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## **Abstract**

In this paper I develop a formal theory of campaign communications. Voters have priors about the quality of candidates' policies in the different policy issues and about the issues' relative importance. Candidates spend time or money (TV ads, public speeches, etc.) in an effort to influence voters' decision at the ballot. Influence has two simultaneous effects: (i) it increases the quality of the policy in the issue as perceived by the voters through policy advertising and (ii) it makes the issue more salient through issue priming, thereby increasing the issue's perceived importance. A strategy is an allocation of influence activities to the different issues or topics. I show conditions under which candidates' strategies converge or diverge, which issues – if any – will dominate the campaign, and under what conditions candidates are forced to focus on issues in which they are perceived to be weak. I develop a set of novel testable predictions and discuss the model's predictive power by example of the 2008 presidential campaign in the U.S.

## **Keywords**

Multi issue campaign, campaign communication, policy advertising, issue priming

## **JEL Classification**

D01, D72, P16

# 1 Introduction

*“[...] there is no shortage of explanations for why issue convergence is such a rare commodity in American campaigns. Perhaps surprisingly, though, there is a shortage of convincing evidence that issue convergence really is a rare commodity.”*

Sigelman and Buell (2004)

During political campaigns candidates for political office vie for voters’ support at the ballot by giving public speeches, publishing TV ads, or by targeting different groups with tailored advertisement on the internet. In other words, they communicate their standpoints, policies, etc. to the electorate. Naturally, candidates differ significantly in some characteristics and are more similar in others. Some characteristics are important at a given time, while others are not. For example, during economic downturns, voters expect candidates to tell them how they plan to create jobs and the issue’s importance is probably high. Similarly, after a terrorist attack the issue of homeland security becomes increasingly important. A central question is now how these characteristics and their relative importance *together* shape candidates’ campaign communications? How should a candidate’s communication strategy be tailored optimally? When should a candidate focus on ‘Job creation’ and ‘Homeland security’ during his campaign, but put less emphasis on the issues ‘Social security’ and ‘War in Afghanistan’? When should we expect candidates to follow similar communication strategies, and when is polarization a likely outcome? In this paper I advance a theory of campaign communications that offers answers to these questions.

The theoretical campaigning literature so far is dominated by the seminal works of Petrocik (1996) and Riker (1996). Petrocik (1996) argued that each candidate *owns* certain issues, i.e. he is perceived to be more competent in this issue than her political opponent. Such an advantage in perceived competence has many different sources such as a party’s history, personal professional experience of candidates, and the like. For example, in the recent campaign contest with Barack Obama, the Republican candidate Mitt Romney tried to connect his experience as a business leader to his competence in questions concerning the economy.<sup>1</sup> Riker (1996)

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<sup>1</sup>For example, during the second debate with Barack Obama on October 16, 2012 he stated: “*I want to make small businesses grow and thrive. I know how to make that happen. I spent my life in the private sector. I know why jobs come and why they go*”.

developed two principles of campaigning rhetoric from issue ownership. “*When one side has an advantage on an issue, the other side ignores it; but when neither side has an advantage, both seek new and advantageous issues*” (page 106). He named the former the *dominance principle* and the latter the *dispersion principle*. The prediction of the theory is hence that there is an extreme form of issue divergence in communication strategies.

But how is the predictive power of these two principles? As an example take a look at the 2008 campaign between Barack Obama and John McCain.<sup>2</sup> Take the issue ‘Taxes’: Mr. McCain spend some 21 percent of his budget for TV ads on that issue, which was almost matched by Mr. Obama, who also devoted more than 20 percent of his budget on that issue. Hence, this situation is best described by convergence, rather than divergence. In many other fields such as ‘Iraq’ and ‘National defense’ candidates also converged. Although there are also issues in which candidates diverged clearly, e.g. ‘Health care’ (14.2 vs. 2 percent), the predictions of the dominance and dispersion principles seem too strong. Many empirical studies confirm this conclusion and the above quotation due to Sigelman and Buell (2004) is a nice résumé of the literature so far. This tendency of candidates to also campaign on issues that are supposedly owned by their political opponents has often been described as issue stealing (see e.g. Holian (2004)). However, although it seems to be a frequent phenomenon in political communication, there is no theory that explains why or when it happens.

In this paper I address this question and advance a formal theory of political communication in campaigns, based on two effects that simultaneously shape a voter’s opinion: policy advertising and issue priming. The first posits that political influence / advertising is effective in the sense that it makes voters like candidates’ advertised policies better. Advertising is purely persuasive. The assumption of purely persuasive advertising is very common in both political advertising and advertising on goods markets, see Mueller and Stratmann (1994), Iaryczower and Mattozzi (2012a,b), Bühler and Halbheer (2012) or the survey by Bagwell (2007).<sup>3</sup> The second effect, issue priming, posits that a commercial on health care or a speech about the situation in Iraq makes those issues salient, thereby shifts voters’ attention to these issues and increases their perceived importance. Priming can hence “alter the standards by

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<sup>2</sup>I calculated all numbers on TV ads using data from an online archive of the New York Times: <http://elections.nytimes.com/2008/president/advertising/issues/1439-abortion>.

<sup>3</sup>See also the discussion of the distinction between persuasive and informative advertising in Johnson and Myatt (2006) or Bühler and Halbheer (2011).

which people evaluate election candidates” (Severin and Tankard, 1997). It has a prominent role in the literature on campaign communications, e.g. Iyengar and Kinder (1987), Druckman, Jacobs, and Ostermeier (2004), and Aragonès, Castanheira, and Giani (2012).<sup>4</sup>

I model campaign communication as a number of intertwined contests between two candidates for political office. Voters hold priors about candidates’ policy plans or competence in the issues and about issues’ relative importance. Candidates give speeches or buy TV ads to influence voters. In an ad they address a given set of issues and elaborate on their own or their opponent’s policy plans. This has two effect at the same time: talking about an issue primes the issue and hence increases its perceived importance. At the same time it makes voters like the policies of the candidate better. This may be so because in TV ads candidates address policy plans or because their perceived competence can be increased in public speeches. For reasons of exposition, I will refer to the two channels as ‘issue priming’ and ‘policy advertising’ for the remainder of the paper, while keeping in mind that other interpretations are possible as well. The main contributions of the paper are on the one hand to study the *simultaneous* effects of issue priming and policy advertising and on the other hand to develop a formal model of intertwined contests, which can be applied to other interesting phenomena as well. This simple structure is sufficient to generate many novel testable predictions about candidates’ communication strategies. As I will discuss later in Section 6, the model can explain data from the U.S. presidential campaign in 2008 nicely. The main results are the following:

- Iff candidates do not have *comparative* advantages in the issues, there exists an equilibrium in which there is complete convergence of communication strategies.
- If candidates have *comparative* advantages, there will always be some form of divergence.
- The more effective is issue priming, the more divergence is there in equilibrium.
- A candidate might optimally pay the highest attention to an issue in which he is disadvantaged, if this issue is sufficiently important and the disadvantage not too big.
- Ex ante less important issues may receive the bulk of candidates’ attention if in those issues no candidate has a very large *absolute* advantage.

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<sup>4</sup>For a discussion of possible psychological foundations for policy advertising and issue priming see Appendices A.1 and A.2. For a survey of how the mass media can influence voters’ decision making see Prat and Strömberg (2011).

A candidate has a comparative advantage in an issue if his policy in this issue is relatively more popular than a weighted average of the relative popularity of all his policies. If candidates have comparative advantages, it is beneficial to highlight one's advantage for two reasons. First, advertising a policy plan strengthens the advantage. Second, priming this issue draws attention to one's strength and away from one's weakness. This is also beneficial. While the advertising effect is also beneficial in issues in which a candidate does not have a comparative advantage, the priming effect is now detrimental. However, as long as the first effect dominates, the candidate will still publish some TV ads on that issue. Because of the additional costs (as which we can interpret the negative effect of priming), candidates publish more ads on their comparative advantages than on the other, unless the issue in which there is a disadvantage becomes very important. If this is the case, a marginal increase in perceived quality of one's policy platform in an issue has a relatively strong effect on a candidate's overall assessment, and hence in that issue the advertising effect dominates. To the contrary, in less important issues the priming effect is more important and there we should hence expect more divergence.

The model explains actual candidate behavior from the 2008 presidential campaign in the US nicely, e.g. the strong form of convergence in communication strategies in the issue 'Taxes' and other issues, and the strong form of divergence in issues like 'Health care', 'Immigration', and 'Economy'. The issues in which candidates' strategies diverged significantly were either not among the most important issues or one candidate enjoyed a strong (ex ante) absolute advantage. The model predicts that both of these facts make divergence more likely. In issues that are more important and in which comparative advantages are smaller, like 'Taxes', there is a tendency to converge.

The paper is organized as follows. Next I discuss the relevant related literature. In Section 2 I present the baseline model assuming there are only two important issues. I discuss this model in Section 3. In Section 4 I generalize the analysis and allow for  $n$  issues. In Section 5 I study conditions under which a subset of issues is neglected. In Section 6 I discuss my findings in relation to observed behavior during the 2008 presidential campaign in the US. Section 7 concludes.

**Related literature.** Many scholars have directed their attention to the study of political campaigns. An often posed question is and was how candidates allocate their time and money



during an electoral contest to different states and electoral districts, e.g. Brams and Davis (1973, 1974), Snyder (1989), Klumpp and Polborn (2006), and Stromberg (2008), or to different forms of campaigning, e.g. Skaperdas and Grofman (1995). Sahuguet and Persico (2006), Meirowitz (2008), and Iaryczower and Mattozzi (2012a) consider different effects of campaign spending regulations. Denter and Sisak (2012) investigate whether there is momentum in political competition caused by public opinion polls. In contrast to all those papers, in the current paper the focus is solely on candidates' communication strategies during a campaign, that is how different issues are being addressed during a campaign.

Petrocik (1996) argued in his influential paper that candidates and parties have a reputation to own certain issues, i.e. that they are in the perception of the populace more competent in this issue than their political opponent. A consequence of owning an issue is then that candidates will focus in their campaign communication on issues that they own, and neglect others. This strategy has been called the 'dominance principle' by Riker (1996) and subsequent authors, e.g. Amoros and Puy (2011). The predictions of the dominance principle are that there is some extreme form of divergence in communication strategies. However, empirical scholarship so far tends to reject the hypotheses and finds that there is moderate divergence in some issues, but often candidates also tend to converge in their communication, see for example Bélanger and Meguid (2008), Damore (2004, 2005), Kaplan, Park, and Ridout (2006), Green and Hobolt (2008), Petrocik, Benoit, and Hansen (2003), or Sigelman and Buell (2004). In this paper I develop a theory that can account for these findings.

Recently, some authors have developed theories that aim to explain where issue ownership comes from, for example Krasa and Polborn (2010b) and Aragonès, Castanheira, and Giani (2012). In contrast to this literature the focus here is not the emergence of issue ownership, but the consequences of issue ownership for campaigning. As will become apparent, issue ownership is neither necessary nor sufficient to bring about divergence in communication strategies. Moen and Riis (2010) develop a theoretical justification for issue trespassing, which is based on a signaling argument. In the current paper issue trespassing can also happen, but the reason is that policy advertising has an effect on voters' policy assessment. Egan (2009) shows how candidates can use their perceived advantage in the issues they own to choose policy platforms that are not as conform with voters' preferences. In contrast, I am not concerned with how candidates choose policy platforms, but how issue ownership and policy platforms influence

candidates' communication strategies during a campaign.

The paper also relates to a literature studying models in which candidates have different characteristics, for example Groseclose (2001), Jensen (2012) or a series of papers by Krasa and Polborn (2009, 2010a,b, 2011). In all these papers, the focus is on how certain differences between candidates influences policy choices in equilibrium. To the contrary, the current paper is concerned with the implications of differentiated candidates for campaign communication.

The model I develop can be interpreted as a variant of a Colonel Blotto game. These games come from conflict studies and represent situations in which combatants fight on multiple battlefields, and the important question is how to allocate forces to the different battlefields. Early papers investigating Blotto games are Beale and Heselden (1962) or Shubik and Weber (1981). Roberson (2006) described equilibrium payoffs for a wide range of Blotto games. Other authors have started working on Blotto games subsequently, e.g. Powell (2007), Kovenock and Roberson (2010, 2012), and Chowdhury, Kovenock, and Sheremeta (2011). While structurally similar, a distinctive feature of the current paper is that in Blotto games a battlefield's importance is fixed, while issues' relative importance in this study is endogenous and thus a number of intertwined contests determine the outcome.

Finally, the paper also contributes to the literature on advertising, in particular persuasive advertising. While the paper is couched in the field of political competition, it can be reinterpreted as an advertising model to study goods markets, if goods have multiple characteristics in the sense of Lancaster (1966). Many authors study persuasive advertising in markets, see for example Friedman (1958) and Koh and Leung (1992), or more recently the papers by Johnson and Myatt (2006) and Bühler and Halbheer (2011, 2012). Bagwell (2007) surveys the literature. In contrast to these papers, I model persuasive advertising as highlighting a good's characteristics. That influences the attitudes of consumers by altering the different characteristics' perceived qualities and by changing which characteristics consumers focus on mostly.

## 2 The Baseline Model

Two politicians  $j \in \{1, 2\}$  compete in a campaign by spending effort. While effort can mean many different things, for specificity I will refer to effort in the following as publishing or buying

TV ads. There is a measure-one continuum of voters, indexed by  $v$ . Voters care about two policy issues,  $i \in \{H, S\}$ , health care and security. They assign to each candidate a relative competence prior  $\theta_{v,j}^i \in [0, 1]$ , where, without loss of generality, relative competence is defined in a way such that  $\theta_{v,1}^i + \theta_{v,2}^i = 1$ . It is useful to define  $\theta_{v,1}^i \equiv \theta_v^i$  and  $\theta_{v,2}^i \equiv 1 - \theta_v^i$  and work with this in the following.

To assess the overall quality of a politician, voters assign a (prior) weight  $\omega_v \in [0, 1]$  to issue  $H$  and  $1 - \omega_v$  to issue  $S$ . In particular, voters have *weighted-issue preferences*<sup>5</sup> (Krasa and Polborn, 2010a) and a voter assumes to receive utility  $u_{v,j}(\theta_v^H, \theta_v^S, \omega_v)$  if candidate  $j$  gets elected, where

$$u_{v,1}(\theta_v^H, \theta_v^S, \omega_v) = \theta_v^H \omega_v + \theta_v^S (1 - \omega_v), \quad (1)$$

$$u_{v,2}(\theta_v^H, \theta_v^S, \omega_v) = (1 - \theta_v^H) \omega_v + (1 - \theta_v^S) (1 - \omega_v). \quad (2)$$

Hence, when  $u_{v,1} > \frac{1}{2}$  voter  $v$  prefers 1 over 2, and vice versa if  $u_{v,1} < \frac{1}{2}$ .

Voters' priors about candidates' relative competence in issue  $i$  are distributed on  $\Theta^i = [\underline{\theta}^i, \bar{\theta}^i]$  with distribution  $\mathcal{D}^i(\theta_v^i)$ . Similarly, the issue importance prior is distributed on  $\Omega = [\underline{\omega}, \bar{\omega}]$  with distribution  $\mathcal{D}^\omega(\omega_v)$ . Hence, every voter  $v$  is completely described by  $T_v = \{\theta_v^H, \theta_v^S, \omega_v\} \in \mathcal{S} \equiv \Theta^H \times \Theta^S \times \Omega$ . Priors are independent draws from  $\mathcal{S}$ . It will be useful to define  $\Delta^\theta \equiv \int_{\Theta^H} \int_{\Theta^S} (\theta_v^H - \theta_v^S) d\mathcal{D}^H(\theta_v^H) d\mathcal{D}^S(\theta_v^S)$ . To avoid notational baggage I will often use an expectation operator instead of integrals in the following, and thus  $E_S[\theta_v^H - \theta_v^S] = \Delta^\theta$ .

Having described how voters assess candidates before the campaign starts, I now describe the process of campaigning. Candidates can buy TV ads in an effort to sway voters. Advertising may have an influence on voters' evaluation of candidates for different reasons. First, if voters dislike uncertainty, informative TV ads can help reduce uncertainty about policies and voters like that. Alternatively, it may be the case that different policies can be appropriate in different states of the world. For example, a fiscal stimulus to the economy may seem appropriate during economic downturns, but not quite as appropriate when the economy is roaring. TV ads can then be used to try to convince voters that in the current state of the world the chosen policy is appropriate.<sup>6</sup> I will refer to this function of campaigning as policy advertising and assume

<sup>5</sup>Krasa and Polborn (2010a) model weighted-issue preferences as the weighted distance from a voter's ideal position in the policy space. It is straightforward to apply this interpretation to the current model.

<sup>6</sup>I will not discuss in detail what exactly advertising does, but assume it to be effective. That this assumption

advertising is effective. A candidate's advertising expenditures being effective means that the assessment of a candidate's competence is non-decreasing (in expectation) in the number of published ads,  $x_j^i$ . Denoting voter's post campaigning assessment of candidates' relative competence by  $c_{v,1}^i \equiv c_v^i$  and  $c_{v,2}^i \equiv 1 - c_v^i$ , based on recent work by Skaperdas and Vaidya (2012) I assume the following advertising technology:

$$c_v^i(x_1^i, x_2^i; \theta_v^i) = \frac{\theta_v^i \bar{f}(\kappa^c + x_1^i)}{\theta_v^i \bar{f}(\kappa^c + x_1^i) + (1 - \theta_v^i) \bar{f}(\kappa^c + x_2^i)} = \frac{\theta_v^i f(x_1^i)}{\theta_v^i f(x_1^i) + (1 - \theta_v^i) f(x_2^i)}, \quad (3)$$

$\bar{f}(\cdot) > 0$  measures the impact of publishing TV ads and is an increasing function.  $\kappa^c \geq 0$  is a parameter that determines the effectiveness of publishing TV ads in influencing voters' assessment of policies. Since throughout most of the analysis I will not need this parameter I define  $\bar{f}(\kappa^c + x_i^i) = f(x_i^i)$  and work mostly with the latter. The (relative) competence prior also determines the relative effectiveness of spending. If both candidates spend an equal amount on TV ads,  $c_v^i = \theta_v^i$ . Skaperdas and Vaidya (2012) derive this functional form as a technology of persuasion / advertising based on a Bayesian learning model.

To assure a well behaved problem I make the following assumptions:

**Assumption 1.** 1.  $f(x)$  is at least twice continuously differentiable.

2.  $f(0) > 0$ .

3.  $f'(x) > 0$  for finite  $x$  and  $\lim_{x \rightarrow +\infty} f'(x) = 0$ .

4.  $f''(x) \leq 0$ .

5.  $\lim_{x \rightarrow 0} f'(x) = \infty$ .

Part 2 means that even if a candidate does not spend anything in the campaign his perceived competence remains positive. A direct implication is that perceived competence is a continuous function of candidates' efforts. Part 3 reflects that publishing ads does not hurt a candidate's policy's assessment by voters. Part 4 implies marginal products of effort are decreasing. Alternatively, it might as well be interpreted as increasing marginal costs of spending, for example, because marginal costs of funding increase (costs of spending will be introduced in a bit). Part 5 is not a necessary assumption but helps to guarantee the existence of an *interior* equilibrium

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is not very strict has been shown repeatedly in empirical work, e.g. Erikson and Palfrey (2000).

for appropriate  $\kappa^c$ .<sup>7</sup> An example function fulfilling Assumption 1 is  $f(x) = (\kappa^c + x)^a$  for some  $\kappa^c > 0$  and  $1 > a > 0$ .

While policy advertising is one purpose of buying TV ads, it is not the only one. Publishing ads also primes an issue. The more ads are published on issue  $j$ , the more salient the issue becomes and the more attention will be directed towards this issue. As a consequence, the issue's relative importance increases. This priming effect has been studied extensively and lies at the heart of most campaigning models, e.g. Amoros and Puy (2011) and Aragonès, Castanheira, and Giani (2012). With  $\omega_v$  being a voter's importance prior of issue  $H$ , priming leads to a reassessment of issues' relative importance. In particular, I assume the following mechanism:

$$\begin{aligned} w_v(x_1^H, x_1^S, x_2^H, x_2^S; \omega_v) &= \frac{\omega_v \bar{g}(\kappa^w + x_1^H + x_2^H)}{\omega_v \bar{g}(\kappa^w + x_1^H + x_2^H) + (1 - \omega_v) \bar{g}(\kappa^w + x_1^S + x_2^S)} \\ &= \frac{\omega_v g(x_1^H + x_2^H)}{\omega_v g(x_1^H + x_2^H) + (1 - \omega_v) g(x_1^S + x_2^S)} \end{aligned} \quad (4)$$

for  $H$  and  $1 - w_v$  for  $S$ .  $\kappa^w \geq 0$  is a parameter that determines the effectiveness of creating salience in making the issue more important and is exogenous. It may represent institutional features such as the degree to which the media follow the candidates in creating issue salience. Since for most parts of the paper I will not need the parameter  $\kappa^w$  I define  $g(x) := \bar{g}(\kappa^w + x)$  and work with this formulation.

I make the following assumptions regarding  $\bar{g}(x)$ :

**Assumption 2.** 1.  $g(x)$  is at least twice continuously differentiable.

2.  $g(0) > 0$ .

3.  $g'(x) \in (0, \infty)$  for  $x \in (0, \infty)$ ,  $\lim_{x \rightarrow 0} g(x) = +\infty$ , and  $\lim_{x \rightarrow +\infty} g'(x) = 0$ .

4.  $g''(x) \leq 0$  and  $\lim_{x \rightarrow +\infty} g''(x) = 0$ .

5.  $g'''(x) > 0$ .

Part 2 reflects that an issue's importance cannot drop to zero just because nobody talks about it. Part 3 reflects that creating salience affects the relative importance of the two issues. Part

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<sup>7</sup>Assumption 1 is not necessary but sufficient.

4 means there are decreasing returns of salience, and part 4 and 5 together imply that returns do not decrease very quickly. The assumptions are also not necessary for the analysis, but – as we will see below – sufficient to guarantee a nicely behaved problem for the candidates.<sup>8</sup> An example function fulfilling Assumption 2 is  $g(x) = (\kappa^w + x)^b$  for  $\kappa^w > 0$  and  $1 > b > 0$ .

Voters' assessment of candidates after campaigning is

$$U_{v,1}(c_v^H, c_v^S, w_v) = c_v^H w_v + c_v^S (1 - w_v), \quad (5)$$

$$U_{v,2}(c_v^H, c_v^S, w_v) = (1 - c_v^H) w_v + (1 - c_v^S) (1 - w_v). \quad (6)$$

Voting is probabilistic and for simplicity the probability that a voter cast her ballot for a candidate equals  $U_{v,j}$ . Note, however, that any function  $Pr[b_v = j] = \zeta(U_{v,j})$ , where  $\zeta'(\cdot) > 0$  and  $\zeta(U_{v,1}) + \zeta(U_{v,2}) = 1$ , would yield qualitatively identical outcomes.<sup>9</sup>

Candidates maximize their share of the popular vote subject to costs of campaigning, with constant marginal costs  $\gamma > 0$  for both. I will maintain this assumption throughout the main body of the paper, but show in Appendix B.11 that results are qualitatively identical if candidates have a fixed campaigning budget instead.

We can write their respective maximization problem as

$$\max_{(x_1^H, x_1^S) \in \mathbb{R}_+^2} \pi_1 = \int \int \int_{\mathcal{S}} U_{v,1}(c_v^H, c_v^S, w_v) d\mathcal{D}^H(\theta_v^H) d\mathcal{D}^S(\theta_v^S) d\mathcal{D}^\omega(\theta_v^\omega) - \gamma(x_1^H + x_1^S) \quad (7)$$

$$\begin{aligned} &= E_{\mathcal{S}} [U_{v,1}(c_v^H, c_v^S, w_v)] - \gamma(x_1^H + x_1^S) \\ \max_{(x_2^H, x_2^S) \in \mathbb{R}_+^2} \pi_2 &= \int \int \int_{\mathcal{S}} U_{v,2}(c_v^H, c_v^S, w_v) d\mathcal{D}^H(\theta_v^H) d\mathcal{D}^S(\theta_v^S) d\mathcal{D}^\omega(\theta_v^\omega) - \gamma(x_2^H + x_2^S) \quad (8) \\ &= E_{\mathcal{S}} [U_{v,2}(c_v^H, c_v^S, w_v)] - \gamma(x_2^H + x_2^S) \end{aligned}$$

To assure a well behaved problem, I need one more assumption:

**Assumption 3.**  $\kappa^w$  is large.

Without stating explicitly what large means, for sufficiently large but finite  $\kappa^w$  the just

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<sup>8</sup>An alternative assumption guaranteeing a nicely behaved problem, that would allow us to dispense with Assumptions 2.3-2.5, is  $0 < g'(x) < \alpha_1$  and  $|g''(x)| < \alpha_2$  for appropriately chosen  $\alpha_1$  and  $\alpha_2$ .

<sup>9</sup>Voters do not necessarily flip a coin for whom they cast the ballot. It is sufficient that candidates perceive voting to be probabilistic. For example, if voters are biased in favor of one or the other candidate, the bias is unobservable, non-policy related, and continuously distributed across voters, candidates perceive voting to be probabilistic even if voters vote strictly sincere. See for example Lindbeck and Weibull (1987).

defined problem for the two candidates is well-behaved. For given functional forms ‘large’ can be pinned down precisely.

A rule that determines how candidates allocate resources to the different issues – given the electorates’ priors – is called a communication strategy. The main goal is to identify conditions under which communication strategies converge or diverge, which issue will be in the focus of candidates, and which issue, if any, will be dominating issue in the campaign. The equilibrium concept I employ is Nash equilibrium.

### 3 Equilibrium

Before I go into the details of communication strategies in equilibrium, it needs to be established that an equilibrium exists:

**Theorem 1.** *Under Assumptions 1, 2, and 3 the candidates’ utility functions are strictly concave in their own strategies and the game has a pure strategy equilibrium. If, in addition,  $\gamma$  is sufficiently small, only interior equilibria exist.*

*Proof.* See appendix. □

The intuition for the existence result is straightforward. The effect of the relative importance on the second order conditions must not be too large, because then the problem is not concave anymore. By restricting the curvature of  $g(\cdot)$  we can avoid this problem and apply standard equilibrium existence proofs.<sup>10</sup> If  $\gamma$  is sufficiently small, the marginal costs of publishing the first ad are lower than the associated marginal benefit for both issues, and hence an interior equilibrium exists. With the exception of Section 5, I will assume this to be the case throughout the paper.

Knowing that an interior pure strategy equilibrium exists, we can use first order conditions to determine equilibrium behavior. From (7) and (8) the following system of first order conditions

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<sup>10</sup>Note that for this purpose Assumption 2 is sufficient, but not necessary. There are alternative assumptions guaranteeing existence.

follows:

$$\frac{\partial \pi_1}{\partial x_1^H} = E_S \left[ \frac{\partial c_v^H}{\partial x_1^H} w_v + (c_v^H - c_v^S) \frac{\partial w_v}{\partial x_1^H} \right] - \gamma = 0 \quad (9)$$

$$\frac{\partial \pi_1}{\partial x_1^S} = E_S \left[ \frac{\partial c_v^S}{\partial x_1^S} (1 - w_v) + (c_v^H - c_v^S) \frac{\partial w_v}{\partial x_1^S} \right] - \gamma = 0 \quad (10)$$

$$\frac{\partial \pi_2}{\partial x_2^H} = E_S \left[ -\frac{\partial c_v^H}{\partial x_2^H} w_v - (c_v^H - c_v^S) \frac{\partial w_v}{\partial x_2^H} \right] - \gamma = 0 \quad (11)$$

$$\frac{\partial \pi_2}{\partial x_2^S} = E_S \left[ -\frac{\partial c_v^S}{\partial x_2^S} (1 - w_v) - (c_v^H - c_v^S) \frac{\partial w_v}{\partial x_2^S} \right] - \gamma = 0 \quad (12)$$

Here we can nicely see the different channels through which buying TV ads influences a voter's candidate assessment.  $\frac{\partial c_v^H}{\partial x_1^H} w_v$  is the marginal impact of candidate 1's spending on a voter's policy evaluation, weighted by the issue's importance. This effect is positive independent of a voter's priors  $T_v$ .  $(c_v^H - c_v^S) \frac{\partial w_v}{\partial x_1^H}$  is the marginal effect of TV ads on evaluation through the issue priming channel. Whether this is positive or negative depends on the sign of  $\Delta^c \equiv E_{\Theta^H \times \Theta^S} [c_v^H - c_v^S]$ , which is endogenously determined. If a candidate has a comparative advantage taking the campaign into account, the priming effect is generally positive. If he has a comparative disadvantage, however, priming is detrimental. Hence, there is an additional cost associated with spending on the issue of one's disadvantage, which is due to the priming effect. But note that due to the policy advertising channel it may nevertheless be beneficial to buy *some* TV ads, even for the weaker issue. Also note that the issue of one's disadvantage is not necessarily the issue in which there was also ex-ante a disadvantage, i.e. in our example  $S$  for candidate 1. By spending heavily it might be possible to change comparative advantages. Therefore, the logic that spending on one's disadvantage has additional costs applies to the equilibrium disadvantage, that is the disadvantage taking campaigning into account.

From the first order conditions we can derive the following condition, which has to hold in any interior equilibrium:

$$E_\Omega \left[ \frac{w_v}{\frac{\partial w_v}{\partial x_1^H}} \right] E_{\Theta^H \times \Theta^S} \left[ \frac{\partial c_v^H}{\partial x_1^H} + \frac{\partial c_v^H}{\partial x_2^H} \right] = E_\Omega \left[ \frac{(1 - w_v)}{\frac{\partial w_v}{\partial x_1^S}} \right] E_{\Theta^H \times \Theta^S} \left[ \frac{\partial c_v^S}{\partial x_1^S} + \frac{\partial c_v^S}{\partial x_2^S} \right] \quad (13)$$

This equation is fundamental for the analysis. Since the derivatives of the importance weight in the denominator have opposite signs, it follows that the second expectation on each side –



the derivative of the policy evaluation – must have opposite signs or be both zero. This implies the following lemma:

**Lemma 1.** *Assumptions 1, 2, and 3 hold and  $\gamma$  is sufficiently low. In any equilibrium it must hold that*

$$\text{Sign} [x_1^H - x_2^H] = -\text{Sign} [x_1^S - x_2^S].$$

*Proof.* See appendix. □

What does this now mean for the equilibrium of the game? It tells us that either each candidate must spend more on one issue than her opponent, and less than her opponent on the other, or both spend an identical amount on each. It does not yet, however, tell us under which conditions that is the case. Proposition 1 provides these conditions.

**Proposition 1.** *Assumptions 1, 2, and 3 hold and  $\gamma$  is sufficiently low.*

- *Complete convergence exists if and only if candidates do not have comparative advantages,  $\Delta^\theta = 0$ . If in addition  $E_\Omega [\omega_v] = \frac{1}{2}$ , a perfectly symmetric equilibrium exists in which each candidate spends identical effort on each issue,  $x_j^i = \bar{x} > 0$  for all  $i, j$ .*
- *If  $\Delta^\theta \neq 0$ , and hence candidates have comparative advantages, there is always some degree of divergence.*

*Proof.* See appendix. □

A perfect convergence equilibrium may only exist if candidates have no comparative advantages. Then each candidate spends identical effort on issue  $i$ .<sup>11</sup> If, in addition, issues are of identical ex-ante importance on average, there exists a perfectly symmetric equilibrium. However, as soon as there are comparative advantages, symmetric equilibria cannot exist anymore. To see why this must be the case, assume such an equilibrium would exist even when there are comparative advantages. Then, by definition of comparative advantages and symmetric equilibria,  $\Delta^c \neq 0$ . Changing the relative weights of the issues has an effect on the winning probabilities at the margin, and this effect goes in opposite directions. Hence, since the marginal

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<sup>11</sup>If  $E[w_v] = E[\theta_v^H] = E[\theta_v^S] = 1/2$ , there may actually be a continuum of equilibria, in which also divergence may occur. In this case  $x_1^i = x_2^{-i}$ . Here I focus on the symmetric equilibrium.

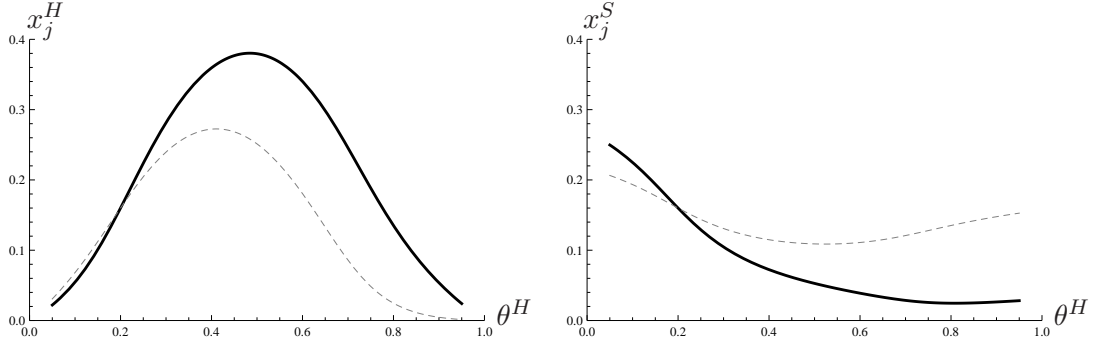


Figure 1: Equilibrium spending of 1 (solid line) and 2 (dashed line) in the different issues as  $\theta^H$  varies, where  $\bar{f}(x) = \frac{1}{200} + x$ ,  $\bar{g}(x) = \frac{1}{2} + x$ ,  $\theta^S = \frac{1}{5}$ ,  $\omega = \frac{1}{2}$ , and  $\gamma = \frac{1}{2}$ . It is easy to see that when 1 has a comparative advantage in  $H$ ,  $\theta^H > \frac{1}{5}$ , he publishes more ads than 2 on  $H$  (left panel) and less on  $S$  (right panel). Since  $\omega = \frac{1}{2}$ , at  $\theta^H = \theta^S = \frac{1}{5}$ , there is complete convergence.

effect of buying TV ads on platform evaluation in an issue is identical in a symmetric equilibrium, this cannot be an equilibrium, because there are profitable deviations. There must be some degree of divergence in equilibrium and a weak version of the dominance principle holds.

Note at this point that so far the assumption that voters have different priors did not play an important role for the results. In fact, all results so far and all the results that come in the remainder of the paper are independent of this assumptions. To avoid unnecessary notational baggage, during the remainder of the paper I will use a reduced form of the model in which  $\Theta^i \rightarrow \theta^i$  as well as  $\Omega \rightarrow \omega$ , which represents a situation in which all voters have identical priors. This will not change results in any meaningful way.

If there is divergence, candidates specialize on an issue in the campaign. In principle it might happen that candidates in equilibrium specialize against their ex-ante comparative advantage. For example, in a recent study Denter and Sisak (2012) show that if campaigning is relatively effective there can be multiple equilibria and in some advantages change in expectation. However, if that is the case it must hold that the issue a candidate specializes in is the issue in which he has an ex-post comparative advantage, i.e. taking into account campaigning. When a candidate has a significant ex-ante advantage in a given issue, he would have to spend a lot to turn his comparative advantage. Depending on marginal costs of TV ads, this may not be worthwhile and thus when marginal costs are high and  $\Delta^\theta \neq 0$ , i.e. there are ex-ante comparative advantages, candidates specialize accordingly. Similarly, if ex-ante comparative advantages are sufficiently large or political advertising does not have a very strong effect on

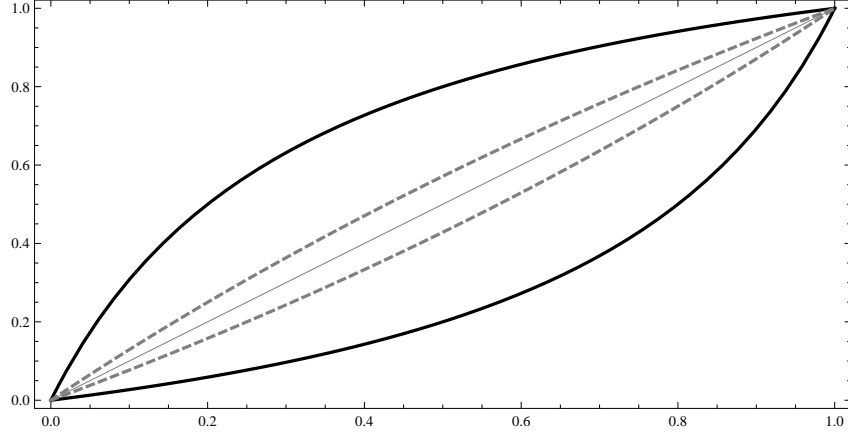


Figure 2:  $R = 1/4$  (black, solid) and  $R = 3/4$  (gray, dashed). If (but not only if)  $\theta^H$  lies outside the elliptic region between the solid curves, candidates specialize on their comparative advantages. If  $R$  becomes smaller (larger), the elliptic region becomes larger (smaller). In the limit, as  $R \rightarrow 1$ , the region converges to the straight line with  $\theta^H = \theta^S$ .

voters' policy assessment, candidates will specialize in this direction:

**Proposition 2.** *If (but not only if)*

$$\theta^H \notin \left( \frac{R\theta^S}{1 - (1 - R)\theta^S}, \frac{\theta^S}{R + (1 - R)\theta^S} \right),$$

where  $R := f(0)/f(x^{max})$  and  $x^{max}$  is the maximal not strictly dominated amount of TV ads bought for an issue, candidates specialize in their ex-ante comparative advantages.

*Proof.* See appendix. □

This result is a sufficient condition only. The intuition is straightforward. When both candidates would focus completely on the issue they are disadvantaged in, but this is not sufficient to turn the comparative advantage, then this cannot be an equilibrium, also in the weaker form where they do not focus solely on this issue. Thus, in equilibrium candidates must focus on their ex-ante comparative advantages. The underlying intuition is that when advertising a policy platform only has a relatively weak impact on candidate evaluation, it is not possible to turn the electorate's ranking.

So far I have shown conditions under which there is convergence or divergence in the campaign, the extent of divergence, and under which conditions ex-ante advantages must persist throughout the campaign. An interesting questions I did not yet address is whether candidates

might highlight the issue of their disadvantage more than the issue in which they have an advantage. For example, in 2008 both Mr. Obama and Mr. McCain spend large amounts of their money on the issue ‘Energy/Gas’. In fact, it was the most important issue in McCain’s campaign and the second most important in the campaign of Obama (they spend 25.0 respectively 14.8 percent of their money on TV ads on that issue<sup>12</sup>). Of course, it is not possible that both have a comparative advantage in ‘Taxes’, so it is interesting to see whether the model can explain such a scenario. The following proposition provides an answer:

**Proposition 3.** *Assumptions 1, 2, and 3 hold and  $\gamma$  is sufficiently low. If  $\omega(1-\omega)$  is sufficiently low, both candidates spend more on one issue than on the other. Formally,*

$$\min \{x_1^i, x_2^i\} > \max \{x_1^{-j}, x_2^{-j}\}.$$

*Proof.* See appendix. □

This result has a straightforward interpretation. If one issue is much more important than the other, small changes in the assessment of the policy in this issue have a large impact. Hence, both candidates will spend a lot campaigning in this issue. Such a case is more likely the less pronounced are comparative advantages. Note that this is completely at odds with the predictions of the dominance principle. However, it is in accord with empirical evidence. For example, in 2008 the issue was of great importance: according to a USA Today/Gallup poll from June 2008, 90 percent of voters found the issue ‘Energy/Gas’ to be either extremely or very important, which makes it the second most important issue in the eyes of voters. Even though Mr. Obama was perceived to be more competent on the issue – 47 percent of survey respondents found him to be more competent, while Mr. McCain was picked by only 25 percent – it was one of the most important issue in both candidates’ campaigns.<sup>13</sup> This is well in accord with the predictions of the model.

If an issue is very important, a candidate may well put the highest emphasis on an issue in which he has a disadvantage. Together with Proposition 1 this implies the following profile of communication strategies in equilibrium:

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<sup>12</sup>Numbers were calculated using data from an online archive of the New York Times: <http://elections.nytimes.com/2008/president/advertising/issues/1435-taxes>.

<sup>13</sup>For the survey data see the June 15-19, 2008 USA Today/Gallup poll on that subject: <http://www.gallup.com/poll/108331/obama-has-edge-key-election-issues.aspx?version=print>.

**Corollary 1.** *Assumptions 1, 2, and 3 hold and  $\gamma$  is sufficiently low. If  $\omega(1-\omega)$  is sufficiently low,*

$$x_j^i > x_{-j}^i > x_{-j}^{-i} > x_j^{-i}.$$

*Hence, the variance of spending is lower for the candidate who is disadvantaged in the important issue.*

*Proof.* This follows immediately from Propositions 1 and 3. □

The corollary gives another testable prediction of the model. When there is a dominant issue the spending profile of the candidate that owns this issue has a larger variance than his opponent's profile. In other words, the candidate that is weak in the relatively important issue will have a more balanced communication strategy, while his opponent's strategy puts a lot of focus on one issue.

A question that is related to the last two results is which is the dominant issue during the campaign. We have already seen that if one issue is ex-ante very important compared to the other, than this will be the most important issue also in the campaign contest. However, is it also possible that an issue is more prominent than another even if voters' believe it is less important? The next proposition shows that this might well be the case:

**Proposition 4.** *Assumptions 1, 2, and 3 hold and  $\gamma$  is sufficiently low. Let  $\omega(1-\omega)$  be relatively large but smaller than  $1/4$ . That is, there exists a most important issue but the difference is not too big. Without loss of generality let  $\omega > 1/2$  such that  $H$  is the ex-ante most important issue. Then, if  $\theta^S(1-\theta^S)$  is sufficiently large compared to  $\theta^H(1-\theta^H)$ , the less important issue  $S$  will dominate the campaign in the sense that the total number of TV ads published on  $S$  exceeds the total number of TV ads on  $H$ .*

*Proof.* See appendix. □

This result may be surprising at first glance. After all, the electorate cares more about one issue than about the other, but this will not be represented in communication strategies: candidates focus on another issue. Why can such a scenario happen? It is clear that – everything else kept equal – a more important issue receives more publicity. However, we have also seen that creating salience for one's weak issue is detrimental. If, then, in the less important issue

the electorate is relatively undecided and in the other issue one candidate has a clear advantage, the candidate who's comparative advantage is in the less important issue has strong incentives to put this issue in the spotlight. Thereby, he exerts competitive pressure on her opponent also to direct time and money to campaign on that issue. An example from the 2008 campaign showing such a situation are the issues 'Taxes' and 'Health care'. The latter was considered to be more important – 80 percent of poll respondents classified it as either important or extremely important compared to 72 percent for 'Taxation'. John McCain was considered more competent in handling health care issues by 18 percent of the electorate, while only 40 percent favored Barack Obama, giving the clear advantage to him. In the less important issue 'Taxation' the electorate was split almost equally, and Mr. Obama had only a marginal advantage over his adversary, 33 percent vs. 27 percent, and 40 percent did not favor any candidate over the other. In accordance with the proposition taxation proved to be the far more important issue in the campaign. In fact, it was the issue that candidates spent most of their money on in the campaign.

## 4 A campaign with $n$ issues

If there are more than just two important issues, comparative advantages are not defined as clearly as before. In particular, there might be an issue in which neither candidate has a comparative advantage. The main purpose of this section is to show that Proposition 1 holds more generally.

Assume the set of issues is  $I = \{I^1, \dots, I^n\}$ . Candidates' competence or the popularity of their policies is given by  $\Theta = \{\theta^1, \dots, \theta^n\}$  and issue weights are  $W = \{\omega^1, \dots, \omega^n\}$ . The technology of campaigning is as above and existence of equilibrium follows from a similar proof than in the two-issues case before. I hence omit the formal proof.

Candidates maximize

$$\begin{aligned}\pi_1 &= \sum_{i \in I} c^i w^i - \gamma \sum_{i \in I} x_1^i, \\ \pi_2 &= \sum_{i \in I} (1 - c^i) w^i - \gamma \sum_{i \in I} x_2^i.\end{aligned}$$

In the campaign with two issues only we compared the relative popularity of the two policies

and the issue in which a candidate fared better was his comparative advantage. With more than two issues it is not that clear anymore how to define comparative advantage. However, intuitively it should relate the popularity of a policy with some measure of popularity of all the other policies. The more the voters like a candidate's policy in an issue, the more likely it should be that he has a comparative advantage, keeping everything else constant. Both of these things are fulfilled with the following definition:

**Definition 1** (Comparative Advantages). *Candidate 1 has a comparative advantage in issue  $i$  if*

$$\sigma^i \equiv c^i - \frac{\sum_{k \neq i} c^k w^k}{1 - w^i} > 0.$$

*If  $\sigma^i < 0$  candidate 2 has a comparative advantage in that issue. If  $\sigma^i = 0$ , no candidate has a comparative advantage in  $i$ .*

Comparative advantage is determined by a comparison of a policy's popularity with a weighted average of all the other policies'. This is a generalization of the definition of comparative advantage above and yields the same result if  $n = 2$ . It is clear from the definition that the more popular a candidate's policy in an issue, the more likely it is that he has a comparative advantage there. Few simple manipulations reveal that  $\sigma^i > 0 \Leftrightarrow c^i > \sum_j w^j c^j$ . Thus, if we compare two issues  $i$  and  $j$  with  $c^i < c^j$ , it cannot be the case that  $\sigma^i > 0$  but  $\sigma^j < 0$ . If the issue with the more popular policy is not a comparative advantage, then the issue with the less popular policy is neither. In other words: if a candidate has a comparative (dis-)advantage in an issue, all issues in which the policy is relatively more (less) popular must also be comparative (dis-)advantages:

**Lemma 2.** *Let without loss of generality  $c^1 \geq c^2 \geq \dots \geq c^n$ . If  $\sigma^i > 0$ , all  $\sigma^j > 0$  for  $i \leq j$ . If  $\sigma^i < 0$ , all  $\sigma^j < 0$  for  $i \geq j$ .*

*Proof.* Follow from the above discussion. □

The lemma implies that in principal it is sufficient to find the 'marginal' issue, the one with the smallest  $|\sigma|$ , to determine all other comparative advantages. Of course, as before each candidate must have at least one comparative advantage or no candidate has one:

**Lemma 3.** *Let without loss of generality  $c^1 \geq c^2 \geq \dots \geq c^n$ . If  $c^1 > c^n$ , candidate 1 has a comparative advantage in issue 1,  $\sigma^1 > 0$ , and a comparative disadvantage in issue  $n$ ,  $\sigma^n < 0$ . If  $c^1 = c^n$ , no candidate has a comparative advantage and  $\sigma^i = 0$  for all  $i$ .*

*Proof.* See appendix. □

That lemma is very intuitive and needs no more explanation. The central question is now if we can find a relation between comparative advantages and relative spending on the issues as before. Intuition suggests that as before the candidate with a comparative advantage in an issue will spend more on it as the contender. If no candidate has a comparative advantage both spend the same. That is indeed the case:

**Proposition 5.** *Assumptions 1, 2, and 3 hold and  $\gamma$  is sufficiently low. A candidate spends more than his opponent on an issue iff he has a comparative advantage as defined in Definition 1. If no candidate has a comparative advantage in an issue, both spend the same amount on it. Formally:*

$$\text{Sign}[x_1^i - x_2^i] = \text{Sign}[\sigma^i]$$

*Proof.* See appendix. □

The proposition generalizes Proposition 1 to the general case with  $n$  policy issues. Candidates invest heavier than their opponents in issues in which they have comparative advantages; there is at least some divergence. If candidates do not have comparative advantages in an issue, both direct the same amount of time and funds to it and there is complete convergence. Hence, candidates may converge on a subset of issues and diverge on others. Complete convergence as before is only possible if there are no comparative advantages whatsoever.

Note that as in the previous section comparative advantage is defined ex-post, that is taking into account campaigning. However, a similar argument as in Proposition 2 can be made to relate ex-ante and ex-post comparative advantages. In most numerically calculated equilibria ex-ante comparative advantages are very good predictors of spending profiles and differences from ex-post comparative advantages are small. Figure 3 shows an example.



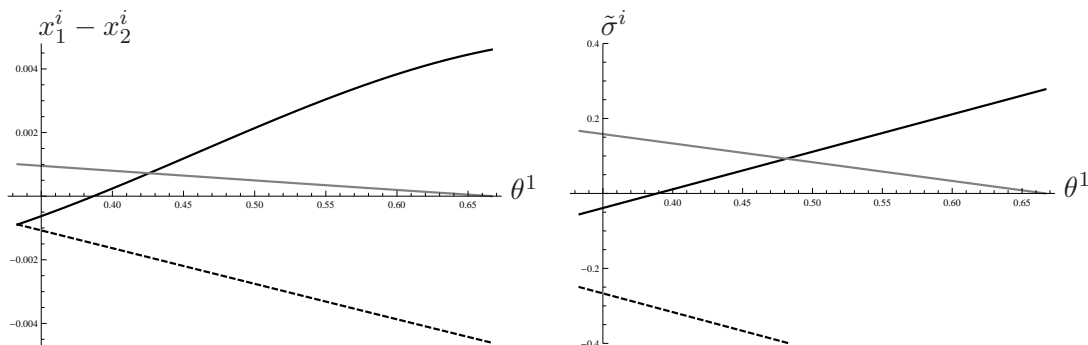


Figure 3: Differences in efforts in issue  $i$  (left) and ex-ante comparative advantages  $\tilde{\sigma}^i$  (right) as a function of  $\theta^1$ . Parameters:  $\theta^2 = 1/2$ ,  $\theta^3 = 1/3$ ,  $\omega^1 = 2/5$ ,  $\omega^2 = 1/5$ ,  $\gamma = 1$ ,  $f(x) = (\frac{1}{200} + x)^{\frac{8}{9}}$ , and  $(2 + x)^{\frac{8}{9}}$ . We can clearly see that Actual spending differences follow quite similar trajectories than the ex-ante comparative advantage. This is robust for other parameter values.

## 5 Neglecting issues

In real campaigns often a subset of issues does not get the candidates' attention and is neglected by one or both candidates, which is then an example of Riker's dispersion principle. For example, in the US inequality is usually not a big topic in political discussions and campaigns, although it has been argued that inequality is severe and as such an important problem for society.<sup>14</sup> Other examples from the 2008 campaign are 'Gun control' and 'Union', that were neglected by both candidates altogether.<sup>15</sup> So far I did not study this phenomenon in detail. We have seen in the last section that some issues can be neglected by both in pure priming campaigns. In this section I am interested in digging a little deeper and to find conditions under which this is likely to happen. In other words, given marginal costs and the technology of persuasion, for which  $W$  and  $\Theta$  will an issue be more likely neglected?

Because we now have to deal with corner equilibria it is helpful to identify the different reasons for why spending on an issue might be low or zero. In a first step I thus show how the different channels – issue priming and policy advertising – affect spending on an issue. Hence, I first look at a pure priming campaign, that is a campaign in which policy advertising is ineffective. Then I turn to a campaign in which only policy advertising has an effect but priming is ineffective.

<sup>14</sup>See Piketty and Saez (2003) and Saez (2012) for studies on inequality in the US. Recent articles addressing the missing politics of inequality in the US are Lowrey (2012) or Lemann (2012).

<sup>15</sup>See <http://elections.nytimes.com/2008/president/advertising/index.html>.

**An advertising campaign.** Assume first candidates' efforts only influence voters attitude towards candidates in the different issues. Thus, campaigning serves the advertising purpose only and  $g'(x) = 0$  holds. What are the implications then for communication strategies?

**Comment 1.** *Assumption 1 holds and  $g'(x) = 0$ . In equilibrium there is always complete convergence. That is, candidates publish exactly the same amount of TV ads on every issue,  $x_1^i = x_2^i$  for all  $i \in I$ . Spending on an issue increases as*

- $\omega^i$  increases,
- and as  $\theta^i(1 - \theta^i)$  increases.

*Proof.* See Snyder (1989). □

If campaigning is only policy advertising and priming does not play a role, there is complete convergence. Hence, candidates put exactly the same emphasis on all issues. As the issue's importance decreases or one candidate's (absolute) advantage increases, spending declines. For given  $\gamma$ , at one point spending reaches zero.

**A priming campaign.** Assume now candidates' efforts only influence voters assessment of issues' relative importance. Thus, campaigning serves the priming purpose only and  $f'(x) = 0$  holds. What are the implications for communication strategies now?

**Comment 2.** *Assumption 2 holds and  $f'(x) = 0$ .*

- *Candidates never publish TV ads on issues in which they have a comparative disadvantage or in which no candidate has a comparative advantage.*
- *Candidates never direct attention to the same issue.*
- *When comparative advantages are small an issue will be neglected. If all comparative advantages are small all issues will be neglected.*

*Proof.* See appendix. □

In a pure priming campaign there is complete divergence on all issues that candidates address. However, some issues may be neglected by both. Hence, in this extreme case the model replicates Riker's predictions. Candidates only address issues in which they have comparative advantage, but not necessarily all. Issues in which comparative advantages are relatively small will be neglected altogether.

The intuition is also straightforward: since campaigning only primes an issue, candidates want to make their strong issues salient and the opponent's strong issues less salient; there cannot be a situation in which both want to buy TV ads for the same issue. If candidates have a comparative disadvantage in an issue, priming that issue deteriorates the outlook because it makes weak issues more important and decreases the importance of strong ones. Hence, those will be muted. If candidates do not have comparative advantages there is no point to campaign in the first place, since effort is costly but cannot be useful. Hence, in that case, the issue is neglected altogether.

**Neglecting issues in general campaigns.** We have seen that in pure advertising campaigns issues will be neglected if they are relatively unimportant or if absolute advantages in these issues are pronounced. If an issue is neglected by one it will also be neglected by the contender. The predictions from the priming campaign are very different. Every issue will be neglected by at least one candidate, the candidate with the comparative disadvantage. However, if comparative advantages are not too strong, no candidate has an incentive to campaign on that issue and hence both will abstain. Comments 1 and 2 summarize conditions that are conducive for neglecting issues altogether. In this section I show now with the help of a simple example that this holds also in the general campaign.

As an example let there be two issues  $H$  and  $S$  with  $\theta^H = \theta^S = \frac{4}{5}$ . Then there is no comparative advantage and candidate 1 has a significant absolute advantage in both issues,  $\frac{4}{5} \frac{1}{5} = \frac{4}{25} = 0.16$ . From comment 2 we know that in priming campaigns that implies that the issue will be neglected. However, now there is also the policy advertising effect. Let  $\omega = \frac{4}{5}$ . Then the marginal benefit of spending on  $H$  is significantly higher than the one from spending on  $S$ . Assume  $\gamma = 1$ . If then  $\frac{16}{125} \geq \frac{f(0)}{f'(0)} \geq \frac{4}{125}$ , both candidate will spend effort only on  $H$  and neglect  $S$ . If  $\frac{16}{125} < \frac{f(0)}{f'(0)}$  there will be no campaign whatsoever. This holds more general:

**Proposition 6.** *Assumptions 1, 2, and 3 hold. Assume  $\theta^1 = \theta^2 = \dots = \theta^n = \theta$ , such that candidates have no comparative advantages. Focus on symmetric equilibria. If*

$$\frac{\theta(1-\theta)\overline{w}^i}{\gamma} \leq \frac{f(0)}{f'(0)},$$

*where  $\overline{w}^i$  is the maximal value that  $w^i$  can take on through campaigning, issue  $i$  is neglected altogether,  $x_1^i = x_2^i = 0$ .*

*Proof.* See appendix. □

In this scenario the least important issues are the most likely ones to be neglected, which is plausible. Of course, if  $\gamma$  becomes too large all issues will be neglected independent of comparative advantages, but this is a trivial observation. If comparative advantages are sufficiently small a condition similar to that Proposition 6 is sufficient for issues to be neglected altogether. That is then an example of Riker’s dispersion principle. Of course, the dominance principle may also hold in certain situations, and conditions that are conducive for such a situation are described in Comment 2. However, note that the empirically most relevant case is that actually none of the principles holds as long as issues are not of negligible importance. Instead, issue trespassing or issue stealing, i.e. a situation in which both candidates buy TV ads on all important issues, is more relevant in communication strategies (see, e.g., Damore (2004, 2005) or Sigelman and Buell (2004)).

## 6 Some evidence: Descriptive statistics from the 2008 presidential campaign

In this section I discuss the predictive power by way of an example of some descriptive statistics from the 2008 presidential campaign.<sup>16</sup> The data concerning issues’ importance and candidates’ assigned competence / popularity in the issues were provided by a Gallup/USA Today survey

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<sup>16</sup>Of course, all the evidence I present is merely anecdotal. There are many problems with the data at hand. First, a number of issues are missing, for example ‘International affairs’, which received quite some attention during the campaign. These missing issues may change comparative advantages and also have an influence on spending. Second, the definition of the variables in the survey and in the archive differ sometimes. For example, ‘Terrorism’ as it exists in the survey does not exist in the archive. This complicates matters additionally. Third, while data in the survey and the archive are aggregates for the US, composition in the different states may actually differ significantly. Hence, all presented numbers have to be interpreted with caution.

from June 2008. Figure 4 provides an overview. The most important issues as considered by the electorate were ‘Economy’, ‘Energy and gas’, ‘Iraq’, and ‘Health care’. With the exception of ‘Iraq’, where the electorate was undecided, Obama held absolute advantages in all of these. ‘Terrorism’, ‘Taxes’, ‘Moral values’, and ‘Immigration’ were also considered important, but not quite as much. In those issues Obama’s dominance was not as clear anymore, and McCain held absolute advantages in the issues ‘Terrorism’ and ‘Immigration’, while Obama had advantages in the other two.

Theory has told us to look not for absolute but for comparative advantages. So let us try to determine comparative advantages. To come up with – admittedly fuzzy – approximations of relative issue importance and relative policy popularity I use the following transformations to create an indices:

$$\omega^i = \frac{(o^i)^r}{\sum_k (o^k)^r}$$

and

$$\theta^i = \frac{(t_O^i)^h}{(t_O^i)^h + (t_{MC}^i)^h}$$

$o^i$  is the share of the electorate that considered issue  $i$  to be either very important or important.  $r$  determines how differences in the shares effect issue weights. If  $r > 1$ , differences in the reported shares will be amplified, while the opposite is the case if  $r < 1$ . I used  $r \in \{\frac{1}{2}, 1, 2\}$  but report  $r = 1$  only.  $t_j^i$  is the share of the electorate that considered  $j$  to be more important.<sup>17</sup>  $h$  is again a parameter determining how differences in the survey translate into differences as studied in the model. I used  $h \in \{\frac{1}{2}, 1, 2\}$  but report only  $h = 1$ . The choice of parameters does not have an impact on comparative advantages except in ‘Taxes’, where the comparative advantage is generally very close to zero.

Now we can use Definition 1 to determine ex ante comparative advantages (Table 1). While Obama had absolute advantages in most issues, McCain had comparative advantage in four out of eight. The clearest comparative advantages were ‘Health care’, where was Obama dominated, and ‘Terrorism’, which was McCain’s stronghold. Note that while Obama had an absolute advantage on five issues and McCain only on two, both have comparative advantages in four issues. That means, while Obama owned five issues and McCain only two, comparative

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<sup>17</sup>Taking instead only the share that considered  $i$  very important or also taking into account that some voters were indifferent between the candidates does not change results in any meaningful way.

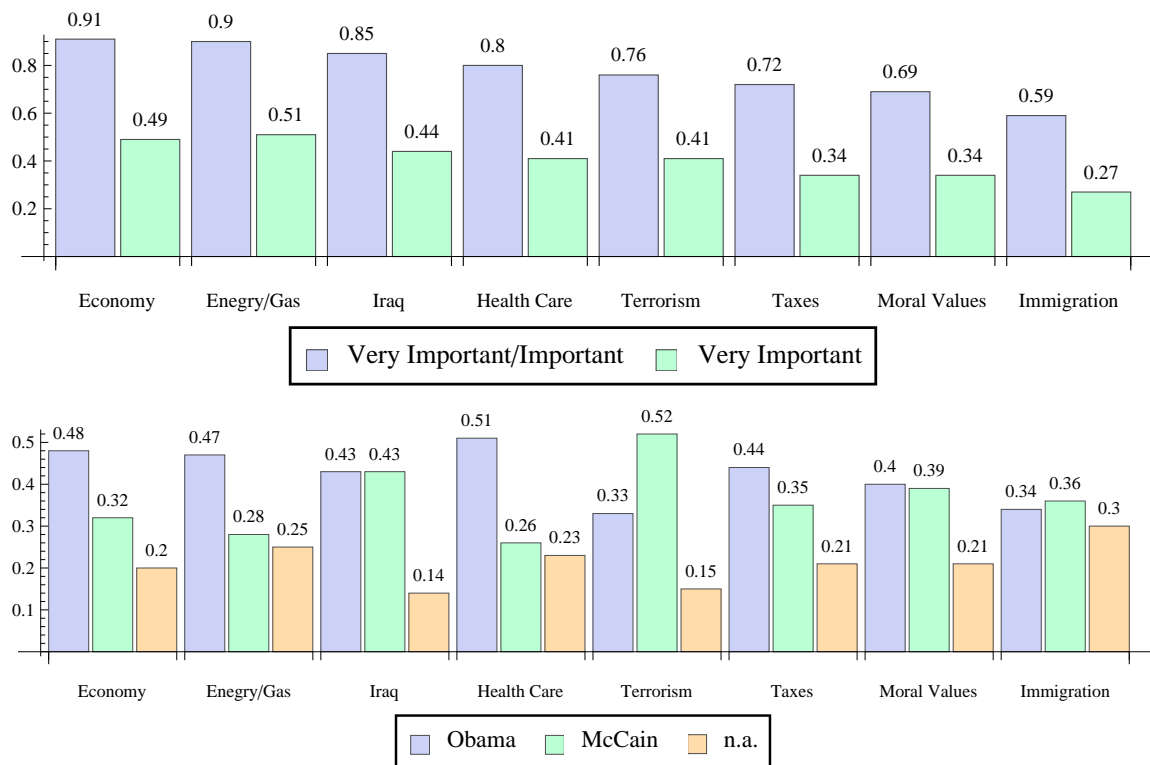


Figure 4: In the upper panel you see the fraction of voters considering the issue as ‘very important’ or either as ‘very important’ or ‘important’ (0.91 = 91 percent), in the lower panel you see the fraction of voters considering candidate  $j$ ’s position / competence as being superior. Source: <http://www.gallup.com/poll/108331/obama-has-edge-key-election-issues.aspx>.

advantages suggest either candidate should specialize in four of them. In the issue ‘Taxes’, in which it seemed that Obama had a notable advantage, his comparative advantage is very small, the smallest comparative advantage among the eight issues and close to zero. This means that in that issue it is more likely than in the others that comparative advantages change due to campaigning. This is even more likely to be the case since Obama had advantages in the key issues, which have a higher weight in the determination of comparative advantages. Hence, if Obama campaigned intensively on ‘Economy’, ‘Energy/Gas’, or Health care’, the advantage might well change.

A problem with applying the model to the campaign is that candidates had different budgets. Obama collected significantly more funds than his republican contender John McCain. Hence, he may spend more on all issues. However, this is not a big problem, because the general intuitions from the model remain valid. I follow Sigelman and Buell (2004) and consider the

| Issue $i$      | $\sigma^i$ (r=1,h=1) | Comparative advantage |
|----------------|----------------------|-----------------------|
| The economy    | 0.053                | Obama                 |
| Energy and gas | 0.070                | Obama                 |
| Iraq           | -0.040               | McCain                |
| Health care    | 0.104                | Obama                 |
| Terrorism      | -0.148               | McCain                |
| Taxes          | 0.011                | Obama                 |
| Moral values   | -0.033               | McCain                |
| Immigration    | -0.049               | McCain                |

Table 1: Ex ante comparative advantages.

shares of their total spending that candidates devoted to the different issues instead of absolute amounts. I compare those shares to the predictions of the model as discussed above and it will become apparent that the predictions are quite good.

**Specialization** The theory predicts that candidates emphasize issues in which they have comparative advantage. As we have seen in Proposition 2, if comparative advantages are sufficiently large ex ante and ex post comparative advantages coincide. At the same time, a small ex ante comparative disadvantage might be turned into an advantage during the campaign. Hence, theory predicts that from the eight issues mentioned above Obama put the highest emphasis on ‘Economy’, ‘Gas and energy’, ‘Health care’, while McCain puts relatively more emphasis on ‘Iraq’, ‘Immigration’, ‘Terrorism’, and ‘Moral values’. ‘Taxes’ is too close to make a clear prediction, but either candidate may spend marginally more than his contender.

Unfortunately, spending categories were sometimes defined differently by the New York Times archive than by Gallup. For example, the issue ‘Moral values’ does not exist in the archive and ‘Energy and gas’ exists only on a different level of aggregation, ‘Energy and environment’ and ‘Gas and oil’. While the missing of the category ‘Moral values’ does not permit an analysis, the differently defined categories make that category much more fuzzy, because it includes in either subcategory something that is not part of the definition of the variable in the Gallup / USA today survey, ‘Environment’ and ‘Oil’. While the ‘Environment’ part is likely to be favoring Obama the opposite holds for ‘Oil’, where the republicans – often heavily backed by the oil industry – should have advantages. A similar problem exists with the issue ‘Terrorism’. The most similar spending category is ‘National defense’, which I will use as a correlate. Finally,

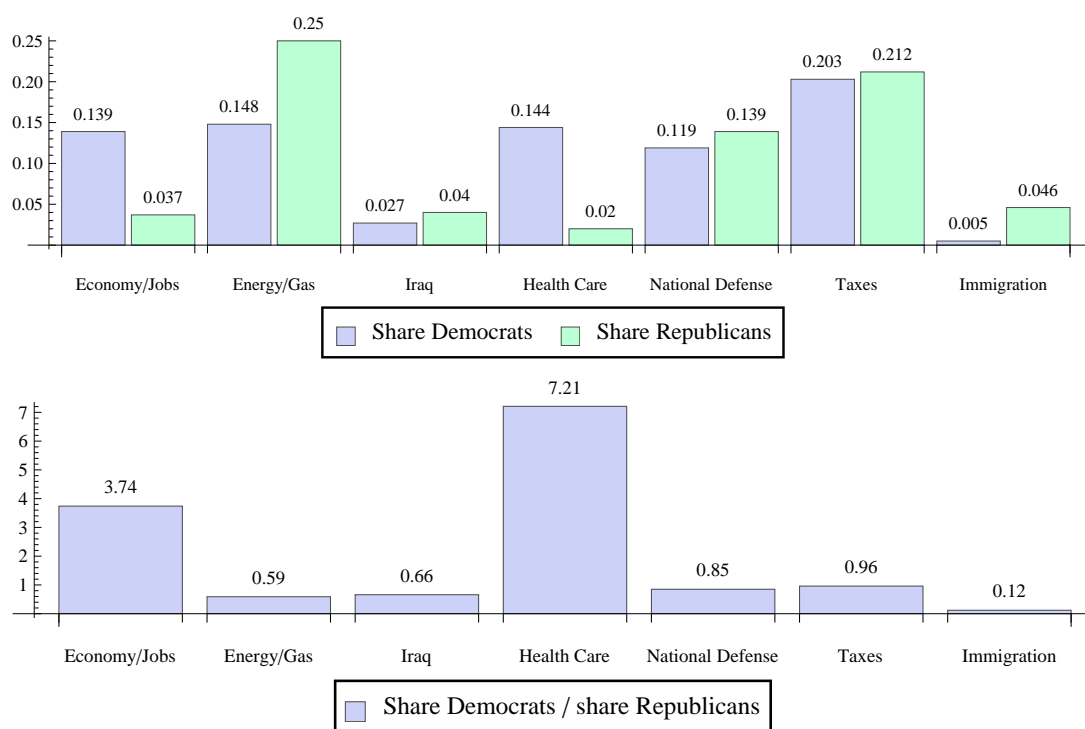


Figure 5: Share of total expenditure devoted to issue  $i$  by candidate  $j$  ( $0.139 = 13.9$  percent) in the upper panel and the ratio of shares in issue  $i$  in the lower panel.

also the issue ‘Economy’ does not exist, but the probably very similar issue ‘Jobs’ exists and I will use this instead. But note again that in these categories the absolute advantages as well as the relative importance may be (somewhat) different than in the survey, especially in ‘Energy and gas’, and reported statistics have to be interpreted with caution.

Figure 5 shows candidates’ spending profiles and the ratio of the shares of their budgets they devoted to the issues. As we can see the above prediction cannot be refuted for any issue but ‘Energy and gas’, where Obama had a comparative advantage but McCain clearly spend more in relative terms. However, this is a variable where we expected to have some trouble for the discussed reasons. Additionally, the oil industry traditionally lobbies the Republican Party much stronger than the Democrats, with an advantage in contributions of 3 : 1 in the last decades.<sup>18</sup> This may also make up for a big part of the discrepancy. For all the other issues comparative advantages are well in line with observed spending profiles. Obama’s largest comparative advantage was ‘Health care’ and he devoted much more attention to that issue than

<sup>18</sup>See for instance <http://www.opensecrets.org/industries/indus.php?ind=E01>.



his opponent. The ratio of the budget shares is 7.2:1. ‘Economy’ (or ‘Jobs’ for that matter) is also clearly a comparative advantage of Obama and we see that in the statistics. ‘Taxes’ was very close and both candidates devoted a similar share of their budgets to that issue, with McCain putting marginally more emphasis on it (0.9 percentage points). All other issues were McCain’s comparative advantage and he also devoted more attention to those. Hence, although we have to interpret the statistics with care, they clearly do not refute the theory.

Note that these statistics also seem to be in line with Proposition 3, which said that in some situations – even when candidates have comparative advantages – both candidates may put higher emphasis on one issue than on another. This is something that could not happen according to Riker (1996), because candidates would either completely neglect an issue or only one candidate spends a positive amount on it. In Figure 5 we can see some evidence that this may well be the case. For example, ‘Taxes’ received more attention by both candidates than ‘Health care’, which in turn received more attention by both than ‘Immigration’.

**Most important issues in the campaign** Theory suggests that the most important issues in the mind of voters do not need to be the most important issues in the campaign. In Comments 1 and 2 we have seen conditions that are conducive for issues to be neglected. Of course, from this we can also directly learn conditions that are likely to have the opposite effect: to increase emphasis. Of course, a higher ex ante importance is likely to increase an issue’s importance also in the campaign, but that does not imply that issues can be ranked by that criterion. The size of candidates’ advantages also plays a crucial role as we have seen in Proposition 4. In particular, if  $\theta^i(1 - \theta^i)$  is large, candidates are likely to put more emphasis on that issue because the policy advertising effect becomes stronger.

What was the issue that received the most attention during the campaign? In Figure 6 we see the issues ranked by candidates’ aggregate spending shares. Although it was only the sixth most important issue ex ante, ‘Taxes’ came out ahead as the most important issue of the 2008 campaign, receiving more than 20 percent of all funds. In that issue comparative advantages were small and Obama’s absolute advantage was also not very large. The issues ‘Energy and oil’ and ‘Economy’ were both more important from an ex ante perspective, but absolute advantages were larger as well. These issues follow on positions two and three in the ranking with shares

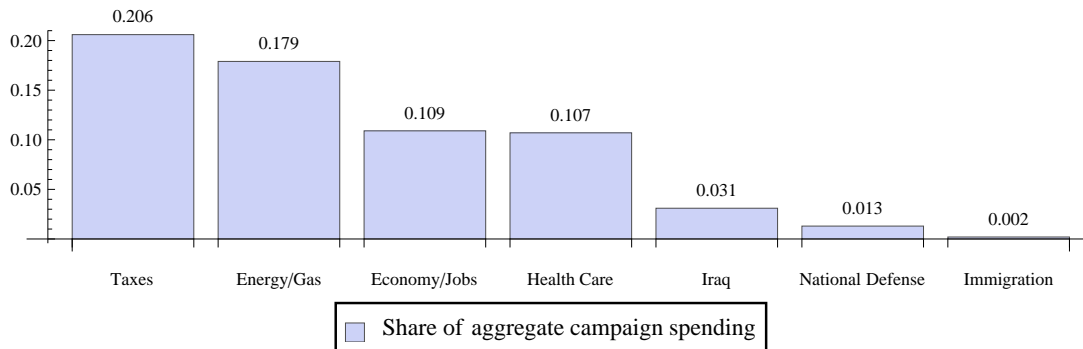


Figure 6: Issue  $i$ 's share of aggregate campaign spending ( $0.206 = 20.6$  percent). Note that some other issues, for which there are no data in the survey, were also quite important. For example, 12.95 percent of aggregate spending on TV ads were devoted to the issue 'International affairs'. However, also taking into account all issues, 'Taxes' still remains the most important issue of the campaign.

of 17.9 and 10.9 percent.<sup>19</sup>

## 7 Conclusion

In this paper I develop a formal theory of political communication in electoral campaigns, based on issue-priming and policy advertising. Within that framework I study under what conditions candidates' communication strategies converge or diverge, which issues dominate the campaign and how candidates' allocate their money and time to the different issues. I discuss how the model helps to understand behavior in political campaigns, using the 2008 campaign between Barack Obama and John McCain as an example.

The fundamental mechanism driving the results is relatively straightforward. If a candidate has a comparative advantage in a given issue, he has a stronger incentive to publish TV ads on that issue (or highlight the issue in some other form) than his opponent. Highlighting an issue is for both beneficial in the sense that advertising makes the voters value a candidate's competence or position higher. However, priming is only beneficial when a candidate has a comparative advantage, and it hurts otherwise. Hence, the priming effect drives a wedge between candidates' incentives to campaign on an issue. However, depending on the relative strength of issue advertising and priming, a candidate may well publish TV ads on all possible

<sup>19</sup>But note again the problems with the definition of 'Energy and gas' and the influence of the oil industry, which may make up for a large part of the difference to 'Economy'.

issues. The reason is that if a candidate abandons an issue in which he has a comparative disadvantage when policy advertising is relatively efficient, the opponent may gain a lot in voters' support through advertising on that issue. Thus, neglecting the issue and leaving the field to the opponent is often not beneficial.

The paper is the first formal generalization of the seminal model of campaign rhetoric due to Riker (1996). In particular, in case of a pure priming campaign the model's predictions roughly resemble his predictions, the dominance and dispersion principle. But, as I have discussed before, these principles cannot explain actual behavior in political campaigns, as has been noted repeatedly by empirical scholarship, e.g. Sigelman and Buell (2004), Damore (2004, 2005), or Green and Hobolt (2008). Taking into account the policy advertising motive allows to rationalize empirically observed behavior and gives more accurate predictions of actual campaign communication strategies. Anecdotal evidence, as presented in Section 6, supports this assertion.

Apart from political campaigns, the model may be applied to other interesting phenomena. An immediate field of application is advertising on goods markets when products have multiple relevant characteristics, for example in the sense of Lancaster (1966).<sup>20</sup> While there exists a large literature analyzing persuasive advertising, see for example the recent survey by Bagwell (2007), the issue of multiple product features has not received much attention so far. An important exception is the article by Johnson and Myatt (2006). There the authors show that advertising attributes rotates demand instead of shifting it, and show that such a marketing strategy is optimal only when the firm wants to serve a niche market. However, they do not consider the possibility of endogenously affecting the weight consumers assign to a good's attributes. Goods with multiple features include computers, cars, or smart phones to name just a few. Advertising an attribute of such goods primes consumers' by highlighting a given purpose the good can be used for, what will lead consumers to give that purpose a higher weight. Of course, the normal advertising effect is still existent and a firm has to face the discussed trade-off and adjust the advertising strategy accordingly. As an example one can think of Apple computers vs. Microsoft Windows based computers. While in most Apple commercials style and graphical features are made salient, Microsoft Windows based computer companies often highlight the

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<sup>20</sup>Akerlof and Kranton (2000) extend this to interpersonal behavior. They do not consider goods markets but characteristics of individuals and study how these affect individuals' social identities.

computer's aptitude for business purposes. The theory advanced in this paper can explain why rational companies seek such different advertising strategies in an effort to optimally market their products.

There are some immediate directions for future research that follow from the current paper. First, it is interesting to investigate how the results change when there are more competing candidates, for example one spoiler candidate and two strong candidates. This is often the case in political campaigns and may yield interesting predictions. This step is especially important in proportional electoral systems, in which usually more than just two parties compete. A second immediate route for future research is to study candidates' dynamic incentives. A conjecture is that comparative advantages will be strengthened over time and thus that divergence in communication will increase over time. This is what we have seen, for example, in the 2008 campaign in the health care campaign between Mr. Obama and Mr. McCain. However, since campaigning also primes issues the prediction is not as clear and in some issues candidates may increasingly converge in communication strategies. Finally, it is interesting to explicitly model voters' preferences and to incorporate a platform choice decision prior to the campaign. Choosing a platform influences voters' candidate assessment in the different issues, and hence also candidates campaign strategies.

## Appendix

### A Psychological underpinnings

#### A.1 Policy advertising and the mere-exposure effect

Policy advertising is modeled as purely persuasive and assumed to be effective. This assumption is quite common and many scholars follow this approach, e.g. Snyder (1989) , and Iaryczower and Mattozzi (2012b,a). Mueller and Stratmann (1994) argue that this form of advertising is also the most important form of political advertising. Economists also frequently use models of purely persuasive advertising, which Johnson and Myatt (2006) call ‘hype’, e.g. Bühler and Halbheer (2011, 2012). See also the survey by Bagwell (2007).

The assumption of persuasive advertising is not as ad-hoc as it may seem very often, but has a deep rooting in cognitive psychology, and scholar often refer to this phenomenon as the *mere-exposure effect*, which says that “repeated exposure to an object results in greater attraction to that object” (Hogg and Vaughan, 2008), because it creates familiarity. This effect was first systematically described by Zajonc (1968). He conducted two experiments with a counterbalanced measure design that ought to establish the effect. In the first, twelve seven letter Turkish words were exposed to a number of subjects either once, twice, five times, ten times or 25 times for two seconds a time. At each exposure subjects were told how to correctly pronounce the word and asked to repeat it. The goal of the study was said to be studying the learning capabilities of subjects. At the end of the experiment subjects were told that each word was a Turkish adjective with either a positive or negative meaning and were asked to rate the goodness of the meaning on 7 point (0-6) scale. He derived a strong and statistically significant effect ( $p < 0.001$ ) of mere exposure, but with diminishing marginal effects. Because learning to pronounce may also be the reason for the effect he did the same experiment again with Chinese characters instead of Turkish words and the results very much resembled those from the first experiment.

Many authors have worked on the mere-exposure effect in very different scenarios since, e.g. Zajonc (1980, 2001), Harmon-Jones and Allen (2001), Tom, Nelson, Srzentic, and King (2007), Moons, Mackie, and Garcia-Marques (2009), and Jones (1999), and found the effect is persistent. Serenko and Bontis (2011) found strong evidence that researchers’ quality rating of

academic journals increases with exposure as well. In a meta-study of more than 200 experiments on the subject, Bornstein (1989) found that the effect is robust and positive, but also confirmed that the marginal effect of exposure is decreasing. Hence, the effect is strongest (at the margin) when individuals are completely unfamiliar with a stimulus.

What does this effect imply for policy advertising? It means that, for example, Obama repeatedly stating that the ‘Affordable Health Care for America Act’ is good for the country will increase individuals attraction to actually adopting such a policy. However, with decreasing marginal impact. Hence, we can interpret the mere-exposure effect as a psychological foundation of the persuasion technology introduced in Assumption 1.

## A.2 Priming

In psychological terms, priming is a cognitive process that activates accessible categories in the mind of a person. Exposure to a stimulus makes the related categories of the stimulus easier accessible and the categories become more important in the mind of individuals. This effect may be long lasting – up to 24 hours – and is quite subtle. People often do not realize that they were primed (see e.g. Hogg and Vaughan (2008)). Smith and Mackie (2007) put it in the following way: “[...] anything that brings an idea to mind—even coincidental, irrelevant events—can make it accessible and influence our interpretation of behavior” (page 67). In the specific example of a political campaign, priming makes an issue more salient and thus individuals evaluate the issue as more relevant for making decisions (see Iyengar and Kinder (1987) or Weaver (2007)). Priming is hence closely related to the theory of agenda setting (see for example the discussion in Willnat (1997)). In deciding between alternatives, the primed issue is still in the memory and becomes more important. Priming can hence “alter the standards by which people evaluate election candidates” (Severin and Tankard, 1997). In that sense, priming theory can be interpreted as a psychological foundation of the issue priming contest as defined in Assumption 2.

## B Technical Appendix

### B.1 Proof of Theorem 1

*Proof.* To prove existence of a pure strategy Nash equilibrium it suffices to show that strategy spaces are convex and compact and utility functions are concave and continuous. Since any effort larger than 1 is strictly dominated the relevant strategy space is  $[0, 1]^2$ , which is both convex and compact. Moreover, since  $f(0) > 0$  and  $g(0) > 0$  and  $f'(\cdot)$  as well as  $g'(\cdot)$  exist, payoffs are also continuous in all strategies. Hence, it remains to show that they are also concave. For concavity it has to hold that

$$\frac{\partial^2 u_1}{\partial (x_1^H)^2} < 0 \quad \text{and} \quad \frac{\partial^2 u_1}{\partial (x_1^H)^2} \frac{\partial^2 u_1}{\partial (x_1^S)^2} - \left( \frac{\partial^2 u_1}{\partial x_1^H \partial x_1^S} \right)^2 > 0$$

for all relevant effort combinations. I show that for  $\kappa^w$  sufficiently large this holds generally, which is then stronger than needed but analytically more convenient. Because the aim of this paper is not to show conditions that are necessary for an equilibrium to exist, but to analyze candidate behavior in equilibrium, providing a sufficient condition for an equilibrium to exist is enough for my purpose.

I will now show when the payoff functions are concave and without loss of generality, I focus on candidate 1's payoff. For candidate 2 the exact same steps then would show the same. The candidates' first order conditions are

$$\frac{\partial u_1}{\partial x_1^H} = E_S \left[ \frac{\partial c_v^H}{\partial x_1^H} w_v + (c_v^H - c_v^S) \frac{\partial w_v}{\partial x_1^H} \right] - \gamma = 0 \quad (14)$$

$$\frac{\partial u_1}{\partial x_1^S} = E_S \left[ \frac{\partial c_v^S}{\partial x_1^S} (1 - w_v) + (c_v^H - c_v^S) \frac{\partial w_v}{\partial x_1^S} \right] - \gamma = 0 \quad (15)$$

$$\frac{\partial u_2}{\partial x_2^H} = E_S \left[ -\frac{\partial c_v^H}{\partial x_2^H} w_v - (c_v^H - c_v^S) \frac{\partial w_v}{\partial x_2^H} \right] - \gamma = 0 \quad (16)$$

$$\frac{\partial u_2}{\partial x_2^S} = E_S \left[ -\frac{\partial c_v^S}{\partial x_2^S} (1 - w_v) - (c_v^H - c_v^S) \frac{\partial w_v}{\partial x_2^S} \right] - \gamma = 0 \quad (17)$$

These have to hold in any interior equilibrium. Second derivatives of candidate 1's payoff function are the following:

$$\frac{\partial^2 u_1}{\partial (x_1^H)^2} = E_S \left[ \frac{\partial^2 c_v^H}{\partial (x_1^H)^2} w_v + 2 \frac{\partial w_v}{\partial x_1^H} \frac{\partial c_v^H}{\partial x_1^H} + \frac{\partial^2 w_v}{\partial (x_1^H)^2} (c_v^H - c_v^S) \right] \quad (18)$$

$$\frac{\partial^2 u_1}{\partial (x_1^S)^2} = E_S \left[ \frac{\partial^2 c_v^S}{\partial (x_1^S)^2} (1 - w_v) - 2 \frac{\partial w_v}{\partial x_1^S} \frac{\partial c_v^S}{\partial x_1^S} + \frac{\partial^2 w_v}{\partial (x_1^S)^2} (c_v^H - c_v^S) \right] \quad (19)$$

$$\frac{\partial^2 u_1}{\partial x_1^H \partial x_1^S} = E_S \left[ \frac{\partial c_v^H}{\partial x_1^H} \frac{\partial w_v}{\partial x_1^S} - \frac{\partial c_v^S}{\partial x_1^S} \frac{\partial w_v}{\partial x_1^H} + (c_v^H - c_v^S) \frac{\partial^2 w_v}{\partial x_1^H \partial x_1^S} \right] \quad (20)$$

Using the specific functional forms the relevant terms are

$$\frac{\partial^2 c_v^H}{\partial (x_1^H)^2} = \frac{\theta_v^H (1 - \theta_v^H) f(x_2^H) (f''(x_1^H) [\theta_v^H f(x_1^H) + (1 - \theta_v^H) f(x_2^H)] - 2\theta_v^H (f'(x_1^H))^2)}{(\theta_v^H f(x_1^H) + (1 - \theta_v^H) f(x_2^H))^3} < 0 \quad (21)$$

$$\frac{\partial^2 c_v^S}{\partial (x_1^S)^2} = \frac{\theta_v^S (1 - \theta_v^S) f(x_2^S) (f''(x_1^S) [\theta_v^S f(x_1^S) + (1 - \theta_v^S) f(x_2^S)] - 2\theta_v^S (f'(x_1^S))^2)}{(\theta_v^S f(x_1^S) + (1 - \theta_v^S) f(x_2^S))^3} < 0 \quad (22)$$

$$\frac{\partial^2 w_v}{\partial (x_1^H)^2} = \frac{g''(x_1^H + x_2^H) [\omega_v g(x_1^H + x_2^H) + (1 - \omega_v) g(x_1^S + x_2^S)] - 2\omega_v (g'(x_1^H + x_2^H))^2}{(\omega_v g(x_1^H + x_2^H) + (1 - \omega_v) g(x_1^S + x_2^S))^3} \times \omega_v (1 - \omega_v) g(x_1^S + x_2^S) \quad (23)$$

$$\frac{\partial^2 w_v}{\partial (x_1^S)^2} = \frac{(g''(x_1^H + x_2^H) [\omega_v g(x_1^H + x_2^H) + (1 - \omega_v) g(x_1^S + x_2^S)] - 2\omega_v (g'(x_1^H + x_2^H))^2)}{(\omega_v g(x_1^H + x_2^H) + (1 - \omega_v) g(x_1^S + x_2^S))^3} \times (-\omega_v (1 - \omega_v) g(x_1^H + x_2^H)) \quad (24)$$

$$\frac{\partial^2 w_v}{\partial x_1^H \partial x_1^S} = \frac{\omega_v (1 - \omega_v) g'(x_1^H + x_2^H) g'(x_1^S + x_2^S) [\omega_v g(x_1^H + x_2^H) - (1 - \omega_v) g(x_1^S + x_2^S)]}{(\omega_v g(x_1^H + x_2^H) + (1 - \omega_v) g(x_1^S + x_2^S))^3} \quad (25)$$

Note that  $g(x) = \bar{g}(\kappa^w + x)$ . From Assumption 2 it follows that (23), (24), and (25) vanish as  $\kappa^w \rightarrow \infty$ . Because (21) and (22) are strictly negative it follows that there exists some finite  $\bar{\kappa}^w$  such that for all  $\kappa^w > \bar{\kappa}^w$  the problem each candidate faces is strictly concave. Because this holds also after integration over  $\mathcal{S}$ , existence of a pure strategy Nash equilibrium follows from the Debreu, Glicksberg, and Fan (1952) existence theorem (see for example Theorem 1.2 in Fudenberg and Tirole (1991)). If, in addition,  $\gamma$  is sufficiently small, a corner equilibrium cannot exist, because a deviation would always be profitable.  $\square$

## B.2 Proof of Lemma 1

*Proof.* If we equate (14) and (16) and (15) and (17) and by noting that  $\frac{\partial w_v}{\partial x_1^H} = \frac{\partial w_v}{\partial x_2^H}$  as well as  $\frac{\partial w_v}{\partial x_1^S} = \frac{\partial w_v}{\partial x_2^S}$  we get after simple manipulations that



$$-2E_{\mathcal{S}} [(c_v^H - c_v^S)] = E_{\mathcal{S}} \left[ \frac{\left( \frac{\partial c_v^H}{\partial x_1^H} + \frac{\partial c_v^H}{\partial x_2^H} \right) w_v}{\frac{\partial w_v}{\partial x_1^H}} \right], \quad (26)$$

$$-2E_{\mathcal{S}} [(c_v^H - c_v^S)] = E_{\mathcal{S}} \left[ \frac{\left( \frac{\partial c_v^S}{\partial x_1^S} + \frac{\partial c_v^S}{\partial x_2^S} \right) (1 - w_v)}{\frac{\partial w_v}{\partial x_1^S}} \right]. \quad (27)$$

Equating both yields the fundamental condition discussed above:

$$E_{\mathcal{S}} \left[ \frac{\left( \frac{\partial c_v^H}{\partial x_1^H} + \frac{\partial c_v^H}{\partial x_2^H} \right) w_v}{\frac{\partial w_v}{\partial x_1^H}} \right] = E_{\mathcal{S}} \left[ \frac{\left( \frac{\partial c_v^S}{\partial x_1^S} + \frac{\partial c_v^S}{\partial x_2^S} \right) (1 - w_v)}{\frac{\partial w_v}{\partial x_1^S}} \right].$$

or

$$E_{\Omega} \left[ \frac{w_v}{\frac{\partial w_v}{\partial x_1^H}} \right] E_{\Theta^H \times \Theta^S} \left[ \frac{\partial c_v^H}{\partial x_1^H} + \frac{\partial c_v^H}{\partial x_2^H} \right] = E_{\Omega} \left[ \frac{(1 - w_v)}{\frac{\partial w_v}{\partial x_1^S}} \right] E_{\Theta^H \times \Theta^S} \left[ \frac{\partial c_v^S}{\partial x_1^S} + \frac{\partial c_v^S}{\partial x_2^S} \right] \quad (28)$$

Since  $\frac{\partial w_v}{\partial x_1^S} < 0$  but  $\frac{\partial w_v}{\partial x_1^H} > 0$ , the signs of the second expected value on both sides have to be different or both expectations must be zero. Hence,

$$\text{Sign} \left[ E_{\Theta^H \times \Theta^S} \left[ \frac{\partial c_v^H}{\partial x_1^H} + \frac{\partial c_v^H}{\partial x_2^H} \right] \right] = -\text{Sign} \left[ E_{\Theta^H \times \Theta^S} \left[ \frac{\partial c_v^S}{\partial x_1^S} + \frac{\partial c_v^S}{\partial x_2^S} \right] \right].$$

The derivatives of  $c_v^i$  with respect to  $x_j^i$  are

$$\frac{\partial c_v^H}{\partial x_1^H} = \frac{\theta_v^H (1 - \theta_v^H) f'(x_1^H) f(x_2^H)}{(\theta_v^H f(x_1^H) + (1 - \theta_v^H) f(x_2^H))^2}, \quad (29)$$

$$\frac{\partial c_v^S}{\partial x_1^S} = \frac{\theta_v^S (1 - \theta_v^S) f'(x_1^S) f(x_2^S)}{(\theta_v^S f(x_1^S) + (1 - \theta_v^S) f(x_2^S))^2}, \quad (30)$$

$$\frac{\partial c_v^H}{\partial x_2^H} = -\frac{\theta_v^H (1 - \theta_v^H) f(x_1^H) f'(x_2^H)}{(\theta_v^H f(x_1^H) + (1 - \theta_v^H) f(x_2^H))^2}, \quad (31)$$

$$\frac{\partial c_v^S}{\partial x_2^S} = -\frac{\theta_v^S (1 - \theta_v^S) f(x_1^S) f'(x_2^S)}{(\theta_v^S f(x_1^S) + (1 - \theta_v^S) f(x_2^S))^2}. \quad (32)$$

It follows that

$$E_{\Theta^H \times \Theta^S} \left[ \frac{\partial c_v^H}{\partial x_1^H} + \frac{\partial c_v^H}{\partial x_2^H} \right] = E_{\Theta^H \times \Theta^S} \left[ \frac{\theta_v^H (1 - \theta_v^H) [f'(x_1^H) f(x_2^H) - f(x_1^H) f'(x_2^H)]}{(\theta_v^H f(x_1^H) + (1 - \theta_v^H) f(x_2^H))^2} \right], \quad (33)$$

$$E_{\Theta^H \times \Theta^S} \left[ \frac{\partial c_v^S}{\partial x_1^S} + \frac{\partial c_v^S}{\partial x_2^S} \right] = E_{\Theta^H \times \Theta^S} \left[ \frac{\theta_v^S (1 - \theta_v^S) [f'(x_1^S) f(x_2^S) - f(x_1^S) f'(x_2^S)]}{(\theta_v^S f(x_1^S) + (1 - \theta_v^S) f(x_2^S))^2} \right]. \quad (34)$$

Since  $\frac{df'(x)/f(x)}{dx} = \frac{f''(x)f(x) - f'(x)^2}{f(x)^2} < 0$  we find that

$$\text{Sign} \left[ E_{\Theta^H \times \Theta^S} \left[ \frac{\partial c_v^k}{\partial x_1^k} + \frac{\partial c_v^k}{\partial x_2^k} \right] \right] = \begin{cases} + & \text{if } x_1^k < x_2^k, \\ 0 & \text{if } x_1^k = x_2^k, \\ - & \text{if } x_1^k > x_2^k. \end{cases}$$

Hence, for (28) to hold it must be the case that

$$\text{Sign}[x_1^H - x_2^H] = -\text{Sign}[x_1^S - x_2^S].$$

□

### B.3 Proof of Proposition 1

*Proof.* From Lemma 1 it follows that unless both spend identical effort in issue  $H$  and also in issue  $S$ , candidates must specialize in one issue. Identical efforts in an issue can, however, only be an equilibrium if  $E_{\Theta^H \times \Theta^S} [\theta_v^H - \theta_v^S] = 0$ . To see this consider (26) and (27). If both spend identical effort on an issue, it follows from (33) and (34) that the right hand side is zero. The left hand side, however, is then only zero if  $E_{\Theta^H \times \Theta^S} [\theta_v^H - \theta_v^S] = 0$ . Hence, a symmetric equilibrium in which candidates do not (imperfectly) specialize can only occur if there are no comparative advantages. To see that there can exist a no-specialization equilibrium look at the first order conditions. If  $E_{\Theta^H \times \Theta^S} [\theta_v^H - \theta_v^S] = 0$  and candidates do not specialize, i.e. spend identical effort on an issue,  $E_{\Theta^H \times \Theta^S} [c_v^H - c_v^S] = 0$ . Thus, what is left is equivalent to what we have seen when salience does not matter for perceived importance. Existence of a symmetric equilibrium then follows immediately. If in addition  $\omega = 1/2$ , the ‘prize’ in each policy advertising contest is identical for both and thus a perfectly symmetric equilibrium exists. □

## B.4 Proof of Proposition 2

*Proof.* Define the maximum amount a candidate might spend on one issue as  $x^{max} > 0$ . I will not specify this now but I will show how this might look later on. Also, let  $\theta^H > \theta^S$  without loss of generality. That is, candidate 1 has a comparative advantage in  $H$  before the campaign starts. After the campaign candidate 1's policy in  $H$  will be evaluated as

$$\frac{\theta^H f(x_1^H)}{\theta^H f(x_1^H) + (1 - \theta^H) f(x_2^H)},$$

and in issue  $S$  as

$$\frac{\theta^S f(x_1^S)}{\theta^S f(x_1^S) + (1 - \theta^S) f(x_2^S)}.$$

If now candidate 1 publishes only ads on  $S$  and 2 only on  $H$ , and both publish the maximum amount  $x^{max}$ , this gives us

$$\frac{\theta^H f(0)}{\theta^H f(0) + (1 - \theta^H) f(x^{max})},$$

and

$$\frac{\theta^S f(x^{max})}{\theta^S f(0) + (1 - \theta^S) f(0)}.$$

Now, if in this extreme situation comparative advantages did not change, it is not possible to change them. Hence, whenever

$$\frac{\theta^H f(0)}{\theta^H f(0) + (1 - \theta^H) f(x^{max})} > \frac{\theta^S f(x^{max})}{\theta^S f(0) + (1 - \theta^S) f(0)}$$

comparative advantages cannot be changed. Solving for  $\theta^H$  yields

$$\theta^H > \frac{\theta^S}{R + (1 - R)\theta^S},$$

where  $R := \frac{f(0)}{f(x^{max})}$ . Similarly it can be shown that when  $\theta^H < \theta^S$ , comparative advantages cannot be changed whenever

$$\theta^H < \frac{R\theta^S}{1 - (1 - R)\theta^S}.$$

Note that those boundaries are sufficient but not necessary. That is, if  $\theta^H$  lies outside comparative advantages cannot change. However, if it lies inside they might still remain unchanged.  $\square$

### B.5 Proof of Proposition 3

*Proof.* Consider a situation in which  $\omega \rightarrow 1$ . Then  $w \rightarrow 1$  and  $\frac{\partial c^S}{\partial x_j^S}(1-w) \rightarrow 0$  as well as  $\frac{\partial w}{\partial x^i} \rightarrow 0$ , and consequently  $x_j^S \rightarrow 0$ , while  $x_j^H > 0$ . Continuity of the first order conditions implies this holds also for  $\omega$  strictly smaller than 1.  $\square$

### B.6 Proof of Proposition 4

*Proof.* Let  $\theta^H = 1/2$ ,  $\theta^S \rightarrow 1$ ,  $\kappa^w$  large but finite, and  $\omega < 1/2$  but positive. Then  $\frac{\partial w}{\partial x_j^i} \rightarrow 0$  and also  $\frac{\partial c^S}{\partial x_j^S} \rightarrow 0$ , and hence  $x_j^S \rightarrow 0$  but positive, while  $x_i^H$  is strictly positive because  $\frac{\partial c^H}{\partial x_j^H}$  is also strictly positive. Continuity of the first order conditions implies this holds also for  $\theta^S$  strictly smaller than 1.  $\square$

### B.7 Proof of Lemma 3

*Proof.* Comparative advantage was defined using

$$\sigma^i = c^i - \frac{\sum_{k \neq i} c^k w^k}{1 - w^i}.$$

I need to show that for  $c^1 \geq c^2 \geq \dots \geq c^n$  and  $c^1 > c^n$  it must hold that  $\sigma^1 > 0$  and  $\sigma^n < 0$ . I will show the result for issue 1 and by implication the result follows for  $n$  immediately.

Assume that the lemma does not hold and  $\sigma^1 \leq 0$ . Then

$$\begin{aligned} c^1 - \frac{\sum_{k \neq 1} c^k w^k}{1 - w^1} &\leq 0 \\ \Leftrightarrow c^1 &\leq \frac{\sum_{k \neq 1} c^k w^k}{1 - w^1} \\ \Leftrightarrow c^1(1 - w^1) &\leq \sum_{k \neq 1} c^k w^k \\ \Leftrightarrow c^1 \sum_{k \neq 1} w^k &\leq \sum_{k \neq 1} c^k w^k \\ \Leftrightarrow \sum_{k \neq 1} w^k (c^1 - c^k) &\leq 0 \end{aligned}$$

Because  $c^1 \geq c^2 \geq \dots \geq c^n$  this is not possible and hence  $\sigma^1 > 0$ . That proves the lemma.  $\square$

## B.8 Proof of Proposition 5

*Proof.* The respective first order conditions in an interior equilibrium are

$$\begin{aligned}
\frac{\partial \pi_1}{\partial x_1^1} &= \frac{\partial c^1}{\partial x_1^1} w^1 + \sum_{k=1}^{n-1} (c^k - c^n) \frac{\partial w^k}{\partial x_1^1} - \gamma \stackrel{!}{=} 0 \\
\vdots &\quad \quad \quad \vdots \\
\frac{\partial \pi_1}{\partial x_1^n} &= \frac{\partial c^n}{\partial x_1^n} w^1 + \sum_{k=1}^{n-1} (c^k - c^n) \frac{\partial w^k}{\partial x_1^n} - \gamma \stackrel{!}{=} 0 \\
\frac{\partial \pi_2}{\partial x_2^1} &= -\frac{\partial c^1}{\partial x_2^1} w^1 - \sum_{k=1}^{n-1} (c^k - c^n) \frac{\partial w^k}{\partial x_2^1} - \gamma \stackrel{!}{=} 0 \\
\vdots &\quad \quad \quad \vdots \\
\frac{\partial \pi_2}{\partial x_2^n} &= -\frac{\partial c^n}{\partial x_2^n} w^1 - \sum_{k=1}^{n-1} (c^k - c^n) \frac{\partial w^k}{\partial x_2^n} - \gamma \stackrel{!}{=} 0
\end{aligned}$$

Substituting  $i$  for  $H$  in (29) - (32) and remembering that  $\frac{\partial w^k}{\partial x_1^i} = \frac{\partial w^k}{\partial x_2^i} = \frac{\partial w^k}{\partial x^i}$ , we can reformulate the two first order conditions in issue  $i$  to get

$$\frac{\theta^i(1 - \theta^i) [f'(x_1^i)f(x_2^i) - f(x_1^i)f'(x_2^i)]}{(\theta^i f(x_1^i) + (1 - \theta^i)f(x_2^i))^2} = -2 \sum_{k=1}^{n-1} (c^k - c^n) \frac{\partial w^k}{\partial x^i}.$$

From Lemma 1 we know that the left hand side is positive (negative/zero) iff candidate 1 spends less (as much/ more) than candidate 2 on that issue. Hence, it remains to relate the RHS to the definition of comparative advantage. In particular, we need to show that the sign of the RHS is the opposite than the sign of  $\sigma^i$ , or that

$$\text{Sign} \left[ \sum_{k=1}^{n-1} (c^k - c^n) \frac{\partial w^k}{\partial x^i} \right] = \text{Sign} [\sigma^i]$$

Manipulating the first expression yields

$$\begin{aligned}
\text{Sign} \left[ \sum_{k=1}^{n-1} (c^k - c^n) \frac{\partial w^k}{\partial x^i} \right] &= \text{Sign} \left[ (c^i - c^n) \frac{\partial w^i}{\partial x^i} + \sum_{k=1, k \neq i}^{n-1} (c^k - c^n) \frac{\partial w^k}{\partial x^i} \right] \\
&= \frac{\omega^i g'(x_1^i + x_2^i)}{\sum_{m=1}^n \omega^m g(x_1^m + x_2^m)} \text{Sign} \left[ (1 - w^i)(c^i - c^n) - \sum_{k=1, k \neq i}^{n-1} w^k (c^k - c^n) \right] \\
&= \text{Sign} \left[ (1 - w^i)(c^i - c^n) + (1 - w^i - w^n)c^n - \sum_{k=1, k \neq i}^{n-1} w^k c^k \right] \\
&= \text{Sign} \left[ (1 - w^i)c^i - \sum_{k=1, k \neq i}^n w^k c^k \right] = \text{Sign} \left[ \sum_{k=1, k \neq i}^n w^k c^i - \sum_{k=1, k \neq i}^n w^k c^k \right] \\
&= \text{Sign} \left[ \sum_{k=1, k \neq i}^n w^k (c^i - c^k) \right] = \text{Sign} \left[ c^i - \frac{\sum_{k=1, k \neq i}^n w^k c^k}{1 - \omega^i} \right] = \text{Sign} [\sigma^i].
\end{aligned}$$



$$\frac{\partial \pi_j}{\partial x_j^i} = \frac{\theta(1-\theta)f'(x^i)w^i}{f(x^i)} - \gamma \leq 0$$

Note again that under the conditions of Theorem 1 the derivative is strictly decreasing in  $x^i$  and also note that  $w^i$  decreases strictly in  $x^{-i}$ . Since all  $x_j^i \geq 1$  are strictly dominated (not only those, however; this is just a fuzzy approximation), the maximal value  $w^i$  can take on is bounded from above by  $\bar{w}^i \equiv \frac{\omega^i g(2)}{g(0)(1-\omega^i) + \omega^i g(2)} < 1$ ,  $w^i < \bar{w}^i$  in any equilibrium. Hence, if

$$\frac{\partial \pi_j}{\partial x_j^i} = \frac{\theta(1-\theta)f'(0)\bar{w}^i}{f(0)} - \gamma \leq 0$$

candidates choose  $x^i = 0$  for all  $x^{-i}$ . Rearranging yields

$$\frac{\theta(1-\theta)\bar{w}^i}{\gamma} \leq \frac{f(0)}{f'(0)}.$$

□

## B.11 When candidates have a fixed budget

Assume instead of constant marginal costs candidates have a fixed budget  $B > 0$  to allocate between the issues. Each candidate then spends  $x_j^H \in [0, B]$  on  $H$  and  $x_j^S = B - x_j^H$  on  $S$ . Expected utilities are as follows

$$\begin{aligned} \pi_1 &= c^H(x_1^H, x_2^H)w(x_1^H, x_2^H) + c^S(x_1^H, x_2^H)(1 - w(x_1^H, x_2^H)) \\ \pi_2 &= (1 - c^H(x_1^H, x_2^H))w(x_1^H, x_2^H) + (1 - c^S(x_1^H, x_2^H))(1 - w(x_1^H, x_2^H)) \end{aligned}$$

First derivatives are

$$\begin{aligned} \frac{\partial \pi_1}{\partial x_1^H} &= \frac{\partial c^H(x_1^H, x_2^H)}{\partial x_1^H} w(x_1^H, x_2^H) + \frac{\partial c^S(x_1^H, x_2^H)}{\partial x_1^H} (1 - w(x_1^H, x_2^H)) + \frac{\partial w}{\partial x_1^H} (c^H - c^S) \\ \frac{\partial \pi_2}{\partial x_2^H} &= -\frac{\partial c^H(x_1^H, x_2^H)}{\partial x_2^H} w(x_1^H, x_2^H) - \frac{\partial c^S(x_1^H, x_2^H)}{\partial x_2^H} (1 - w(x_1^H, x_2^H)) - \frac{\partial w}{\partial x_2^H} (c^H - c^S) \end{aligned}$$

Assuming an interior solution, both have to be zero in equilibrium. Equalizing and simple manipulations reveal that

$$\left( \frac{\partial c^H}{\partial x_1^H} + \frac{\partial c^H}{\partial x_2^H} \right) \frac{w}{\frac{\partial w}{\partial x_1^H}} + \left( \frac{\partial c^S}{\partial x_1^H} + \frac{\partial c^S}{\partial x_2^H} \right) \frac{(1-w)}{\frac{\partial w}{\partial x_1^H}} = -2(c^H - c^S),$$

where I dropped arguments for simplicity. Using the specific functional forms this is

$$\begin{aligned} & \frac{\theta^H(1-\theta^H)(f'(x_1^H)f(x_2^H) - f(x_1^H)f'(x_2^H))}{(\theta^H f(x_1^H) + (1-\theta^H)f(x_2^H))^2} \frac{w}{\frac{\partial w}{\partial x_1^H}} \\ + & \frac{\theta^S(1-\theta^S)(f(B_1 - x_1^S)f'(B_2 - x_2^S) - f'(B_1 - x_1^S)f(B_2 - x_2^S))}{(\theta^S f(B_1 - x_1^S) + (1-\theta^S)f(B_2 - x_2^S))^2} \frac{(1-w)}{\frac{\partial w}{\partial x_1^S}} \\ = & -2(c^H - c^S). \end{aligned}$$

First we check whether a symmetric equilibrium can exist in which  $x_j^i = x_{-j}^i$ . If that is the case the equation reduces to

$$\begin{aligned} & \frac{\theta^H(1-\theta^H)(f'(x^H)f(x^H) - f(x^H)f'(x^H))}{(\theta^H f(x^H) + (1-\theta^H)f(x^H))^2} \frac{w}{\frac{\partial w}{\partial x_1^H}} \\ + & \frac{\theta^S(1-\theta^S)(f(B - x^S)f'(B - x^S) - f'(B - x^S)f(B - x^S))}{(\theta^S f(B - x^S) + (1-\theta^S)f(B - x^S))^2} \frac{(1-w)}{\frac{\partial w}{\partial x_1^S}} \\ = & 0 \\ \stackrel{!}{=} & -2(\theta^H - \theta^S). \end{aligned}$$

Hence, whenever  $\theta^H \neq \theta^S$ , the equilibrium must be asymmetric. Moreover, if  $c^H > c^S$ , the RHS is negative and hence so must be the LHS, too. Look at the derivative of the policy advertising function  $c^i$ :

$$\frac{\partial c^i}{\partial x_1^i} = \frac{\theta^i(1-\theta^i)f'(x_1^i)f(x_2^i)}{(\theta f(x_1^i) + (1-\theta^i)f(x_2^i)^2)} > 0$$

as well as

$$\frac{\partial c^i}{\partial x_2^i} = -\frac{\theta^i(1-\theta^i)f(x_1^i)f'(x_2^i)}{(\theta f(x_1^i) + (1-\theta^i)f(x_2^i)^2)} < 0$$

Note that when  $x_1^i > x_2^i$ ,  $f'(x_1^i)f(x_2^i) < f(x_1^i)f'(x_2^i)$  such that  $|\frac{\partial c^i}{\partial x_1^i}| < |\frac{\partial c^i}{\partial x_2^i}|$ . Having a look at the first order conditions reveals that this immediately implies  $\text{Sign}[c^H - c^S] = \text{Sign}[x_1^H - x_2^H] = -\text{Sign}[x_1^S - x_2^S]$ . As a consequence, both candidates spend more than their opponent on the issue of their *ex-post* comparative advantage. If *ex-ante* comparative advantages are sufficiently



strong, the effects on communication strategies are the same. Hence, if candidates have fixed budgets or marginal costs of funding has no real influence on results.

## References

- AKERLOF, G. A., AND R. E. KRANTON (2000): “Economics And Identity,” *The Quarterly Journal of Economics*, 115(3), 715–753.
- AMOROS, P., AND M. PUY (2011): “Issue convergence or issue divergence in a political campaign?,” *Public Choice*, pp. 1–17, 10.1007/s11127-011-9865-0.
- ARAGONÈS, E., M. CASTANHEIRA, AND M. GIANI (2012): “Electoral Competition through Issue Selection,” UFAE and IAE Working Papers 903.12, Unitat de Fonaments de l’Anàlisi Econòmica (UAB) and Institut d’Anàlisi Econòmica (CSIC).
- BAGWELL, K. (2007): “The Economic Analysis of Advertising,” vol. 3 of *Handbook of Industrial Organization*, pp. 1701–1844. Elsevier.
- BEALE, E. M. L., AND G. P. M. HESELDEN (1962): “An approximate method of solving Blotto games,” *Naval Research Logistics Quarterly*, 9(2), 65–79.
- BÜHLER, S., AND D. HALBHEER (2011): “Selling when Brand Image Matters,” *Journal of Institutional and Theoretical Economics*, 167(1), 102–118.
- (2012): “Persuading consumers with social attitudes,” *Journal of Economic Behavior & Organization*, 84(1), 439–450.
- BÉLANGER, E., AND B. M. MEGUID (2008): “Issue salience, issue ownership, and issue-based vote choice,” *Electoral Studies*, 27(3), 477 – 491.
- BORNSTEIN, R. F. (1989): “Exposure and affect: Overview and meta-analysis of research, 1968-1987,” *Psychological Bulletin*, 106, 265–289.
- BRAMS, S. J., AND M. D. DAVIS (1973): “Resource-Allocation Models in Presidential Campaigning: Implications for Democratic Representation,” *Annals of the New York Academy of Sciences*, 219, 105–123.
- (1974): “The 3/2’s Rule in Presidential Campaigning,” *The American Political Science Review*, 68(1), pp. 113–134.
- CHOWDHURY, S., D. KOVENOCK, AND R. SHEREMETA (2011): “An experimental investigation of Colonel Blotto games,” *Economic Theory*, pp. 1–29.
- DAMORE, D. F. (2004): “The Dynamics of Issue Ownership in Presidential Campaigns,” *Political Research Quarterly*, 57(3), pp. 391–397.
- (2005): “Issue Convergence in Presidential Campaigns,” *Political Behavior*, 27(1), 71–97.

- DENTER, P., AND D. SISAK (2012): “Do Polls Create Momentum in Political Competition?,” Discussion paper.
- DRUCKMAN, J. N., L. R. JACOBS, AND E. OSTERMEIER (2004): “Candidate Strategies to Prime Issues and Image,” *Journal of Politics*, 66(4), 1180–1202.
- EGAN, P. J. (2009): “Issue Ownership and Representation: A Theory of Legislative Responsiveness to Constituency Opinion,” Discussion paper.
- ERIKSON, R. S., AND T. R. PALFREY (2000): “Equilibria in Campaign Spending Games: Theory and Data,” *The American Political Science Review*, 94(3), pp. 595–609.
- FRIEDMAN, L. (1958): “Game-Theory Models in the Allocation of Advertising Expenditures,” *Operations Research*, 6(5), 699–709.
- FUDENBERG, D., AND J. TIROLE (1991): *Game Theory*. The MIT Press.
- GREEN, J., AND S. B. HOBOLT (2008): “Owning the issue agenda: Party strategies and vote choices in British elections,” *Electoral Studies*, 27(3), 460 – 476.
- GROSECLOSE, T. (2001): “A Model of Candidate Location When One Candidate Has a Valence Advantage,” *American Journal of Political Science*, 45(4), pp. 862–886.
- HARMON-JONES, E., AND J. J. B. ALLEN (2001): “The Role of Affect in the Mere Exposure Effect: Evidence from Psychophysiological and Individual Differences Approaches,” *Personality and Social Psychology Bulletin*, 27(7), 889–898.
- HOGG, M. A., AND G. M. VAUGHAN (2008): *Social Psychology*. Pearson Education Limited, 5th edn.
- HOLIAN, D. B. (2004): “He’s Stealing My Issues! Clinton’s Crime Rhetoric and the Dynamics of Issue Ownership,” *Political Behavior*, 26(2), pp. 95–124.
- IARYCZOWER, M., AND A. MATTOZZI (2012a): “On the Nature of Competition in Alternative Electoral Systems,” *forthcoming Journal of Politics*.
- (2012b): “The pro-competitive effect of campaign limits in non-majoritarian elections,” *Economic Theory*, 49, 591–619.
- IYENGAR, S., AND D. R. KINDER (1987): *News That Matters: Television and American Opinion*. University of Chicago Press.
- JENSEN, T. (2012): “Elections, Information, and State-Dependent Candidate Quality,” Discussion paper.
- JOHNSON, J. P., AND D. P. MYATT (2006): “On the Simple Economics of Advertising, Marketing, and Product Design,” *The American Economic Review*, 96(3), pp. 756–784.
- JONES, J. P. (1999): *What Does Effective Frequency Mean Today?* pp. 285–299. SAGE Publications, Inc., 0 edn.

- KAPLAN, N., D. K. PARK, AND T. N. RIDOUT (2006): "Dialogue in American Political Campaigns? An Examination of Issue Convergence in Candidate Television Advertising," *American Journal of Political Science*, 50(3), pp. 724–736.
- KLUMPP, T., AND M. K. POLBORN (2006): "Primaries and the New Hampshire Effect," *Journal of Public Economics*, 90(6-7), 1073–1114.
- KOH, W. T. H., AND H. M. LEUNG (1992): "Persuasive Advertising and Market Competition," *The American Economist*, 36(2), pp. 39–49.
- KOVENOCK, D., AND B. ROBERSON (2010): "Conflicts with Multiple Battlefields," Purdue University Economics Working Papers 1246, Purdue University, Department of Economics.
- (2012): "Coalitional Colonel Blotto Games with Application to the Economics of Alliances," *Journal of Public Economic Theory*, 14(4), 653–676.
- KRASA, S., AND M. K. POLBORN (2009): "Political Competition between Differentiated Candidates," Discussion paper.
- (2010a): "The binary policy model," *Journal of Economic Theory*, 145(2), 661–688.
- (2010b): "Competition between Specialized Candidates," *American Political Science Review*, 104(04), 745–765.
- (2011): "Social Ideology and Taxes in a Differentiated Candidates Framework," Discussion paper.
- LANCASTER, K. J. (1966): "A New Approach to Consumer Theory," *Journal of Political Economy*, 74(2), pp. 132–157.
- LEMAN, N. (2012): "Evening the Odds: Is there a politics of inequality?," *The New Yorker*, April 23.
- LINDBECK, A., AND J. WEIBULL (1987): "Balanced-budget redistribution as the outcome of political competition," *Public Choice*, 52, 273–297.
- LOWREY, A. (2012): "For Two Economists, the Buffett Rule Is Just a Start," *The New York Times*, April 16.
- MEIROWITZ, A. (2008): "Electoral Contests, Incumbency Advantages, and Campaign Finance," *The Journal of Politics*, 70(03), 681–699.
- MOEN, E. R., AND C. RHIS (2010): "Policy Reversal," *American Economic Review*, 100(3), 1261–68.
- MOONS, W. G., D. M. MACKIE, AND T. GARCIA-MARQUES (2009): "The impact of repetition-induced familiarity on agreement with weak and strong arguments," *Journal of Personality and Social Psychology*, 96(1), 32–44.
- MUELLER, D. C., AND T. STRATMANN (1994): "Informative and Persuasive Campaigning," *Public Choice*, 81(1-2), 55–77.

- PETROCIK, J. R. (1996): "Issue Ownership in Presidential Elections, with a 1980 Case Study," *American Journal of Political Science*, 40(3), pp. 825–850.
- PETROCIK, J. R., W. L. BENOIT, AND G. J. HANSEN (2003): "Issue Ownership and Presidential Campaigning, 1952-2000," *Political Science Quarterly*, 118(4), pp. 599–626.
- PIKETTY, T., AND E. SAEZ (2003): "Income Inequality In The United States, 1913-1998," *The Quarterly Journal of Economics*, (1), 1–39.
- POWELL, R. (2007): "Allocating defensive resources with private information about vulnerability," *American Political Science Review*, 101, 799–809.
- PRAT, A., AND D. STRÖMBERG (2011): "The Political Economy of Mass Media," Discussion paper.
- RIKER, W. (1996): *The strategy of rhetoric: Campaigning for the American constitution*, J-B NCR Single Issue National Civic Review Series. Yale University Press.
- ROBERSON, B. (2006): "The Colonel Blotto game," *Economic Theory*, 29, 1–24.
- SAEZ, E. (2012): "Striking it Richer: The Evolution of Top Incomes in the United States," Institute for Research on Labor and Employment, Working Paper Series qt8dp1f91x, Institute of Industrial Relations, UC Berkeley.
- SAHUGUET, N., AND N. PERSICO (2006): "Campaign spending regulation in a model of redistributive politics," *Economic Theory*, 28(1), 95–124.
- SERENKO, A., AND N. BONTIS (2011): "What's familiar is excellent: The impact of exposure effect on perceived journal quality," *Journal of Informetrics*, 5(1), 219 – 223.
- SEVERIN, W., AND J. TANKARD (1997): *Communication Theories*. New York: Hastings House.
- SHUBIK, M., AND R. J. WEBER (1981): "Systems defense games: Colonel blotto, command and control," *Naval Research Logistics Quarterly*, 28(2), 281–287.
- SIGELMAN, L., AND E. H. BUELL (2004): "Avoidance or Engagement? Issue Convergence in U.S. Presidential Campaigns, 1960-2000," *American Journal of Political Science*, 48(4), 650–661.
- SKAPERDAS, S., AND B. GROFMAN (1995): "Modeling Negative Campaigning," *The American Political Science Review*, 89(1), 49–61.
- SKAPERDAS, S., AND S. VAIDYA (2012): "Persuasion as a contest," *Economic Theory*, 51(2), 465–486.
- SMITH, E. R., AND D. M. MACKIE (2007): *Social Psychology*. Psychology Press, 3rd edn.
- SNYDER, J. M. (1989): "Election Goals and the Allocation of Campaign Resources," *Econometrica*, 57(3), pp. 637–660.
- STROMBERG, D. (2008): "How the Electoral College Influences Campaigns and Policy: The Probability of Being Florida," *American Economic Review*, 98(3), 769–807.

- TOM, G., C. NELSON, T. SRZENTIC, AND R. KING (2007): "Mere Exposure and the Endowment Effect on Consumer Decision Making," *The Journal of Psychology*, 141(2), 117–125.
- WEAVER, D. H. (2007): "Thoughts on Agenda Setting, Framing, and Priming," *Journal of Communication*, 57(1), 142–147.
- WILLNAT, L. (1997): "Agenda Setting and Priming: Conceptual Links and Differences," *Communication and Democracy: Exploring the Intellectual Frontiers in Agenda-Setting Theory*, pp. 51–66. Routledge.
- ZAJONC, R. B. (1968): "Attitudinal Effects of Mere Exposure," *Journal of Personality and Social Psychology*, 9(2P2), 1–&.
- (1980): "Feeling and Thinking - Preferences Need No Inferences," *American Psychologist*, 35(2), 151–175.
- (2001): "Mere Exposure: A Gateway to the Subliminal," *Current Directions in Psychological Science*, 10(6), 224–228.