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Dialogue or issue divergence  
in the political campaign?

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**Abstract**

We incorporate the media priming effects to explain how politicians can affect voters' preferences on issues during the political campaign. We adapt well-known terms of international trade, such as absolute advantage and comparative advantage, to the context of parties' competition in political issues. We show that when either each party has an absolute advantage on a different issue or when parties have "high" comparative advantage on a different issue, the political campaign will consist of issue-emphasis divergence. However, when a party has an absolute advantage on both issues but the parties' comparative advantage is not "high enough", the political campaign will consist of issue engagement or dialogue. Our results conciliate two separated theories concerning whether there must be dialogue or issue-emphasis divergence in the political campaign.

**Keywords:** political campaign, media priming, political issues, spatial model.

**JEL Classification:** D72, C70

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# 1 Introduction

The recent political campaigns in modern democracies highlight the fact that competition of political parties is increasingly based on political issues. We observe how politicians use political campaigns to promote those issues by which they can capture a greater amount of voters. Thus, in recent electoral races (as for instance United States, United Kingdom or Spain), the economic issue and the position in Iraq's war (or the fight against terrorism) are the two issues that the media have covered more extensively.

In this paper, we incorporate the media priming effects to explain the political parties' strategy in the political campaign. The media priming is a way to influence voters by means of emphasizing some political aspects more than others. We hypothesize that campaign expenditure affects the relative intensity that voters assign to one issue over another. This ability of political communication to change the salience of consideration in the public's mind has been demonstrated by several authors (see, e.g. Iyengar and Kinder, 1987, Krosnick and Kinder, 1990, Iyengar and Simon 1993). We show that there is a direct relation between the ex-ante advantage that a political party has on an issue and the incentives that this party has to affect the salience of such issue. The concepts of absolute advantage and comparative advantage on a political issue turns out to be crucial to explain when it is in the best interest of a party to emphasize opposite issues, or to promote dialogue and debate on certain political issues.

## *Empirical evidence and theoretical arguments*

Authors as West (2000) or Spillotes and Vavreck (2002) analyze campaign ads and find that political issues are mentioned in a large number of ads. The pioneering contributions of Riker (1993) and Petrocik (1996) provide some ideas on how political parties compete in political issues. From the analysis of the national campaign of the U.S. for the ratification of the Constitution, Riker (1993) argues that, (i) when one party has a clear-cut advantage on an issue, it regularly emphasizes that issue while the other party abandons it (dominance principle) and, (ii) when neither side has a clear advantage on an issue, both abandon it (dispersion principle). In a similar vein, from the analysis of the U.S. presidential elections between 1960 and 1992, Petrocik (1996) provides the idea of "issue ownership", which is based on the perception that voters have as to how a party handles certain political issues (or political problems). A party has ownership of an issue when the voters view

it as better qualified to handle that issue. Thus, it would be rational for each side to keep the campaign focused on the issue that it owns and to avoid those issues owned by its opponent.

There is an interesting recent debate on whether there is dialogue or issue-divergence on political issues between the parties' candidates during the political campaign. On the one hand, Kaplan, Park and Ridout (2006) contrast the issue ownership theory proposed by Petrocik. They find that the issue engagement or dialogue occurs very frequently. In the same vein, Sigelman and Buell (2004) study the percentage of time that a candidate is engaged in discussion of issues owned by the other political party. They demonstrate a high degree of similarity on the issue emphasis. On the other hand, Spillotes and Vavreck (2002) and Simon (2002) find evidence on issue emphasis divergence, i.e., they find that candidates from different parties do choose to emphasize different issues. In fact, Simon (2002) justifies that, since no issue can work to the advantage of both candidates then, rational candidates will never dialogue.

From a theoretical point of view, Riker (1993), Simon (2002) and Austen-Smith (1993), justify that opponent political parties will emphasize different issues (orthogonal issues in Austen-Smith's terminology). However, from an empirical point of view, Sigelman and Buell (2004) find that a high degree of similarity in the issue emphasis of both political parties appears to have been the norm in U.S. campaigns.

Thus, we find that there is enough evidence on parties emphasizing political issues, and that parties may select one of the following strategies: issue engagement or issue divergence. However, so far, there is no unanimous agreement on what norm should follow the parties. While the theoretical works can only justify issue emphasis divergence, there is enough empirical evidence on both, issue divergence and dialogue.

#### *An outline of the model*

In this paper, we provide a simple theoretical model that tries to capture the basic features of priming in the political campaign. Our model is based on the one of Riker and Ordeshook (1973). We extend this model to allow for the effect of campaign expenditure affecting the salience of the political issues.

We consider a two-dimensional spatial model of political competition between two parties. The parties' political positions are common knowledge. Parties aim at maximizing votes. Voters are represented by their own ideal

policies, and they vote sincerely for the party that matches their own ideal policy more accurately.<sup>1</sup> The strategies of the parties consist of allocating campaign funds between the political issues. In this way, the parties affect the relative importance that voters assign to one of the political issues over the other. We study the equilibria of this allocation of campaign funds game.<sup>2</sup>

We find that both types of strategies, issue divergence and dialogue, can be supported as equilibrium strategies, depending on the absolute advantage and comparative advantage of the parties on each of the political issues. We show that when either each party has an absolute advantage on a different issue or when parties have high comparative advantage on a different issue, the political campaign will consist of issue-emphasis divergence. However, when a party has an absolute advantage on both issues but its comparative advantage on each issue is not high enough, there will be dialogue and issue-engagement in the political campaign.

#### *Related literature*

There are several theories that explain how political campaign expenditure persuades voters: (1) campaign expenditure influences a fixed fraction of voters who are uninformed about the parties' political positions (see, e.g., Baron, 1994, and Grossman and Helpman, 1996); (2) campaign expenditure clarifies the political positions of the candidates and alleviates risk averse voters' uncertainty (see, e.g., Austen-Smith, 1987); (3) campaign expenditure is a signal of the high valence of an incumbent candidate (see, e.g., Prat, 2002); (4) campaign expenditure affects an "electoral production function" and increases the probability of winning the elections (see, e.g., Friedman, 1958, Brams and Davis, 1973, Snyder, 1989).<sup>3</sup> Explanations (1) and (2) relate campaign activities to information acquisition, Explanation (3) interprets campaign expenditure as a signal, and Explanation (4) provides a more

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<sup>1</sup>We follow the proximity model where preferences on political parties follow directly from "closeness". The directional model proposed by Rabinowitz and Macdonald (1989) is an alternative where preferences are defined by one direction on the policy space.

<sup>2</sup>One could think that our campaign game is the second stage of a two-stage game where there are two types of political issues: ideological and non-ideological. The parties' positions on ideological issues are fixed irrevocably, while they can choose their positions on non-ideological issues. In the first stage of the game the parties competed in terms of platform positioning on non-ideological issues (if both parties locate at the median of each non-ideological issue, these issues would become irrelevant in the second stage).

<sup>3</sup>As pointed out by Snyder (1989), the rent-seeking literature provides a particular instance of an "electoral production function". See, for instance, Tullock (1981).

general setting where campaign activities work as an input to produce votes. The main difference between this literature and the present paper is that we incorporate the priming effects to explain how political parties persuade voters.

The rest of the paper is organized as follows. Section 2 introduces the model. Section 3 analyzes the equilibrium strategies. Section 4 provides the conclusions. All the proofs are in the Appendix.

## 2 The model

A society with a continuum of voters shall select a representative to serve in the legislature by popular election. Two political parties,  $A$  and  $B$ , with fixed political positions on a two-dimensional policy space, aim at maximizing votes by spending campaign resources. Two political issues, 1 and 2, describe two salient problems of the society.<sup>4</sup>

### *Political parties*

Each party  $j \in \{A, B\}$  has a fixed and known **political position**  $x_j = (x_{j1}, x_{j2}) \in [0, 1]^2$ , where  $x_{jr} \in [0, 1]$  is the political position of party  $j$  on issue  $r \in \{1, 2\}$ . We assume, without loss of generality, that  $x_{A1} < x_{B1}$  and  $x_{A2} < x_{B2}$ .<sup>5</sup>

Each party  $j$  is endowed with some fixed **campaign funds**  $\bar{c}_j > 0$ . Campaign funds are devoted to the advertising campaign and each party emphasizes those issues that can persuade a greater amount of voters.<sup>6</sup> We define a **campaign strategy** of party  $j$  as a vector  $c_j \in C_j = \{(c_{j1}, c_{j2}) \in \mathbb{R}_+^2 : c_{j1} + c_{j2} = \bar{c}_j\}$ , which indicates how the party allocates its funds between the two different issues.<sup>7</sup> Let  $c = (c_A, c_B) \in C_A \times C_B = C$  denote a profile of

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<sup>4</sup>As pointed out by authors as Poole and Rosenthal (1991), adding a third dimension may explain little more.

<sup>5</sup>As argued by Simon (2002), the assumption that candidates' positions are fixed for the duration of the campaign "reflects empirical evidence, which shows that it is difficult to alter voters' perceptions of a candidate's positions".

<sup>6</sup>In the same vein, Roemer (1998) argues that political parties try to increase the salience of some issues as a mean of pulling voters away from the other competing party.

<sup>7</sup>Assuming that the parties exhaust their budgets should not raise concerns. We could think that the campaign funds are the result of a previous competition for donations between the parties, and assume that the parties cannot put this money to a better use. All our results can be generalized to the case where the space of strategies is such that

campaign strategies. For each  $c \in C$  and each  $r \in \{1, 2\}$ , let  $c_r = c_{Ar} + c_{Br}$  be the total funds spent on issue  $r$ .<sup>8</sup>

### Voters

Each voter  $i$  has a fixed and known **ideal political position**  $\pi_i = (\pi_{i1}, \pi_{i2}) \in [0, 1]^2$  where  $\pi_{ir} \in [0, 1]$  is the ideal political position of voter  $i$  on issue  $r$ . Voters' ideal political positions are uniformly distributed on  $[0, 1]^2$ . Note that the median voter's ideal policy is  $(\frac{1}{2}, \frac{1}{2})$ .

Each voter prefers the party that matches his own ideal policy more accurately. Besides that, campaign strategies also have an influence on voters' preferences. Thus, one of the crucial assumptions of this model is that the intensity of voters' preferences over each issue  $r$  depends on the campaign expenditure on that issue,  $c_r$ . In particular, the following utility function represents the preferences of each voter  $i$  over the political parties:

$$u_i(j, c) = -\alpha_1(c_1)[x_{j1} - \pi_{i1}]^2 - \alpha_2(c_2)[x_{j2} - \pi_{i2}]^2 \quad (1)$$

where, for each issue  $r$ ,  $\alpha_r(\cdot)$  is a continuously differentiable function of the campaign expenditure on issue  $r$  that indicates the weight that voters assign to that issue. We will refer to  $\alpha_r(\cdot)$  as the **influence function** on issue  $r$ , where  $\alpha_r(0) > 0$  and  $\frac{\partial \alpha_r(c_r)}{\partial c_r} > 0$ . Note that we have made the simplifying assumption that all voters are equally influenced by the campaign expenditure, i.e., for any issue  $r$ , the influence function  $\alpha_r(\cdot)$  does not vary among voters. This assumption can be justified on the basis that all voters have equal access to advertising activities. Riker and Ordeshook (1973) pointed out that a relaxation that is generally permitted consists of considering that there exists some average level of concern for each of the issues.<sup>9</sup>

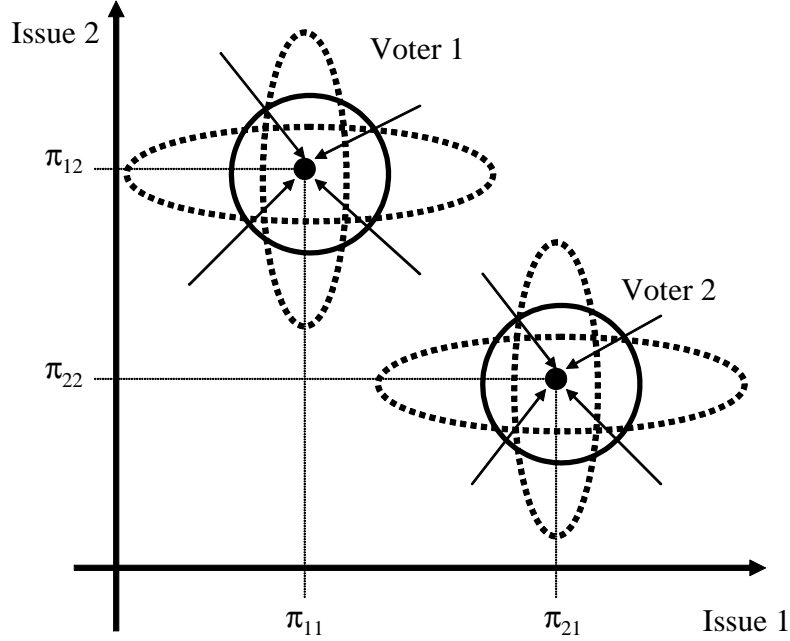
Figure 1 illustrates an example of voters' indifference curves. The solid curves represent the indifference curves when there is no campaign expenditure. Expending campaign funds can vary the relative importance that voters assign to each issue. Thus, the narrow dotted curves represent the indifference curves when campaign expenditure makes issue 1 more relevant,

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$c_{j1} + c_{j2} \leq \bar{c}_j$ .

<sup>8</sup>We can also interpret the campaign strategy  $c_j$  as the time that party  $j$  devotes to advertising each political issue.

<sup>9</sup>Note also that, while the campaign expenditure determines the intensity of voters' preferences over issues, it has no influence on their ideal political positions. This restriction is probably the smallest step one could take to analyze the effect of campaign expenditure when there are several issues (and it is still reasonable in many settings).



**Figure 1.** Example of voters' indifference curves.

while the wide dotted curves represent the indifference curves when campaign expenditure makes issue 2 more relevant.

Given any profile of campaign strategies  $c \in C$ , voter  $i$  casts his ballot for party  $j$  when  $u_i(j, c) > u_i(k, c)$  (where  $k \neq j$ ). We can rewrite the utility function of voter  $i$ :

$$u_i(j, c) = -T(c) [x_{j1} - \pi_{i1}]^2 - [x_{j2} - \pi_{i2}]^2 \quad (2)$$

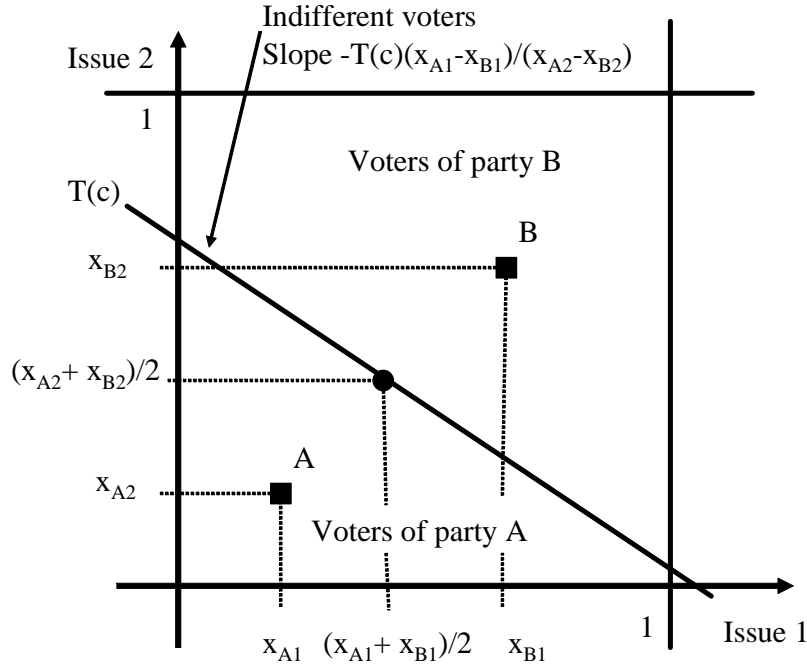
where  $T(c) = \frac{\alpha_1(c_1)}{\alpha_2(c_2)}$  can be interpreted as the relative intensity of voters' preferences over issue 1 when the profile of campaign strategies is  $c$ . Thus, the greater  $T(c)$  is, the more relevant issue 1 is compared to issue 2 in voters' preferences.

From (2), voter  $i$  is indifferent between the two parties when his ideal political position satisfies the following condition:

$$\pi_{i2} = \frac{T(c) [x_{A1}^2 - x_{B1}^2] + [x_{A2}^2 - x_{B2}^2]}{2 [x_{A2} - x_{B2}]} - \frac{T(c) [x_{A1} - x_{B1}]}{[x_{A2} - x_{B2}]} \pi_{i1} \quad (3)$$



Equation 3 allows us to distinguish between those voters that vote for party  $A$  and those voters that vote for party  $B$ . Figure 2 shows an example of that. In a slight abuse of notation, we use  $T(c)$  to denote the line defined by Equation 3. Any voter whose ideal political position is located on this line is indifferent between the two parties. If the ideal political position of a voter is located below that line, he votes for party  $A$ . Similarly, if the ideal political position of a voter is located above that line, he votes for party  $B$ .

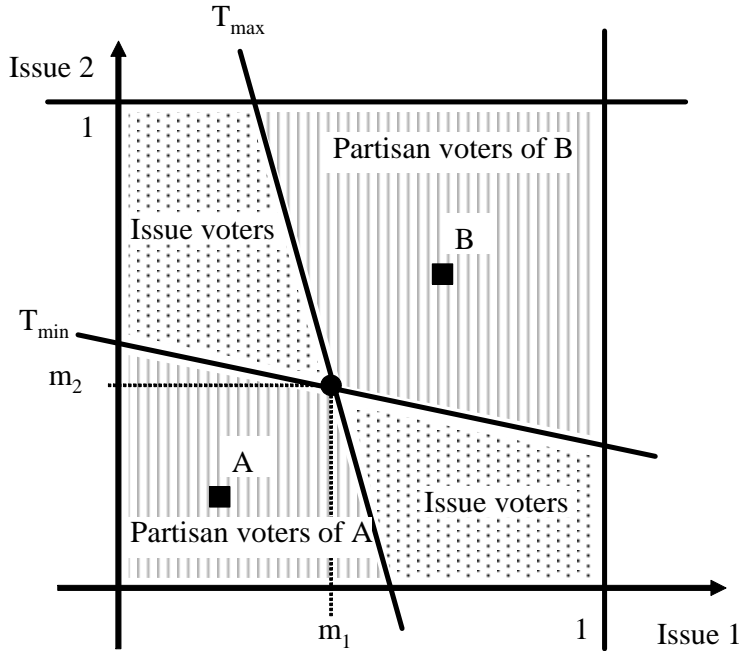


**Figure 2.** Example of voters of party A and party B.

Since each party  $j$  can expend at most  $\bar{c}_j$  on an issue, we have  $\frac{\alpha_1(0)}{\alpha_2(\bar{c}_A+\bar{c}_B)} \leq T(c) \leq \frac{\alpha_1(\bar{c}_A+\bar{c}_B)}{\alpha_2(0)}$ , for all  $c \in C$ . We denote  $T_{\min} = \frac{\alpha_1(0)}{\alpha_2(\bar{c}_A+\bar{c}_B)}$  and  $T_{\max} = \frac{\alpha_1(\bar{c}_A+\bar{c}_B)}{\alpha_2(0)}$  the minimum and maximum values of  $T(c)$ . These values are the key to knowing the subgroup of voters that may change their vote according to the specific profile of campaign strategies. A voter located in the midpoint of the distance between the political position of party  $A$  and party  $B$  is always indifferent between both parties, whatever the campaign strategies are. Let  $(m_1, m_2) = (\frac{x_{A1}+x_{B1}}{2}, \frac{x_{A2}+x_{B2}}{2})$  denote the midpoint of the parties' political positions. Note the  $m_r$  can be interpreted as the percentage of votes

that party  $A$  would obtain if voters only cared about issue  $r$  (and therefore,  $(1 - m_r)$  is the percentage of votes that party  $B$  would obtain if voters only cared about issue  $r$ ).

Consider the example depicted in Figure 3. Again, we abuse of notation and use  $T_{\min}$  and  $T_{\max}$  to denote the lines defined by Expression 3 when  $T(c) = T_{\min}$  and  $T(c) = T_{\max}$ , respectively. Any voter whose ideal political position is located below lines  $T_{\min}$  and  $T_{\max}$  is such that  $u_i(A, c) > u_i(B, c)$  for all  $c \in C$ , and then he always votes for party  $A$ , no matter what the profile of campaign strategies is. Similarly, any voter whose ideal political position is located above lines  $T_{\min}$  and  $T_{\max}$  is such that  $u_i(B, c) > u_i(A, c)$  for all  $c \in C$ , and then he always votes for party  $B$ . We call these voters **partisan voters**.



**Figure 3.** Example of partisan voters and issue voters.

Any voter located between lines  $T_{\min}$  and  $T_{\max}$  is such that  $u_i(A, c) > u_i(B, c)$  for some  $c \in C$  and  $u_i(B, c') > u_i(A, c')$  for some  $c' \in C$ , and then his vote will depend on the particular profile of campaign strategies. We call these voters **issue voters**. The campaign expenditure on a particular

issue can move the vote of an issue voter towards the party that best fits his preferences on that issue. Note that  $\frac{\partial T_{\min}}{\partial(\bar{c}_A + \bar{c}_B)} < 0$  and  $\frac{\partial T_{\max}}{\partial(\bar{c}_A + \bar{c}_B)} > 0$ , and then, the greater the campaign funds are, the greater the set of issue voters is.<sup>10</sup>

### *Campaign game*

Each party objective is maximizing votes.<sup>11</sup> Given any profile of campaign strategies  $c \in C$ , let  $V_j(c)$  be the percentage of votes that party  $j$  obtains in the elections. Our equilibrium concept in this paper is Nash equilibrium. A profile of campaign strategies  $c^* \in C$  is a (Nash) **equilibrium** if, for all party  $j$  and all  $c'_j \in C_j$ ,  $V_j(c_j^*, c_k^*) \geq V_j(c'_j, c_k^*)$  (where  $k \neq j$ ).

## 3 Results

### 3.1 Equilibrium existence

We first show existence of equilibrium. For that, we need to study the votes that each party obtains as a function of their campaign strategies. To simplify our notation, for each issue  $r \in \{1, 2\}$ , let  $x_r = x_{Ar} - x_{Br}$ .

**Lemma 1** *The percentage of votes for party A as a function of the campaign strategies,  $V_A(c)$ , is such that,*

(1) *if  $m_1 + m_2 \leq 1$ , then:*

$$V_A(c) = \begin{cases} m_2 + \frac{T(c)x_1[m_1 - \frac{1}{2}]}{x_2} & ; \text{if } T(c) \leq \frac{x_2 m_2}{x_1[1 - m_1]} \\ m_1 m_2 + \frac{T(c)x_1 m_1^2}{2x_2} + \frac{x_2 m_2^2}{T(c)2x_1} & ; \text{if } \frac{x_2 m_2}{x_1[1 - m_1]} \leq T(c) \leq \frac{x_2[1 - m_2]}{x_1 m_1} \\ m_1 + \frac{x_2[m_2 - \frac{1}{2}]}{T(c)x_1} & ; \text{if } T(c) \geq \frac{x_2[1 - m_2]}{x_1 m_1} \end{cases}$$

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<sup>10</sup>Baron (1994), Grossman and Helpman (1996) consider an exogenous fraction of voters that can be influenced by the political campaign (the so called impressionable voters by Grossman a Helpman and uninformed voters by Baron). In contrast, our issue-voters are informed and do have an ideal political position.

<sup>11</sup>In a previous version of this paper (Amorós and Puy, 2004), we analyzed the case where parties only cared about winning the elections.

(2) if  $m_1 + m_2 \geq 1$ , then:

$$V_A(c) = \begin{cases} m_2 + \frac{T(c)x_1[m_1 - \frac{1}{2}]}{x_2} & ; \text{if } T(c) \leq \frac{x_2[1-m_2]}{x_1m_1} \\ \frac{1 - [1 - m_1][1 - m_2] - \frac{T(c)x_1[1-m_1]^2}{2x_2} - \frac{x_2[1-m_2]^2}{T(c)2x_1}}{2x_2} & ; \text{if } \frac{x_2[1-m_2]}{x_1m_1} \leq T(c) \leq \frac{x_2m_2}{x_1[1-m_1]} \\ m_1 + \frac{x_2[m_2 - \frac{1}{2}]}{T(c)x_1} & ; \text{if } T(c) \geq \frac{x_2m_2}{x_1[1-m_1]}. \end{cases}$$

The vote functions  $V_A(\cdot)$  and  $V_B(\cdot) = 1 - V_A(\cdot)$  are continuous and, since the space of strategies  $C_A$  and  $C_B$  are compact, we can affirm that the campaign game always possesses a Nash equilibrium (see, for example, Glicksberg, 1952).

**Theorem 1** *The campaign game always has an equilibrium.*

As it follows from the functions  $V_A(\cdot)$  and  $V_B(\cdot) = 1 - V_A(\cdot)$  described in Lemma 1, the percentage of votes obtained by each party not only depends on the campaign strategies, but also on the political position of the parties. Next, we characterize the equilibrium strategies in terms of the parties' advantage on each of the issues.

## 3.2 Equilibrium strategies

The campaign strategies indicate how the parties allocate its funds between the two different issues. Following the terminology of previous authors (Simon 2002, Sigelman and Buell 2004, Kaplan et al. 2006), we distinguish between two different types of political campaigns: those where there is issue divergence (or no dialogue) between the political parties, and those where there is issue engagement (or dialogue) between the political parties.

**Definition 1** *We say that there is **issue divergence in the political campaign** when the unique equilibrium of the campaign game is a pure strategy equilibrium where each party spends all its campaign funds on a different issue.*

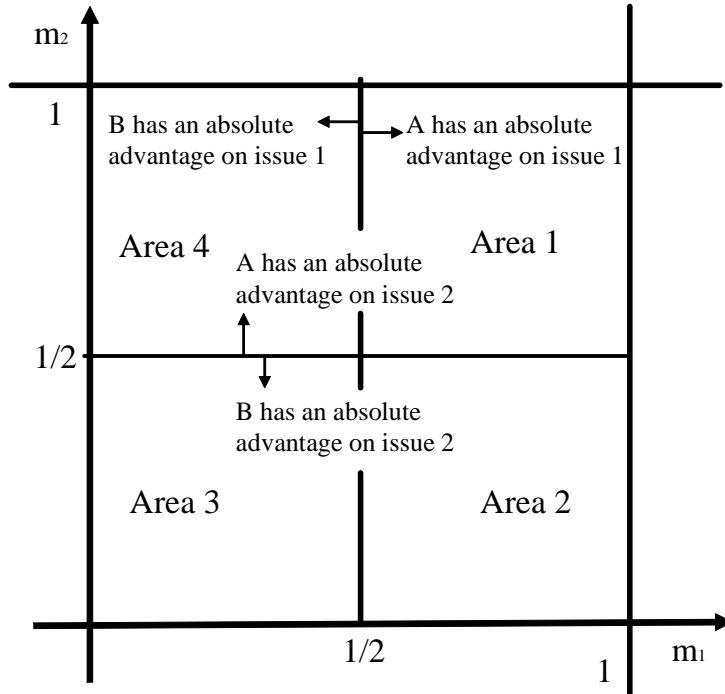
**Definition 2** *We say that there is **issue engagement in the political campaign** when any equilibrium of the campaign game assigns positive probability to both parties spending campaign funds on the same issue.<sup>12</sup>*

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<sup>12</sup>Note that, in general, the fact that there is no issue divergence would not necessarily imply that there is issue engagement. In this model, however, we find that this is the case.

When there is issue divergence in the political campaign, each political party emphasizes a different political issue. Next, we show that there is a direct relation between the advantage that each party has on each of the political issues, and the political campaigns characterized by issue divergence.

**Definition 3** We say that a party has an *absolute advantage on issue  $r$*  if it would obtain a strict majority of the votes if voters only cared about issue  $r$ .



**Figure 4.** Absolute advantage

In other words, a party has an absolute advantage on an issue if its political position on that issue is closer than the one of its rival to the ideal political position of the median voter on that issue. Therefore, if the midpoint of the parties' political positions on issue  $r$ , is greater (respectively smaller) than the ideal political position of the median voter on that issue (i.e.,  $m_r > \frac{1}{2}$ ) then party  $A$  (respectively party  $B$ ) has an absolute advantage on issue  $r$ .<sup>13</sup> In Figure 4, we distinguish four different areas depending on the location

<sup>13</sup>If  $m_r > \frac{1}{2}$  then, since  $x_{Ar} < x_{Br}$ ,  $|x_{Ar} - \frac{1}{2}| < |x_{Br} - \frac{1}{2}|$ . Similarly, if  $m_r < \frac{1}{2}$  then  $|x_{Ar} - \frac{1}{2}| > |x_{Br} - \frac{1}{2}|$ .

of the midpoint  $(m_1, m_2)$ .

As we next show, when each party has an absolute advantage on a different issue (Areas 2 and 4 in Figure 4), each party spends all its funds on the issue in which it has an absolute advantage.

**Proposition 1** *When each party has an absolute advantage on a different issue, there is issue divergence in the political campaign, and each party emphasizes the issue where it has an absolute advantage.*

In the proof of Proposition 1, we show that the voting function of each party is an increasing function of the campaign expenditure on the issue in which it has an absolute advantage. Therefore, each party has a strictly dominant strategy that consists of spending all its campaign funds on the issue where it has an absolute advantage.<sup>14</sup>

Next, we analyze the case in which the same party has an absolute advantage on both issues (Areas 1 and 3 in Figure 4).

**Proposition 2** *When party  $j$  has an absolute advantage on both political issues, there is issue divergence in the political campaign if and only if either  $V_j\left(\frac{\alpha_1(\bar{c}_j)}{\alpha_2(\bar{c}_k)}\right) \leq V_j(T_{\max})$  or  $V_j\left(\frac{\alpha_1(\bar{c}_k)}{\alpha_2(\bar{c}_j)}\right) \leq V_j(T_{\min})$ , where  $k \neq j$  (in the first case party  $j$  emphasizes issue 1 while in the second case it emphasizes issue 2). Otherwise, there is issue engagement in the political campaign.*

In the proof of Proposition 2 we show that, if party  $j$  has an absolute advantage on both issues, then  $V_j$  is a single-peaked function of  $T(c)$  (and, therefore, the voting function of its opponent is a single-dipped function of  $T(c)$ ). There is no equilibrium where the vote-share of party  $j$  coincides with the peak of its voting function. As a consequence, the only two possible pure strategy equilibria are either  $((c_{A1}^*, c_{A2}^*); (c_{B1}^*, c_{B2}^*)) = ((\bar{c}_A, 0); (0, \bar{c}_B))$  or  $((c_{A1}^*, c_{A2}^*); (c_{B1}^*, c_{B2}^*)) = ((0, \bar{c}_A); (\bar{c}_B, 0))$ . We characterize the situations where pure strategy equilibria exist and show that, in these cases, the equilibrium is unique (i.e., there is no other equilibrium in pure or mixed strategies). Thus, in these situations there is issue divergence in the political campaign.

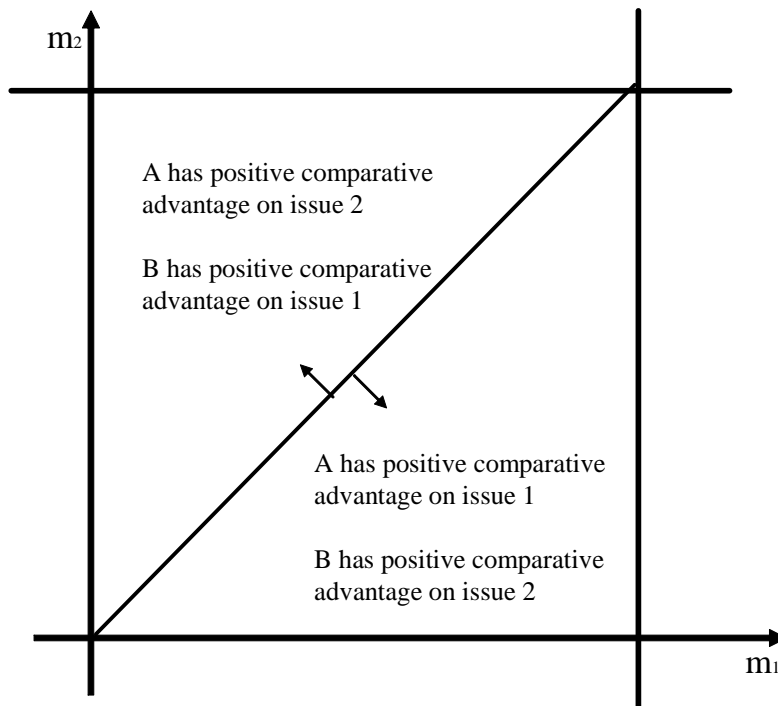
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<sup>14</sup>When either  $m_1 = \frac{1}{2}$  and  $m_2 < \frac{1}{2}$  or  $m_1 > \frac{1}{2}$  and  $m_2 = \frac{1}{2}$ , the function  $V_A(\cdot)$  is weakly increasing and  $(c_{A1}^*, c_{A2}^*) = (\bar{c}_A, 0)$   $(c_{B1}^*, c_{B2}^*) = (0, \bar{c}_B)$  is an equilibrium but it may not be the unique equilibrium. In the same way, when either  $m_1 = \frac{1}{2}$  and  $m_2 > \frac{1}{2}$  or  $m_1 < \frac{1}{2}$  and  $m_2 = \frac{1}{2}$ , the function  $V_A(\cdot)$  is weakly decreasing and  $(c_{A1}^*, c_{A2}^*) = (0, \bar{c}_A)$   $(c_{B1}^*, c_{B2}^*) = (\bar{c}_B, 0)$  is an equilibrium but it may not be unique.

When equilibria in pure strategies fail to exist, by Theorem 1, there exist equilibria in mixed strategies. Note that any equilibrium in mixed strategies assigns positive probability to both parties spending campaign funds on the same issue. Therefore, in these situations there is issue engagement in the political campaign.

The following notion of comparative advantage, will help us to define the borderline between issue divergence (pure strategy equilibrium) and issue engagement (mixed strategy equilibrium). The comparative advantage measures the relative advantage that a party has on an issue over the other.

**Definition 4** *The comparative advantage of party  $j$  on issue  $r$  is the difference between the percentage of votes that party  $j$  would obtain if voters only cared about issue  $r$  and the the percentage of votes that it would obtain if voters only cared about issue  $s$  ( $s \neq r$ ). In particular, the comparative advantage of party A on issue  $r$  is  $m_r - m_s$ , and the comparative advantage of party B on issue  $r$  is  $(1 - m_r) - (1 - m_s) = m_s - m_r$ .*



**Figure 5.** Comparative advantage

Note that the comparative advantage of party  $A$  on issue  $r$  coincides with the comparative advantage of party  $B$  on issue  $s$ . When party  $A$  has positive comparative advantage on issue  $r$ , party  $B$  has positive comparative advantage on issue  $s$ . Figure 5 illustrates this notion.

As we show in the following proposition, when a party has an absolute advantage on both issues, a high comparative advantage guarantees that in equilibrium there is issue divergence in the political campaign.

**Proposition 3** *Suppose that party  $j$  has an absolute advantage on both political issues. If the comparative advantage of party  $j$  on issue  $r$  is “high enough”, there is issue divergence in the political campaign (party  $j$  emphasizes issue  $r$  and the other party emphasizes issue  $s$ ,  $s \neq r$ ).*

In the proof of this proposition we show that, given  $m_s$ , there always exists some value for  $m_r$  such that the comparative advantage of party  $j$  on issue  $r$  is sufficiently large to guarantee that there exists unique equilibrium in pure strategies where party  $j$  spends all its funds on issue  $r$  and the other party spends all its funds on issue  $s$ . Our next result shows that such an equilibrium keeps existing (and is unique) as the comparative advantage of party  $j$  on issue  $r$  increases. On the other hand, if  $m_s$  increases then an equilibrium in pure strategies fails to exist at some point. Of course, if  $m_s$  continues increasing, then, by Proposition 3, the equilibrium in pure strategies comes again into the scene (in this case, however, party  $j$  spends all its funds on issue  $s$ , and its opponent on issue  $r$ ).

**Proposition 4** *Suppose that there is a party that has an absolute advantage on both political issues and that there is issue divergence in the political campaign where party  $j$  emphasizes issue  $r$ . Then:*

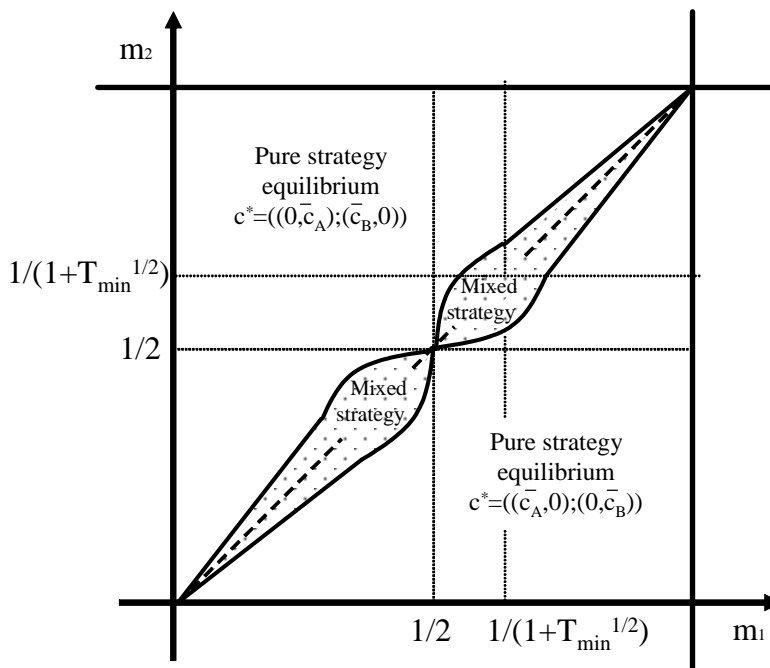
- (1) *If the comparative advantage of party  $j$  on issue  $r$  increases because either  $m_r$  or  $m_s$  is modified (keeping constant the rest of parameters), there is still issue divergence in the political campaign where party  $j$  emphasizes issue  $r$ .*
- (2) *If the comparative advantage of party  $j$  on issue  $r$  decreases (keeping constant  $m_r$  and the rest of parameters), at some point there is issue engagement in the political campaign.<sup>15</sup>*

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<sup>15</sup>In particular, in statement (1),  $m_r$  (respectively  $m_s$ ) changes, while  $m_s$  (respectively  $m_r$ ),  $x_1$  and  $x_2$  do not change. In statement (2),  $m_s$  changes, while  $m_r$ ,  $x_1$  and  $x_2$  do not change.



This proposition allows us to define the borderline between issue divergence (pure strategy equilibrium) and issue engagement (mixed strategy equilibrium). Figure 6 provides a particular example (explained in detail in the next section). The shadowed area represents the midpoints of the parties' political positions for which there is issue engagement in the political campaign. This shadowed area may not always be symmetric around the diagonal and it may not necessarily contain the diagonal (remember that the influence functions may differ across issues, and that parties' campaign expenditure can be different). We know however from Proposition 4, that this shadowed area is always located in Areas 1 and 3 defined in Figure 4, and in between the two different types of pure strategy equilibria (the one where party  $j$  emphasizes issue 1, and the other where party  $j$  emphasizes issue 2). By Proposition 4 we know that this shadowed area will never include those locations where the parties have “high” comparative advantage.



**Figure 6.** Issue divergence versus dialogue

### 3.3 The symmetric case

To illustrate what happens when a party has an absolute advantage on both issues, we analyze in this subsection the simple case in which the influence functions are equal,  $\alpha_1(\cdot) = \alpha_2(\cdot)$ , and both parties have the same amount of campaign funds,  $\bar{c}_A = \bar{c}_B$ . Note that in this case  $\frac{\alpha_1(\bar{c}_A)}{\alpha_2(\bar{c}_B)} = \frac{\alpha_1(\bar{c}_B)}{\alpha_2(\bar{c}_A)} = 1$  and  $T_{\min} < 1 < T_{\max}$ .

Suppose, without loss of generality, that party  $A$  has an absolute advantage on both issues. Then,  $V_A$  is the function described in the second part of Lemma 1. By Propositions 2 and 4, the expressions  $V_A(\frac{\alpha_1(\bar{c}_B)}{\alpha_2(\bar{c}_A)}) = V_A(T_{\min})$  and  $V_A(\frac{\alpha_1(\bar{c}_A)}{\alpha_2(\bar{c}_B)}) = V_A(T_{\max})$  define the border between the pure and the mixed strategy equilibrium. Next, we calculate the values of  $m_1$  and  $m_2$  defined by these expressions.

Assume for simplicity that  $x_1 = x_2$  (where  $x_r = x_{Ar} - x_{Br}$ ). Then  $\frac{1-m_2}{m_1} \leq 1 \leq \frac{m_2}{1-m_1}$  and the percentage of votes obtained by party  $A$  when  $T(c) = \frac{\alpha_1(\bar{c}_A)}{\alpha_2(\bar{c}_B)} = 1$  is:

$$V_A(1) = 1 - [1 - m_1][1 - m_2] - \frac{[1-m_1]^2}{2} - \frac{[1-m_2]^2}{2} \quad (4)$$

Since  $T_{\min} \leq 1 \leq \frac{m_2}{1-m_1}$ , when calculating the percentage of votes obtained by party  $A$  if  $T(c) = T_{\min}$  we can ignore the last part of the function described in Lemma 1. Then, we have:

$$V_A(T_{\min}) = \begin{cases} m_2 + T_{\min} \left[ m_1 - \frac{1}{2} \right] & ; \text{ if } T_{\min} \leq \frac{1-m_2}{m_1} \\ 1 - [1 - m_1][1 - m_2] - \frac{T_{\min}[1-m_1]^2}{2} - \frac{[1-m_2]^2}{2T_{\min}} & ; \text{ if } T_{\min} \geq \frac{1-m_2}{m_1} \end{cases} \quad (5)$$

Similarly, since  $\frac{x_2[1-m_2]}{x_1 m_1} \leq 1 \leq T_{\max}$ , the percentage of votes obtained by party  $A$  when  $T(c) = T_{\max}$  is:

$$V_A(T_{\max}) = \begin{cases} 1 - [1 - m_1][1 - m_2] - \frac{T_{\max}[1-m_1]^2}{2} - \frac{[1-m_2]^2}{2T_{\max}} & ; \text{ if } T_{\max} \leq \frac{m_2}{1-m_1} \\ m_1 + \frac{1}{T_{\max}} \left[ m_2 - \frac{1}{2} \right] & ; \text{ if } T_{\max} \geq \frac{m_2}{1-m_1} \end{cases} \quad (6)$$

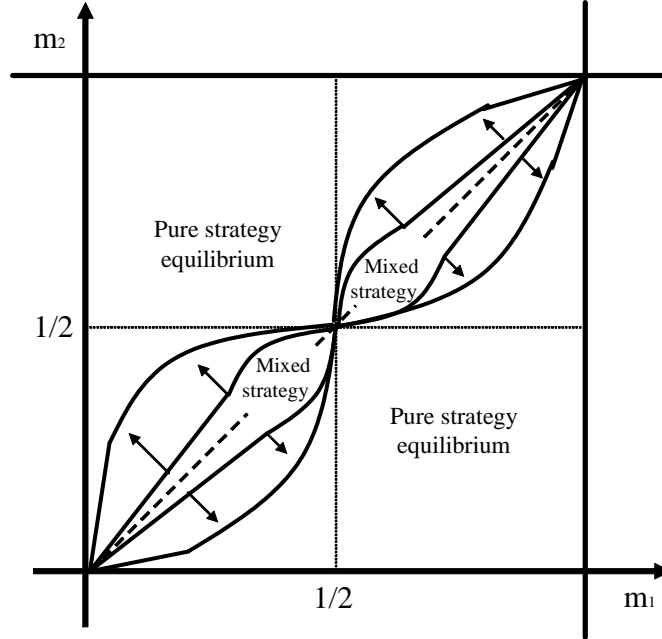
From Expressions 4 and 5, the values of  $m_1$  and  $m_2$  for which  $V_A(\frac{\alpha_1(\bar{c}_B)}{\alpha_2(\bar{c}_A)}) = V_A(T_{\min})$  are given by the following function:

$$m_2 = \begin{cases} 1 - m_1 + [T_{\min} - 1 + 2m_1 - 2m_1T_{\min}]^{1/2} & ; \text{ if } m_1 \leq \frac{1}{1+T_{\min}^{1/2}} \\ 1 - T_{\min}^{1/2} [1 - m_1] & ; \text{ if } m_1 \geq \frac{1}{1+T_{\min}^{1/2}} \end{cases} \quad (7)$$

The function described in Expression 7 is continuous, increasing in  $m_1$  and concave. From Expressions 4 and 6, the values of  $m_1$  and  $m_2$  for which  $V_A(\frac{\alpha_1(\bar{c}_A)}{\alpha_2(\bar{c}_B)}) = V_A(T_{\max})$  are defined by a function which is symmetric to the one defined in Expression 7:

$$m_1 = \begin{cases} 1 - m_2 + \left[ \frac{1}{T_{\max}} - 1 + 2m_2 - \frac{2m_2}{T_{\max}} \right]^{1/2} & ; \text{ if } m_2 \leq \frac{1}{1 + \left[ \frac{1}{T_{\max}} \right]^{1/2}} \\ 1 - \left[ \frac{1}{T_{\max}} \right]^{1/2} [1 - m_2] & ; \text{ if } m_2 \geq \frac{1}{1 + \left[ \frac{1}{T_{\max}} \right]^{1/2}} \end{cases} \quad (8)$$

Using a similar reasoning, we can obtain the analogous to Expressions 7 and 8 for the case in which party  $B$  has an advantage on both issues. In Figure 6, we represent all these functions.



**Figure 7.** Mixed-strategy equilibrium expansion when the campaign funds increase.

Suppose that both parties' campaign funds increase by the same amount. Then  $T_{\min}$  decreases,  $T_{\max}$  increases and, therefore, the area in which there is no equilibrium in pure strategies spans (see Figure 7).

### 3.4 Equilibrium strategies under dialogue

Suppose that there is issue engagement in the political campaign. So far, we have shown that this is possible only if one of the parties has an absolute advantage on both political issues and it has not a “large” comparative advantage on any issue. In this case, there is no equilibrium in pure strategies. Next, we describe an equilibrium in mixed strategies that always exists in this situation.

#### Equilibrium strategies:

- The party with an absolute advantage on both issues plays a pure strategy where it spends campaign funds on both issues.
- The other party randomizes between spending all its funds on issue 1 or spending all its funds on issue 2.<sup>16</sup>

Note that any realization of these equilibrium strategies is such that there is one issue where both parties spend funds on.

Consider, without loss of generality, that party  $A$  has an absolute advantage on both political issues. As we show in the proof of Proposition 2, the percentage of votes of party  $A$ ,  $V_A$ , is a single-peaked function of  $T(c)$ , with peak  $T^P = \frac{1-m_2}{1-m_1}$ .<sup>17</sup> We have  $T_{\min} < T^P < T_{\max}$  (otherwise, the only equilibrium is in pure strategies and there is no issue engagement). For simplicity, let us redefine a pure strategy for party  $j$  as  $c_{j1} \in [0, \bar{c}_j]$  (then  $c_{j2} = \bar{c}_j - c_{j1}$ ). It can be shown that the best response function of party  $A$ ,  $c_{A1} = f_A(c_{B1})$ , is continuous and decreasing.

The percentage of votes of party  $B$ ,  $V_B(\cdot)$ , is a single-dipped function of  $T(c)$ . Thus, party  $B$ 's best response,  $c_{B1} = f_B(c_{A1})$ , is such that either it spends all its funds on issue 1 or it spends all its funds on issue 2, i.e., there

<sup>16</sup>To give an example, suppose that  $m_1 = m_2 = m > \frac{1}{2}$ ,  $\bar{c}_j = \bar{c}$  and  $\alpha_j(c) = k + c_{j1} + c_{j2}$  where  $k > \frac{\bar{c}(2-2m)}{2m-1}$  for  $j \in \{A, B\}$ . Then, the proposed equilibrium is given by  $c_A = (\frac{\bar{c}}{2}, \frac{\bar{c}}{2})$ , and party  $B$  randomizing between  $c_B = (\bar{c}, 0)$  and  $c'_B = (0, \bar{c})$  with probability  $p = \frac{1}{2}$ .

<sup>17</sup>When comparing different political positions of the political parties, we consider for the sake of simplicity that  $x_1 = x_2$ .

is some  $\hat{c}_A \in [0, \bar{c}_A]$  such that:

$$f_B(c_{A1}) = \begin{cases} 0 & ; \text{ if } c_{A1} \leq \hat{c}_A \\ \bar{c}_B & ; \text{ if } c_{A1} \geq \hat{c}_A \end{cases} \quad (9)$$

Since we are assuming that there is issue engagement in the political campaign, then there is no pure strategy equilibrium (we have shown in the proof of Proposition 2 that any equilibrium in pure strategies is such that each party spends all its funds on a different issue, and that if such an equilibrium exists, it is unique). Therefore  $\hat{c}_A \neq 0$ ,  $\hat{c}_A \neq \bar{c}_A$ , and when  $c_{A1} = \hat{c}_A$ , party  $B$  is indifferent between spending all its funds on issue 1 or spending all its funds on issue 2. Let  $T_1 = T((\hat{c}_{A1}, \bar{c}_A - \hat{c}_{A1}), (0, \bar{c}_B))$  and  $T_2 = T((\hat{c}_{A1}, \bar{c}_A - \hat{c}_{A1}), (\bar{c}_B, 0))$ . Then,  $V_B(T_1) = V_B(T_2)$  and, since  $V_B(\cdot)$  is single-dipped,  $T_1 < T^P < T_2$ .

Consider the following strategies: party  $A$  plays the pure strategy  $c_{A1} = \hat{c}_A$ , and party  $B$  plays  $c_{B1} = 0$  with probability  $p \in (0, 1)$  and  $c'_{B1} = \bar{c}_B$  with probability  $(1 - p)$ . Next, we show that there always exists some  $p \in (0, 1)$  such that these strategies are an equilibrium.

Given party  $B$ 's strategy, party  $A$ 's strategy should satisfy that

$$\hat{c}_A \in \arg \max_{c_{A1} \in [0, \bar{c}_A]} pV_A((c_{A1}, \bar{c}_A - c_{A1}), (0, \bar{c}_B)) + (1 - p)V_A((c_{A1}, \bar{c}_A - c_{A1}), (\bar{c}_B, 0)) \quad (10)$$

Solving Expression 10, and substituting  $c_{A1} = \hat{c}_A$ , we have

$$p \frac{\partial V_A(T_1)}{\partial c_{A1}} + (1 - p) \frac{\partial V_A(T_2)}{\partial c_{A1}} = 0. \quad (11)$$

Solving for  $p$ :

$$p = \frac{-\frac{\partial V_A(T_2)}{\partial c_{A1}}}{\frac{\partial V_A(T_1)}{\partial c_{A1}} - \frac{\partial V_A(T_2)}{\partial c_{A1}}} \quad (12)$$

where  $T_1 < T^P < T_2$  implies that  $\frac{\partial V_A(T_1)}{\partial c_{A1}} > 0$  and  $\frac{\partial V_A(T_2)}{\partial c_{A1}} < 0$ , and therefore  $p \in (0, 1)$ .

Therefore, when there is issue engagement in the political campaign, there is always an equilibrium where the party with an absolute advantage on both issues spends funds on both issues, whereas its opponent randomizes between spending all its funds on one or the other political issue. We do not discard the existence of other equilibria in mixed strategies. However, the proposed equilibrium is the only one where one of the parties plays a pure strategy.

## 4 Conclusion

This paper proposes a theoretical model of political competition where priming effects determine the strategies of the electoral campaign. In doing so, we have focused on the role that the advertising campaign plays on the weight that voters employ to evaluate political actors. By means of affecting the salience of certain political issues, parties can modify in its favor the electoral results. We show that, depending on the absolute and the comparative advantage of the parties on the political issues, we can describe when we should expect dialogue or issue emphasis divergence in the political campaign.

We say that a party has an absolute advantage on an issue when such party would obtain a simple majority on the one-issue election. The comparative advantage on an issue is given by the relative percentage of votes that a party would obtain on that issue with respect to the other issue.

The equilibrium obtained when each party has an absolute advantage on a different issue is coherent with the empirical evidence on “issue emphasis divergence” as proposed by Simon (2002) and Spillotes and Vavreck (2002). In fact, we find that the unique equilibrium strategy consists of emphasizing the issue in which the party has an absolute advantage. The obtained equilibrium is along the lines of the “dominance principle” suggested by Riker (1993) and of the “issue-ownership” theory proposed by Petrocik (1996).

When a party has an absolute advantage on both issues we can have two different situations. If the parties comparative advantage is “high”, then there is a unique pure strategy equilibrium where each party emphasizes a different issue (the one in which it has a comparative advantage). If, however, the parties’ comparative advantage is not high enough, then there is no pure strategy equilibrium, but there are mixed strategy equilibria. In this case, there always exists a mixed strategy equilibrium where a party emphasizes both issues and the other randomizes between spending all its funds on one or the other issue. The mixed strategy equilibria are along the lines of the empirical evidence on “issue engagement” defended by Kaplan, Park and Ridout (2006), Sigelman and Buell (2004), since these equilibria always assign a positive probability to both parties spending campaign funds on the same issue. Furthermore, the larger amount of campaign funds, the higher probability of issue engagement.

The predictions of our model are to some extent in line with the theory on international trade developed by David Ricardo (1821). From Ricardo’s Law, a country should specialize in and export those products where it has

a comparative advantage, even when the country has no absolute advantage when it manufactures a product. In our model of political campaign, we show that when each party has an absolute advantage on a different issue, they should specialize on the issues where they have an absolute advantage. In the same way, when one party has an absolute advantage on both issues (and so its opponent does not have an absolute advantage on any issue) and each party has high comparative advantage on a different issue, then each party should specialize on the issue where it has high comparative advantage. However, we depart from Ricardo's Law when the same party has an absolute advantage on both issues but the comparative advantage is "low": this party shall promote dialogue in the political campaign by emphasizing both political issues simultaneously.

Extensions which account for more than two political parties, or which distinguish among groups of voters who weight issues differently (as for instance gender or race groups) may also shed some light in the electoral results derived from parties' competition in political issues.

## APPENDIX

### PROOF OF LEMMA 1:

From Expression 3, a voter  $i$  will vote for party  $A$  if and only if his ideal political position satisfies the following condition:

$$\frac{T(c)[x_{A1}-x_{B1}]}{[x_{A2}-x_{B2}]} \pi_{i1} + \pi_{i2} - \frac{T(c)[x_{A1}^2-x_{B1}^2]+[x_{A2}^2-x_{B2}^2]}{2[x_{A2}-x_{B2}]} < 0 \quad (13)$$

Let  $Y_i = \alpha(c)\pi_{i1} + \pi_{i2} - \beta(c)$ , where  $\alpha(c) = \frac{T(c)[x_{A1}-x_{B1}]}{[x_{A2}-x_{B2}]}$  and  $\beta(c) = \frac{T(c)[x_{A1}^2-x_{B1}^2]+[x_{A2}^2-x_{B2}^2]}{2[x_{A2}-x_{B2}]}$ . The distribution function of  $Y_i$  is:

$$F(y) = \begin{cases} 0 & ; \text{ if } y \leq -\beta(c) \\ \frac{[y+\beta(c)]^2}{2\alpha(c)} & ; \text{ if } -\beta(c) \leq y \leq \min\{1, \alpha(c)\} - \beta(c) \\ \frac{2y+2\beta(c)-\min\{1, \alpha(c)\}}{2\max\{1, \alpha(c)\}} & ; \text{ if } \min\{1, \alpha(c)\} - \beta(c) \leq y \leq \max\{1, \alpha(c)\} - \beta(c) \\ 1 - \frac{[\alpha(c)-\beta(c)-y+1]^2}{2\alpha(c)} & ; \text{ if } \max\{1, \alpha(c)\} - \beta(c) \leq y \leq 1 + \alpha(c) - \beta(c) \\ 1 & ; \text{ if } y \geq 1 + \alpha(c) - \beta(c) \end{cases} \quad (14)$$

Evaluating the previous distribution function in zero, we obtain the percentage of voters that cast their ballots for party  $A$  as a function of the campaign strategies.

$$V_A(c) = \begin{cases} 0 & ; \text{if } \beta(c) \leq 0 \\ \frac{\beta(c)^2}{2\alpha(c)} & ; \text{if } 0 \leq \beta(c) \leq \min\{1, \alpha(c)\} \\ \frac{2\beta(c) - \min\{1, \alpha(c)\}}{2 \max\{1, \alpha(c)\}} & ; \text{if } \min\{1, \alpha(c)\} \leq \beta(c) \leq \max\{1, \alpha(c)\} \\ 1 - \frac{[\alpha(c) - \beta(c) + 1]^2}{2\alpha(c)} & ; \text{if } \max\{1, \alpha(c)\} \leq \beta(c) \leq 1 + \alpha(c) \\ 1 & ; \text{if } \beta(c) \geq 1 + \alpha(c) \end{cases} \quad (15)$$

Let  $x_1 = x_{A1} - x_{B1}$ ,  $x_2 = x_{A2} - x_{B2}$ . Note that the following relations are satisfied:

- (i)  $0 \leq \beta(c) \leq 1 + \alpha(c)$  for all  $c$ ,<sup>18</sup>
- (ii)  $\alpha(c) \geq 1$  if and only if  $T(c) \geq \frac{x_2}{x_1}$ ,
- (iii)  $0 \leq \beta(c) \leq 1$  if and only if  $T(c) \leq \frac{x_2[1-m_2]}{x_1 m_1}$ ,
- (iv)  $1 \leq \beta(c) \leq \alpha(c)$  if and only if  $T(c) \geq \max\left\{\frac{x_2[1-m_2]}{x_1 m_1}, \frac{x_2 m_2}{x_1[1-m_1]}\right\}$ ,
- (v)  $\alpha(c) \leq \beta(c) \leq 1 + \alpha(c)$  if and only if  $T(c) \leq \frac{x_2 m_2}{x_1[1-m_1]}$ ,
- (vi)  $0 \leq \beta(c) \leq \alpha(c)$  if and only if  $T(c) \geq \frac{x_2 m_2}{x_1[1-m_1]}$ ,
- (vii)  $\alpha(c) \leq \beta(c) \leq 1$  if and only if  $T(c) \leq \min\left\{\frac{x_2[1-m_2]}{x_1 m_1}, \frac{x_2 m_2}{x_1[1-m_1]}\right\}$ , and
- (viii)  $1 \leq \beta(c) \leq 1 + \alpha(c)$  if and only if  $T(c) \geq \frac{x_2[1-m_2]}{x_1 m_1}$ .

Then, we can rewrite Expression 15:

$$V_A(c) = \begin{cases} m_1 m_2 + \frac{T(c)x_1 m_1^2}{2x_2} + \frac{x_2 m_2^2}{T(c)2x_1} & ; \text{if } \frac{x_2 m_2}{x_1[1-m_1]} \leq T(c) \leq \frac{x_2}{x_1} \\ & \text{or } \frac{x_2}{x_1} \leq T(c) \leq \frac{x_2[1-m_2]}{x_1 m_1} \\ m_1 + \frac{x_2[m_2 - \frac{1}{2}]}{T(c)x_1} & ; \text{if } T(c) \geq \max\left\{\frac{x_2 m_2}{x_1[1-m_1]}, \frac{x_2[1-m_2]}{x_1 m_1}, \frac{x_2}{x_1}\right\} \\ m_2 + \frac{T(c)x_1[m_1 - \frac{1}{2}]}{x_2} & ; \text{if } T(c) \leq \min\left\{\frac{x_2 m_2}{x_1[1-m_1]}, \frac{x_2[1-m_2]}{x_1 m_1}, \frac{x_2}{x_1}\right\} \\ 1 - [1 - m_1][1 - m_2] - \frac{T(c)x_1[1-m_1]^2}{2x_2} - \frac{x_2[1-m_2]^2}{T(c)2x_1} & ; \text{if } \frac{x_2}{x_1} \leq T(c) \leq \frac{x_2 m_2}{x_1[1-m_1]} \\ & \text{or } \frac{x_2[1-m_2]}{x_1 m_1} \leq T(c) \leq \frac{x_2}{x_1} \end{cases} \quad (16)$$

<sup>18</sup>Note that  $\beta(c) < 0$  if and only if  $T(c) < -\frac{x_2 m_2}{x_1 m_1} \leq 0$ , which never occurs, since  $T(c) > 0$  for all  $c$ . Similarly,  $\beta(c) > 1 + \alpha(c)$  if and only if  $T(c) < \frac{x_2[m_2-1]}{x_1[1-m_1]} \leq 0$ .



Note that either  $\frac{x_2 m_2}{x_1 [1-m_1]} \leq \frac{x_2}{x_1} \leq \frac{x_2 [1-m_2]}{x_1 m_1}$  or  $\frac{x_2 [1-m_2]}{x_1 m_1} \leq \frac{x_2}{x_1} \leq \frac{x_2 m_2}{x_1 [1-m_1]}$ . Moreover,  $\frac{x_2 m_2}{x_1 [1-m_1]} \leq \frac{x_2 [1-m_2]}{x_1 m_1}$  if and only if  $m_1 + m_2 \leq 1$ . Therefore,  $V_A(c)$  is given by the expressions in the statement of this lemma.

### PROOF OF PROPOSITION 1:

We need the following lemma to prove the proposition.

**Lemma 2** *If each party has an absolute advantage on a different issue, then the percentage of voters that cast their ballots for the party that has an absolute advantage on issue 1 is a strictly increasing function of  $T(c)$ .*

**Proof.** Suppose, without loss of generality, that party  $A$  has an absolute advantage on issue 1 and party  $B$  has an absolute advantage on issue 2. We show that  $V_A$  is a strictly increasing function of  $T(c)$ . From Lemma 1 we have:

$$\frac{\partial V_A(c)}{\partial T(c)} = \begin{cases} \frac{x_1 [m_1 - \frac{1}{2}]}{x_2} & ; \text{if } T(c) \leq \min \left\{ \frac{x_2 m_2}{x_1 [1-m_1]}, \frac{x_2 [1-m_2]}{x_1 m_1} \right\} \\ -\frac{x_1 [1-m_1]^2}{2x_2} + \frac{x_2 [1-m_2]^2}{2x_1 T(c)^2} & ; \text{if } \frac{x_2 [1-m_2]}{x_1 m_1} < T(c) < \frac{x_2 m_2}{x_1 [1-m_1]} \\ \frac{x_1 m_1^2}{2x_2} - \frac{x_2 m_2^2}{2x_1 T(c)^2} & ; \text{if } \frac{x_2 m_2}{x_1 [1-m_1]} < T(c) < \frac{x_2 [1-m_2]}{x_1 m_1} \\ -\frac{x_2 [m_2 - \frac{1}{2}]}{x_1 T(c)^2} & ; \text{if } T(c) \geq \max \left\{ \frac{x_2 m_2}{x_1 [1-m_1]}, \frac{x_2 [1-m_2]}{x_1 m_1} \right\} \end{cases} \quad (17)$$

Since  $m_1 > \frac{1}{2}$  it follows that  $\frac{x_1 [m_1 - \frac{1}{2}]}{x_2} > 0$ , and since  $m_2 < \frac{1}{2}$  it follows that  $-\frac{x_2 [m_2 - \frac{1}{2}]}{x_1 T(c)^2} > 0$ . Furthermore, when  $m_2 < \frac{1}{2}$  then  $\frac{x_2 m_2}{x_1 [1-m_1]} < \frac{x_2 [1-m_2]}{x_1 [1-m_1]}$ . Therefore, if  $\frac{x_2 [1-m_2]}{x_1 m_1} < T(c) < \frac{x_2 m_2}{x_1 [1-m_1]}$  we have  $T(c) < \frac{x_2 [1-m_2]}{x_1 [1-m_1]}$ , in which case  $-\frac{x_1 [1-m_1]^2}{2x_2} + \frac{x_2 [1-m_2]^2}{2x_1 T(c)^2} > 0$ . Finally, when  $m_1 > \frac{1}{2}$  then  $\frac{x_2 m_2}{x_1 m_1} < \frac{x_2 m_2}{x_1 [1-m_1]}$ . Therefore, if  $\frac{x_2 m_2}{x_1 [1-m_1]} < T(c) < \frac{x_2 [1-m_2]}{x_1 m_1}$  we have  $T(c) > \frac{x_2 m_2}{x_1 m_1}$ , which implies that  $\frac{x_1 m_1^2}{2x_2} - \frac{x_2 m_2^2}{2x_1 T(c)^2} > 0$ . ■

Now, we proceed with the proof of Proposition 1.

Suppose, without loss of generality, that party  $A$  has an absolute advantage on issue 1 and party  $B$  has an absolute advantage on issue 2. Hence,  $m_1 > \frac{1}{2}$  and  $m_2 < \frac{1}{2}$ . By Lemma 2, the payoff function of party  $A$  is strictly increasing in  $T(c)$ , and therefore  $(c_{A1}^*, c_{A2}^*) = (\bar{c}_A, 0)$  is a strictly dominant

strategy for party  $A$  and  $(c_{B1}^*, c_{B2}^*) = (0, \bar{c}_B)$  is a strictly dominant strategy for party  $B$ . ■

## PROOF OF PROPOSITION 2:

We need a previous lemma to prove this proposition.

**Lemma 3** *If a party has an absolute advantage on both political issues, then the percentage of voters that cast their ballots for that party is a single-peaked function of  $T(c)$ .*

**Proof.** Suppose, without loss of generality, that party  $A$  has an absolute advantage on both issues. We will show that  $V_A$  is a strictly increasing function of  $T(c)$  for all  $T(c) < \frac{x_2[1-m_2]}{x_1[1-m_1]}$ , and strictly decreasing in  $T(c)$  for all  $T(c) > \frac{x_2[1-m_2]}{x_1[1-m_1]}$ .

If party  $A$  has an absolute advantage on both issues then  $m_1 + m_2 > 1$  (since  $m_1 > \frac{1}{2}$  and  $m_2 > \frac{1}{2}$ ). Note that  $m_1 > \frac{1}{2}$  implies  $\frac{x_2[1-m_2]}{x_1 m_1} < \frac{x_2[1-m_2]}{x_1[1-m_1]}$ , and  $m_2 > \frac{1}{2}$  implies  $\frac{x_2[1-m_2]}{x_1[1-m_1]} < \frac{x_2 m_2}{x_1[1-m_1]}$ .

First we show that when  $T(c) < \frac{x_2[1-m_2]}{x_1[1-m_1]}$ , then  $\frac{\partial V_A(c)}{\partial T(c)} > 0$ . From Lemma 1, if  $T(c) \leq \frac{x_2[1-m_2]}{x_1 m_1}$ , then  $\frac{\partial V_A(c)}{\partial T(c)} = \frac{x_1[m_1 - \frac{1}{2}]}{x_2}$ . Since  $m_1 > \frac{1}{2}$ , we have  $\frac{\partial V_A(c)}{\partial T(c)} > 0$ . If  $\frac{x_2[1-m_2]}{x_1 m_1} < T(c) < \frac{x_2[1-m_2]}{x_1[1-m_1]}$ , then:

$$\frac{\partial V_A(c)}{\partial T(c)} = -\frac{x_1[1-m_1]^2}{2x_2} + \frac{x_2[1-m_2]^2}{2x_1 T(c)^2} \quad (18)$$

where  $T(c) < \frac{x_2[1-m_2]}{x_1[1-m_1]}$ , implies  $\frac{\partial V_A(c)}{\partial T(c)} > 0$ .

Second, we show that when  $T(c) > \frac{x_2[1-m_2]}{x_1[1-m_1]}$ , then  $\frac{\partial V_A(c)}{\partial T(c)} < 0$ . If  $\frac{x_2[1-m_2]}{x_1[1-m_1]} < T(c) < \frac{x_2 m_2}{x_1[1-m_1]}$ , then the derivative  $\frac{\partial V_A(c)}{\partial T(c)}$  is given by Expression 18. Since  $T(c) > \frac{x_2[1-m_2]}{x_1[1-m_1]}$ , it follows that  $\frac{\partial V_A(c)}{\partial T(c)} < 0$ . If  $T(c) \geq \frac{x_2 m_2}{x_1[1-m_1]}$ , then  $\frac{\partial V_A(c)}{\partial T(c)} = -\frac{x_2[m_2 - \frac{1}{2}]}{2x_1 T(c)^2}$ . Since  $m_2 > \frac{1}{2}$ , we have  $\frac{\partial V_A(c)}{\partial T(c)} < 0$ . ■

We now proceed with the proof of Proposition 2.

Suppose, without loss of generality, that  $m_1 > \frac{1}{2}$  and  $m_2 > \frac{1}{2}$ , i.e., party  $A$  has an absolute advantage on both issues.

First, we show that every equilibrium in pure strategies is such that each party spends all its campaign funds on a different issue. By Lemma 3,  $V_A(\cdot)$  is

a single-peaked function of  $T(c)$  (and then  $V_B(\cdot)$  is a single-dipped function of  $T(c)$ ). Let  $T^P = \arg \max_{T(c) \in [T_{\min}, T_{\max}]} V_A(T(c))$  (i.e.,  $T^P$  is the peak of  $V_A(\cdot)$ ).

Let  $c^* \in C$  be a pure strategy equilibrium. We show that  $T(c^*) \neq T^P$ . Suppose on the contrary that  $T^P = T(c^*)$ . Then, any change in  $T(c)$  increases party  $B$ 's vote-share. Therefore  $c_B^*$  is not the best response to  $c_A^*$ , which is a contradiction. Suppose now that  $T(c^*) < T^P$ . Then, any increase (respectively decrease) in  $T(c)$  would make party  $A$ 's vote-share (respectively party  $B$ 's vote share) to increase. Therefore  $c_A^* = (\bar{c}_A, 0)$ ,  $c_B^* = (0, \bar{c}_B)$  (otherwise  $c^*$  was not an equilibrium). Similarly, if  $T^P < T(c^*)$ , then any decrease (respectively increase) in  $T(c)$  would make party  $A$ 's vote-share (respectively party  $B$ 's vote share) to increase.<sup>19</sup> Therefore  $c_A^* = (0, \bar{c}_A)$ ,  $c_B^* = (\bar{c}_B, 0)$  (otherwise  $c^*$  was not an equilibrium).

Second, we show that an equilibrium in pure strategies exists if and only if  $V_A\left(\frac{\alpha_1(\bar{c}_A)}{\alpha_2(\bar{c}_B)}\right) \leq V_A(T_{\max})$  or  $V_A\left(\frac{\alpha_1(\bar{c}_B)}{\alpha_2(\bar{c}_A)}\right) \leq V_A(T_{\min})$ . By Lemma 3,  $V_A(\cdot)$  is a single-peaked function of  $T(c)$  (and  $V_B(\cdot)$  is a single-dipped function of  $T(c)$ ). Then, if  $V_A\left(\frac{\alpha_1(\bar{c}_A)}{\alpha_2(\bar{c}_B)}\right) \leq V_A(T_{\max})$ , we have  $((c_{A1}^*, c_{A2}^*); (c_{A1}^*, c_{A2}^*)) = ((\bar{c}_A, 0); (0, \bar{c}_B))$  is an equilibrium in pure strategies. Similarly, if  $V_A\left(\frac{\alpha_1(\bar{c}_B)}{\alpha_2(\bar{c}_A)}\right) \leq V_A(T_{\min})$ ,  $((c_{A1}^*, c_{A2}^*); (c_{A1}^*, c_{A2}^*)) = ((0, \bar{c}_A); (\bar{c}_B, 0))$  is an equilibrium in pure strategies. Suppose now that  $V_A(T_{\max}) < V_A\left(\frac{\alpha_1(\bar{c}_A)}{\alpha_2(\bar{c}_B)}\right)$  and  $V_A(T_{\min}) < V_A\left(\frac{\alpha_1(\bar{c}_B)}{\alpha_2(\bar{c}_A)}\right)$ . Since  $V_A(T_{\max}) < V_A\left(\frac{\alpha_1(\bar{c}_A)}{\alpha_2(\bar{c}_B)}\right)$ , then the profile of pure strategies  $((c_{A1}^*, c_{A2}^*); (c_{A1}^*, c_{A2}^*)) = ((\bar{c}_A, 0); (0, \bar{c}_B))$  is not an equilibrium (given the strategy of party  $A$ , party  $B$  could increase its vote-share by spending all its funds on issue 1). Similarly, since  $V_A(T_{\min}) < V_A\left(\frac{\alpha_1(\bar{c}_B)}{\alpha_2(\bar{c}_A)}\right)$ , then the profile of pure strategies  $((c_{A1}^*, c_{A2}^*); (c_{A1}^*, c_{A2}^*)) = ((0, \bar{c}_A); (\bar{c}_B, 0))$  is not an equilibrium (given the strategy of party  $A$ , party  $B$  could increase its vote-share by spending all its funds on issue 2). Then, it follows that there is no equilibrium in pure strategies.

Third, we show that if there exists an equilibrium in pure strategies, then the equilibrium is unique. Suppose that  $V_A\left(\frac{\alpha_1(\bar{c}_A)}{\alpha_2(\bar{c}_B)}\right) \leq V_A(T_{\max})$ . As we have shown, in this case  $c^* = ((\bar{c}_A, 0); (0, \bar{c}_B))$  is the only equilibrium in pure strategies. Next, we show that there is no other equilibrium in mixed strategies. Since  $V_B(\cdot)$  is a single-dipped function of  $T(c)$  and  $V_B\left(\frac{\alpha_1(\bar{c}_A)}{\alpha_2(\bar{c}_B)}\right) \geq$

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<sup>19</sup>Note that this statement is also true if we think on mixed-strategy equilibrium.

$V_B(T_{\max})$  then, given any mixed strategy for party  $A$ , the best response of party  $B$  is to spend all its funds on issue 2. Moreover, since  $V_A(\cdot)$  is a single-peaked function of  $T(c)$  and  $V_A\left(\frac{\alpha_1(\bar{c}_A)}{\alpha_2(\bar{c}_B)}\right) \leq V_A(T_{\max})$ , if party  $B$  spends all its funds on issue 2 then the best response of party  $A$  is to spend all its funds on issue 1. The case where  $V_A\left(\frac{\alpha_1(\bar{c}_B)}{\alpha_2(\bar{c}_A)}\right) \leq V_A(T_{\min})$  is analogous. ■

### PROOF OF PROPOSITION 3:

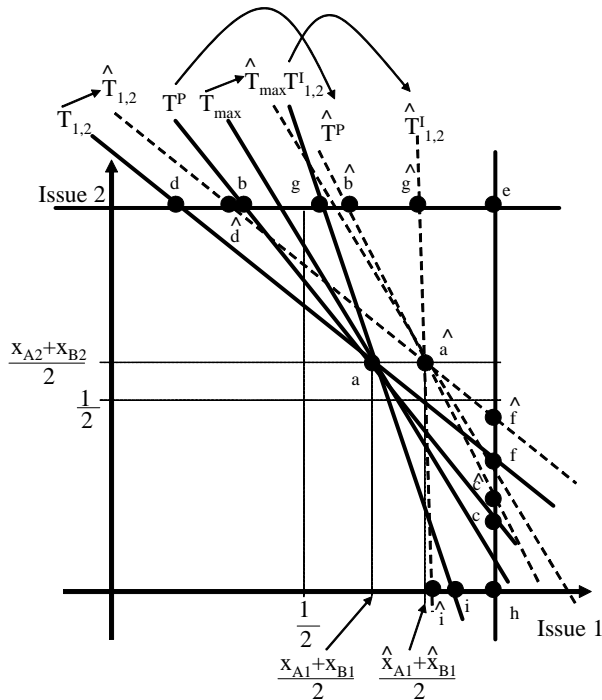
Suppose, without loss of generality, that party  $A$  has an absolute advantage on both issues. Then by Lemma 3,  $V_A$  is a single-peaked function of  $T(c)$  (and  $V_B$  is a single-dipped function of  $T(c)$ ). Moreover, from the proof of that lemma we know that the peak of  $V_A$  is  $T^P = \frac{x_2[1-m_2]}{x_1[1-m_1]}$ . Note that  $\lim_{m_1 \rightarrow 1} T^P = \infty$ . Then, since  $V_A$  is strictly increasing up to  $T^P$ , for any  $m_2$  there exists  $m_1$  large enough so that  $V_A\left(\frac{\alpha_1(\bar{c}_A)}{\alpha_2(\bar{c}_B)}\right) < V_A(T_{\max})$ . In this case, by Proposition 2, there exists an equilibrium in pure strategies where party  $A$  spends all its funds on issue 1. Similarly, note that  $\lim_{m_2 \rightarrow 1} T^P = 0$ . Since  $V_A$  is strictly decreasing for all  $T(c) > T^P$ , given any  $m_1$  there exists  $m_2$  large enough so that  $V_A\left(\frac{\alpha_1(\bar{c}_B)}{\alpha_2(\bar{c}_A)}\right) < V_A(T_{\min})$ . In this case, by Proposition 2, there is issue divergence in the political campaign where party  $A$  spends all its funds on issue 2. We can use the same argument for party  $B$ . ■

### PROOF OF PROPOSITION 4:

Suppose, without loss of generality, that party  $A$  has an absolute advantage on both issues. From Lemma 3,  $V_A(\cdot)$  is a single-peaked function of  $T(c)$ .

(1) Suppose that, initially,  $(m_1, m_2)$  is located in point  $a$  of Figure 8 and that there exists an equilibrium in pure strategies,  $c^*$ , such that party  $A$  spends all its funds on issue 1 and party  $B$  spends all its funds on issue 2. Let  $T_{1,2} = \frac{\alpha_1(\bar{c}_A)}{\alpha_2(\bar{c}_B)}$ . Given the political positions in the initial situation, suppose that there exists  $T_{1,2}^I$  such that  $V_A(T_{1,2}^I) = V_A(T_{1,2})$ , and let  $T^P = \arg \max_{T(c) \in [T_{\min}, T_{\max}]} V_A(T(c))$ . From Proposition 2, we have  $V_A(T_{1,2}) \leq V_A(T_{\max})$ . The lines  $T^P$ ,  $T_{1,2}$ ,  $T_{\max}$  and  $T_{1,2}^I$  define the location of the indifferent voters in the initial situation when  $T(c)$  is equal to  $T^P$ ,  $T_{1,2}$ ,  $T_{\max}$  and  $T_{1,2}^I$  respectively. Note that the line  $T^P$  must be such that  $\bar{b}a$  and  $\bar{c}a$  are two segments of the same length. Moreover, since  $V_A(\cdot)$  is single-peaked with peak in  $T^P$  and  $V_A(T_{1,2}) \leq V_A(T_{\max})$ , then the line  $T_{1,2}$  must be flatter than the line  $T^P$ , the

line  $T^P$  must be flatter than the line  $T_{\max}$ , and the line  $T_{\max}$  must be flatter than the line  $T_{1,2}^I$ . Note also that, since  $V_A(T_{1,2}^I) = V_A(T_{1,2})$ , the surfaces above the lines  $T_{1,2}$  and  $T_{1,2}^I$  must be equal (i.e., the surface defined by the lines  $\overline{de}$ ,  $\overline{ef}$  and  $\overline{fd}$  and the surface defined by the lines  $\overline{ge}$ ,  $\overline{eh}$ ,  $\overline{hi}$  and  $\overline{ig}$  are equal). Suppose now that the midpoint of the parties' political positions on issue 1 increases to  $\frac{\hat{x}_{A1} + \hat{x}_{B1}}{2} > \frac{x_{A1} + x_{B1}}{2}$  (the same reasoning applies if the parties' political positions on issue 2 decreases), so that the comparative advantage of party A on issue 1 becomes greater and the new midpoint of the parties' political positions is located in point  $\hat{a}$  (suppose that the rest of parameters do not change, and in particular  $\hat{x}_{A1} - \hat{x}_{B1} = x_{A1} - x_{B1}$ ). Let  $\hat{T}^P$ ,  $\hat{T}_{1,2}$ ,  $\hat{T}_{\max}$  and  $\hat{T}_{1,2}^I$  the analogous to  $T^P$ ,  $T_{1,2}$ ,  $T_{\max}$  and  $T_{1,2}^I$  in the new situation.<sup>20</sup> Note that the lines  $\hat{T}_{1,2}$  and  $\hat{T}_{\max}$  must be parallel to the lines  $T_{1,2}$  and  $T_{\max}$  respectively (since  $\frac{\alpha_1(\bar{c}_A)}{\alpha_2(\bar{c}_B)}$ ,  $\frac{\alpha_1(\bar{c}_A + \bar{c}_B)}{\alpha_2(0)}$  and  $\frac{x_{A1} - x_{B1}}{x_{A2} - x_{B2}}$  do not change).



**Figure 8.** Example showing Case 1 of Proposition 4.

<sup>20</sup>If there not exists any  $T_{1,2}^I$  such that  $V_A(T_{1,2}^I) = V_A(T_{1,2})$ , then  $\hat{T}_{1,2}^I$  does not exist either, and then it follows that  $c^*$  is still an equilibrium (something similar happens if  $T_{1,2}^I$  exists but  $\hat{T}_{1,2}^I$  does not exist).

On the other hand, the line  $\hat{T}^P$  must be such that the segments  $\overline{\hat{b}\hat{a}}$  and  $\overline{\hat{c}\hat{a}}$  are of the same length, and therefore the line  $\hat{T}^P$  must be steeper than the line  $T^P$ . Similarly, the surfaces above the lines  $\hat{T}_{1,2}$  and  $\hat{T}_{1,2}^I$  must be equal (i.e., the surface defined by the lines  $\overline{\hat{d}\hat{e}}$ ,  $\overline{\hat{e}\hat{f}}$  and  $\overline{\hat{f}\hat{d}}$  and the surface defined by the lines  $\overline{\hat{g}\hat{e}}$ ,  $\overline{\hat{e}\hat{h}}$ ,  $\overline{\hat{h}\hat{i}}$  and  $\overline{\hat{i}\hat{g}}$  are equal), and therefore the line  $\hat{T}_{1,2}^I$  must be steeper than the line  $T_{1,2}^I$ . Therefore,  $\hat{T}_{1,2} < \hat{T}^P$  and  $\hat{T}_{\max} < \hat{T}_{1,2}^I$ . Then, in the new situation,  $V_A(\hat{T}_{1,2}) \leq V_A(\hat{T}_{\max})$  and, from Proposition 2,  $c^*$  is still an equilibrium in pure strategies. The case in which the initial equilibrium in pure strategies was such that party  $A$  spends all its funds on issue 2 is similar.

(2) Suppose that there exists an equilibrium in pure strategies,  $c^*$ , such that party  $A$  spends all its funds on issue 1 and party  $B$  spends all its funds on issue 2. From Proposition 2 we have  $V_A(\frac{\alpha_1(\bar{c}_A)}{\alpha_2(\bar{c}_B)}) \leq V_A(T_{\max})$ , and therefore  $\frac{\alpha_1(\bar{c}_A)}{\alpha_2(\bar{c}_B)} \leq T^P \leq T_{\max}$ . From the proof of Lemma 3 we know that the peak of  $V_A$  is  $T^P = \frac{x_2[1-m_2]}{x_1[1-m_1]}$ . Then, as  $m_2$  increases (keeping constant  $x_2$ ),  $T^P$  decreases. Since  $\lim_{m_2 \rightarrow 1} T^P = 0$ , if  $m_2$  increases, at some point we have  $V_A(T_{\max}) < V_A(\frac{\alpha_1(\bar{c}_A)}{\alpha_2(\bar{c}_B)})$  and  $V_A(T_{\min}) < V_A(\frac{\alpha_1(\bar{c}_B)}{\alpha_2(\bar{c}_A)})$ , and then, from Proposition 2, an equilibrium in pure strategies fails to exist. The case in which the initial equilibrium in pure strategies was such that party  $A$  spends all its funds on issue 2 is similar. ■

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