in \{\{1\},\{3\},\{1,3\}\} \end{cases} \tag{10}$$

For (9) and (10) to hold, a necessary condition is $g^{FA} = g^{AF} = g^{FF} = \{3\}$. Additionally, note that if $(x_1, x_2) = (AA)$, the social concerned voter thinks policy F is the best one, then $g^{AA} = \{3\}$. Hence, candidates 1 and 2 never gets votes, therefore the configuration considered is an equilibrium. This completes the proof.

□

Proof of Proposition 3:

Proof. We have to analyze four cases:

(i) Let us conjecture an equilibrium in which $\sigma_c = (1,0;1,0)$.
In equilibrium, choosing F when having observed F must be a best response for candidates 1 and 2, respectively:

$$P_{F/F} \begin{cases} K & \text{if } g^{FF} = \{1\} \\ K/2 & \text{if } g^{FF} \in \{\{1,2\},\{1,3\}\} \\ 0 & \text{if } g^{FF} \in \{\{2\},\{3\},\{2,3\}\} \end{cases} \geq P_{F/F}K + P_{A/F} \begin{cases} K & \text{if } g^{AA} = \{1\} \\ 0 & \text{if } g^{AA} = \{2\} \end{cases} \tag{11}$$

$$P_{F/F} \begin{cases} K & \text{if } g^{FF} = \{2\} \\ K/2 & \text{if } g^{FF} \in \{\{1,2\},\{2,3\}\} \\ 0 & \text{if } g^{FF} \in \{\{1\},\{3\},\{1,3\}\} \end{cases} \geq P_{F/F}K + P_{A/F} \begin{cases} K & \text{if } g^{AA} = \{2\} \\ 0 & \text{if } g^{AA} = \{1\} \end{cases} \tag{12}$$

A necessary condition for (11) to hold is $g^{FF} = \{1\}$. But then (12) cannot hold. Hence, there is not an equilibrium of the type conjectured.

(ii) Let us conjecture an equilibrium in which $\sigma_c = (1, 0; 0, 1)$.

In equilibrium, choosing F (A) when having observed F must be a best response for candidate 1 (2), respectively:

$$P_{F/F}\begin{cases} K & \text{if } g^{FA} = \{1\} \\ K/2 & \text{if } g^{FA} = \{1,3\} \\ 0 & \text{if } g^{FA} = \{3\} \end{cases} + P_{A/F}\begin{cases} K & \text{if } g^{FF} = \{1\} \\ K/2 & \text{if } g^{FF} \in \{\{1,2\},\{1,3\}\} \\ 0 & \text{if } g^{FF} \in \{\{2\},\{3\},\{2,3\}\} \end{cases} \geq$$
$$P_{F/F}\begin{cases} K & \text{if } g^{AA} = \{1\} \\ 0 & \text{if } g^{AA} = \{2\} \end{cases} + P_{A/F}K \quad (13)$$

$$P_{A/F}\begin{cases} K & \text{if } g^{AA} = \{2\} \\ 0 & \text{if } g^{AA} = \{1\} \end{cases} \geq P_{F/F}\begin{cases} K & \text{if } g^{FF} = \{2\} \\ K/2 & \text{if } g^{FF} \in \{\{1,2\},\{2,3\}\} \\ 0 & \text{if } g^{FF} \in \{\{1\},\{3\},\{1,3\}\} \end{cases} \quad (14)$$

Analogously, choosing A (F) when having observed A must be a best response for candidate 1 (2), respectively:

$$P_{A/A}K + P_{F/A}\begin{cases} K & \text{if } g^{AA} = \{1\} \\ 0 & \text{if } g^{AA} = \{2\} \end{cases} \geq P_{A/A}\begin{cases} K & \text{if } g^{FF} = \{1\} \\ K/2 & \text{if } g^{FF} \in \{\{1,2\},\{1,3\}\} \\ 0 & \text{if } g^{FF} \in \{\{2\},\{3\},\{2,3\}\} \end{cases} +$$
$$P_{F/A}\begin{cases} K & \text{if } g^{FA} = \{1\} \\ K/2 & \text{if } g^{FA} = \{1,3\} \\ 0 & \text{if } g^{FA} = \{3\} \end{cases} \quad (15)$$

$$P_{F/A}\begin{cases} K & \text{if } g^{FF} = \{2\} \\ K/2 & \text{if } g^{FF} \in \{\{1,2\},\{2,3\}\} \\ 0 & \text{if } g^{FF} \in \{\{1\},\{3\},\{2,3\}\} \end{cases} \geq P_{A/A}\begin{cases} K & \text{if } g^{AA} = \{2\} \\ 0 & \text{if } g^{AA} = \{1\} \end{cases} \quad (16)$$

First, note that if $g^{AA} = \{2\}$, condition (16) cannot hold. Hence, there is not an equilibrium in this case.

Now, consider $g^{AA} = \{1\}$. A necessary condition for (14) to hold is $g^{FF} \in \{\{1\},\{3\},\{1,3\}\}$, and the necessary conditions for (13) to hold are $g^{FA} = g^{FF} = \{1\}$. Note that in this case, both (15) and (16) hold. Hence, there is an equilibrium of the type conjectured.

(iii) The case $\sigma_c = (0, 1; 1, 0)$ is analogous to the previous one.

(iv) Last, let us conjecture an equilibrium in which $\sigma_c = (0, 1; 0, 1)$.

In equilibrium, choosing F when having observed A must be a best response for candidates 1 and 2, respectively:

$$P_{A/A}\begin{cases} K & \text{if } g^{FF} = \{1\} \\ K/2 & \text{if } g^{FF} \in \{\{1,2\},\{1,3\}\} \\ 0 & \text{if } g^{FF} \in \{\{2\},\{3\},\{2,3\}\} \end{cases} \geq P_{A/A}K \quad (17)$$

$$P_{A/A}\begin{cases} K & \text{if } g^{FF}=\{2\} \\ K/2 & \text{if } g^{FF}\in\{\{1,2\},\{2,3\}\} \\ 0 & \text{if } g^{FF}\in\{\{1\},\{3\},\{1,3\}\} \end{cases} \geq P_{A/A}K \tag{18}$$

For (17) to hold, a necessary condition is $g^{FF}=\{1\}$. But then (18) cannot hold. Hence, there is not an equilibrium of the type conjectured. This completes the proof.

□

Proof of Proposition 4:

Proof. We prove it in two steps: Like biases and opposing biases.

1. Let us first consider the case of like biases, i.e. $q>\frac{1}{2}$. We have to analyze four cases:

1.i) Let us conjecture an equilibrium in which $\sigma_c=(1,0;1,0)$.
In equilibrium, choosing A when having observed A must be a best response for candidates 1 and 2:

$$P_{A/A}[\beta\sigma_{4,1}^{AA}+(1-\beta)\sigma_{5,1}^{AA}]\geq P_{A/A}+P_{F/A}[\beta\sigma_{4,1}^{FF}+(1-\beta)\sigma_{5,1}^{FF}]$$

$$P_{A/A}[\beta\sigma_{4,2}^{AA}+(1-\beta)\sigma_{5,2}^{AA}]\geq P_{A/A}+P_{F/A}[\beta\sigma_{4,2}^{FF}+(1-\beta)\sigma_{5,2}^{FF}]$$

Adding inequalities we obtain $0\geq P_{A/A}+P_{F/A}=1$, which is impossible. Hence, there is no equilibrium of the type conjectured.

1.ii) Let us conjecture an equilibrium in which $\sigma_c=(1,0;0,1)$.
In equilibrium, choosing A when having observed A must be a best response for candidate 1:

$$P_{A/A}\beta+P_{F/A}[\beta\sigma_{4,1}^{AA}+(1-\beta)\sigma_{5,1}^{AA}]\geq P_{A/A}[\beta\sigma_{4,1}^{FF}+(1-\beta)\sigma_{5,1}^{FF}]+P_{F/A}$$

Analogously, choosing A when having observed F must be a best response for candidate 2:

$$P_{A/F}[\beta\sigma_{4,2}^{AA}+(1-\beta)\sigma_{5,2}^{AA}]\geq P_{F/F}[\beta\sigma_{4,2}^{FF}+(1-\beta)\sigma_{5,2}^{FF}]+P_{A/F}(1-\beta)$$

Since, for $i,j\in\{F,A\}$ and $k\in\{4,5\}$, $P_{i/j}=P_{j/i}$ and $\sigma_{k,1}^{ii}+\sigma_{k,2}^{ii}=1$, adding inequalities and rearranging, we obtain $0\geq P_{A/A}(1-\beta)+P_{F/A}(1-\beta)$. Since for $i,j\in\{F,A\}$, $P_{j/i}+P_{i/i}=1$, there is no equilibrium of the type conjectured.

1.iii) The case $\sigma_c=(0,1;1,0)$ is analogous to the previous one.

1.iv) Last, let us conjecture an equilibrium in which $\sigma_c = (0,1;0,1)$.
In equilibrium, choosing A when having observed F must be a best response for any of the two strategic candidates, let us say, candidate 1. That is to say:

$$P_{F/F}[\beta\sigma_{4,1}^{AA} + (1-\beta)\sigma_{5,1}^{AA}] \geq P_{F/F} + P_{A/F}[\beta\sigma_{4,1}^{FF} + (1-\beta)\sigma_{5,1}^{FF}]$$

Since $\beta\sigma_{4,1}^{AA} + (1-\beta)\sigma_{5,1}^{AA} \leq 1$, there is no equilibrium of the type conjectured.

2. Let us now consider the case of opposing biases, i.e., $q < \frac{1}{2}$. Again, there are four cases to analyze:

2.i) Let us conjecture an equilibrium in which $\sigma_c = (1,0;1,0)$.
In equilibrium, choosing F when having observed F must be a best response for candidates 1 and 2:

$$P_{F/F}[\beta\sigma_{4,1}^{FF}+(1-\beta)\sigma_{5,1}^{FF}]+P_{A/F}(1-\beta) \geq P_{F/F}\beta+P_{A/F}[\beta\sigma_{4,1}^{AA}+(1-\beta)\sigma_{5,1}^{AA}] \quad (19)$$

$$P_{F/F}[\beta\sigma_{4,2}^{FF}+(1-\beta)\sigma_{5,2}^{FF}]+P_{A/F}(1-\beta) \geq P_{F/F}\beta+P_{A/F}[\beta\sigma_{4,2}^{AA}+(1-\beta)\sigma_{5,2}^{AA}] \quad (20)$$

Adding inequalities we obtain $P_{F/F}(1-2\beta) + P_{A/F}(1-2\beta) \geq 0 \Leftrightarrow \beta \leq 1/2$.
Similarly, in equilibrium, choosing A when having observed A must be a best response for candidates 1 and 2:

$$P_{A/A}[\beta\sigma_{4,1}^{AA}+(1-\beta)\sigma_{5,1}^{AA}]+P_{F/A}\beta \geq P_{A/A}(1-\beta)+P_{F/A}[\beta\sigma_{4,1}^{FF}+(1-\beta)\sigma_{5,1}^{FF}] \quad (21)$$

$$P_{A/A}[\beta\sigma_{4,2}^{AA}+(1-\beta)\sigma_{5,2}^{AA}]+P_{F/A}\beta \geq P_{A/A}(1-\beta)+P_{F/A}[\beta\sigma_{4,2}^{FF}+(1-\beta)\sigma_{5,2}^{FF}] \quad (22)$$

Adding inequalities we obtain $0 \geq P_{A/A}(1-2\beta) + P_{F/A}(1-2\beta) \Leftrightarrow \beta \geq 1/2$.
Hence, both requirements can only meet if $\beta = 1/2$. Now, if $\beta = 1/2$, and taking into account that for $k \in \{4,5\}$ and $i \in \{F,A\}$, $\sigma_{k,1}^{ii} + \sigma_{k,2}^{ii} = 1$, inequalities (19)-(22) can be rewritten as:

$$P_{A/F}(1 - \sigma_{4,1}^{AA} - \sigma_{5,1}^{AA}) = P_{F/F}(1 - \sigma_{4,1}^{FF} - \sigma_{5,1}^{FF})$$

$$P_{A/A}(1 - \sigma_{4,1}^{AA} - \sigma_{5,1}^{AA}) = P_{F/A}(1 - \sigma_{4,1}^{FF} - \sigma_{5,1}^{FF})$$

Now, since $P_{i/i} > P_{j/i}$, there is a unique solution for the system above, which is $\sigma_{4,1}^{AA} = \sigma_{5,1}^{AA} = \sigma_{4,1}^{FF} = \sigma_{5,1}^{FF} = 1/2$. Hence, in this case, there is an equilibrium of the type conjectured.

2.ii) Let us conjecture an equilibrium in which $\sigma_c = (1,0;0,1)$. In this case, the payoffs coincide with those in case 1.ii). Hence, there is not an equilibrium in this case.

2.iii) Analogously, there is neither an equilibrium in the case $\sigma_c = (0,1;1,0)$.

2.iv) Last, let us conjecture an equilibrium in which $\sigma_c = (0,1;0,1)$.

In equilibrium, choosing A when having observed F must be a best response for candidates 1 and 2. That is to say:

$$P_{F/F}[\beta\sigma_{4,1}^{AA}+(1-\beta)\sigma_{5,1}^{AA}]+P_{A/F}\beta \geq P_{F/F}(1-\beta)+P_{A/F}[\beta\sigma_{4,1}^{FF}+(1-\beta)\sigma_{5,1}^{FF}] \quad (23)$$

$$P_{F/F}[\beta\sigma_{4,2}^{AA}+(1-\beta)\sigma_{5,2}^{AA}]+P_{A/F}\beta \geq P_{F/F}(1-\beta)+P_{A/F}[\beta\sigma_{4,2}^{FF}+(1-\beta)\sigma_{5,2}^{FF}] \quad (24)$$

Adding inequalities we obtain $0 \geq P_{F/F}(1-2\beta)+P_{A/F}(1-2\beta) \Leftrightarrow \beta \geq 1/2$.

Similarly, in equilibrium, choosing F when having observed A must be a best response for candidates 1 and 2. That is to say:

$$P_{A/A}[\beta\sigma_{4,1}^{FF}+(1-\beta)\sigma_{5,1}^{FF}]+P_{F/A}(1-\beta) \geq P_{A/A}\beta+P_{F/A}[\beta\sigma_{4,1}^{AA}+(1-\beta)\sigma_{5,1}^{AA}] \quad (25)$$

$$P_{A/A}[\beta\sigma_{4,2}^{FF}+(1-\beta)\sigma_{5,2}^{FF}]+P_{F/A}(1-\beta) \geq P_{A/A}\beta+P_{F/A}[\beta\sigma_{4,2}^{AA}+(1-\beta)\sigma_{5,2}^{AA}] \quad (26)$$

Adding inequalities we obtain $P_{A/A}(1-2\beta)+P_{F/A}(1-2\beta) \geq 0 \Leftrightarrow \beta \leq 1/2$.

Hence, both requirements can only meet if $\beta = 1/2$. Now, if $\beta = 1/2$, and taking into account that for $k \in \{4,5\}$ and $i \in \{F,A\}$, $\sigma_{k,1}^{ii}+\sigma_{k,2}^{ii} = 1$, inequalities (23)-(26) can be rewritten as:

$$P_{A/F}(1-\sigma_{4,1}^{FF}-\sigma_{5,1}^{FF}) = P_{F/F}(1-\sigma_{4,1}^{AA}-\sigma_{5,1}^{AA})$$
$$P_{A/A}(1-\sigma_{4,1}^{FF}-\sigma_{5,1}^{FF}) = P_{F/A}(1-\sigma_{4,1}^{AA}-\sigma_{5,1}^{AA})$$

Now, since $P_{i/i} > P_{j/i}$, there is a unique solution for the system above, which is $\sigma_{4,1}^{AA} = \sigma_{4,1}^{FF} = \sigma_{5,1}^{AA} = \sigma_{5,1}^{FF} = 1/2$. Hence, in this case, there is an equilibrium of the type conjectured.

□

Proof of Proposition 6:

Proof. First, let us conjecture an equilibrium in which either $\sigma_c = (1,0;0,1)$, $\sigma_c = (1,0;0,1)$ or $\sigma_c = (0,1;1,0)$. In these cases, note that when the platforms' profile observed is $(x_1,x_2) = (AA)$, applying Bayes' rule we obtain $\hat{q} > 1/2$. Hence, $g^{AA} = \{3\}$, as it was the case in the analogous situations of Proposition 1. The analyses of these cases are therefore identical to those in Proposition 1, therefore omitted.

Let us now conjecture an equilibrium in which $\sigma_c = (1, 0; 1, 0)$.

In equilibrium, choosing F when having observed F must be a best response for candidates 1 and 2, respectively:

$$P_{F/F}\begin{cases} K & \text{if } g^{FF}=\{1\} \\ K/2 & \text{if } g^{FF}\in\{\{1,2\},\{1,3\}\} \\ 0 & \text{if } g^{FF}\in\{\{2\},\{3\},\{2,3\}\} \end{cases} + P_{A/F}\begin{cases} K & \text{if } g^{FA}=\{1\} \\ K/2 & \text{if } g^{FA}=\{1,3\} \\ 0 & \text{if } g^{FA}=\{3\} \end{cases} \geq P_{A/F}\begin{cases} K & \text{if } g^{AA}=\{1\} \\ K/2 & \text{if } g^{AA}=\{1,2\} \\ 0 & \text{if } g^{AA}=\{2\} \end{cases} \tag{27}$$

$$P_{F/F}\begin{cases} K & \text{if } g^{FF}=\{2\} \\ K/2 & \text{if } g^{FF}\in\{\{1,2\},\{2,3\}\} \\ 0 & \text{if } g^{FF}\in\{\{1\},\{3\},\{1,3\}\} \end{cases} + P_{A/F}\begin{cases} K & \text{if } g^{AF}=\{2\} \\ K/2 & \text{if } g^{AF}=\{2,3\} \\ 0 & \text{if } g^{AF}=\{3\} \end{cases} \geq P_{A/F}\begin{cases} K & \text{if } g^{AA}=\{2\} \\ K/2 & \text{if } g^{AA}=\{1,2\} \\ 0 & \text{if } g^{AA}=\{1\} \end{cases} \tag{28}$$

Analogously, choosing A when having observed A must be a best response for candidates 1 and 2, respectively:

$$P_{A/A}\begin{cases} K & \text{if } g^{AA}=\{1\} \\ K/2 & \text{if } g^{AA}=\{1,2\} \\ 0 & \text{if } g^{AA}=\{2\} \end{cases} \geq P_{A/A}\begin{cases} K & \text{if } g^{FA}=\{1\} \\ K/2 & \text{if } g^{FA}=\{1,3\} \\ 0 & \text{if } g^{FA}=\{3\} \end{cases} + P_{F/A}\begin{cases} K & \text{if } g^{FF}=\{1\} \\ K/2 & \text{if } g^{FF}\in\{\{1,2\},\{1,3\}\} \\ 0 & \text{if } g^{FF}\in\{\{2\},\{3\},\{2,3\}\} \end{cases} \tag{29}$$

$$P_{A/A}\begin{cases} K & \text{if } g^{AA}=\{2\} \\ K/2 & \text{if } g^{AA}=\{1,2\} \\ 0 & \text{if } g^{AA}=\{1\} \end{cases} \geq P_{A/A}\begin{cases} K & \text{if } g^{AF}=\{2\} \\ K/2 & \text{if } g^{AF}=\{2,3\} \\ 0 & \text{if } g^{AF}=\{3\} \end{cases} + P_{F/A}\begin{cases} K & \text{if } g^{FF}=\{2\} \\ K/2 & \text{if } g^{FF}\in\{\{1,2\},\{2,3\}\} \\ 0 & \text{if } g^{FF}\in\{\{1\},\{3\},\{1,3\}\} \end{cases} \tag{30}$$

Now, let us first suppose $g^{FA} = \{1\}$. By Assumption 2, $g^{AF} = \{2\}$. In this case, a necessary condition for (29) to hold is $G^{AAF} = \{1\}$, but then (30) cannot hold.

Similarly, let us suppose $g^{FA} = \{1, 3\}$. By Assumption 2, $g^{AF} = \{2, 3\}$. Now, $g^{AA} \in \{\{1\}, \{1, 2\}\}$ is necessary for (29) to hold. If $g^{AA} = \{1\}$ we are in the previous situation, therefore no equilibrium exists. Let us consider $g^{AA} = \{1, 2\}$. Then, a necessary condition for (29) to hold is $g^{FF} \in \{\{2\}, \{3\}, \{2, 3\}\}$, and a necessary condition for (30) to hold is $g^{FF} \in \{\{1\}, \{3\}, \{1, 3\}\}$. Note that if $g^{FF} = \{3\}$, conditions (27) and (28) hold. Hence, there is an equilibrium of the type conjectured.

Last, let us suppose $g^{FA} = \{3\}$. By Assumption 2, $g^{AF} = \{3\}$. Here we have three cases: (a) Consider $g^{AA} = \{1\}$. A necessary condition for (30) to hold is $g^{FF} \in \{\{1\}, \{3\}, \{1, 3\}\}$, and a necessary condition for (27) to hold is either $g^{FF} \in \{\{1,2\},\{1,3\}\}$ and $P_{F/F} \geq 2P_{A/F}$, or $g^{FF} = \{1\}$. Note that if $g^{FF} \in \{\{1\},\{1,3\}\}$, conditions (28) and (29) hold. Hence, if either $g^{FF} = \{1,3\}$ and $P_{F/F} \geq 2P_{A/F}$, or $g^{FF} = \{1\}$, there is an equilibrium of the type conjectured. (b) Analogously to the previous case, there is an equilibrium in which $g^{AA} = \{2\}$ and either $g^{FF} = \{2,3\}$ and $P_{F/F} \geq 2P_{A/F}$, or $g^{FF} = \{2\}$. (c) Last, consider $g^{AA} = \{1,2\}$. A necessary condition for (27) to hold is $g^{FF} \in \{\{1\},\{1,2\},\{1,3\}\}$, and a necessary condition for (28) to hold $g^{FF} \in \{\{2\},\{1,2\},\{2,3\}\}$. Note that if $GgFF = \{1,2\}$, conditions (29) and (30) hold. Hence, there is an equilibrium of the type conjectured. This completes the proof. □

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