Reference Dependence and Politicians' Credibility*

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Abstract

We consider a model of electoral competition in which two politicians compete to get elected. Each politician is characterized by a valence, which is unobservable to voters and can take one of two values: high or low. The electorate prefers politicians with high valence, but random shocks may lead to the victory of low-valence ones. Candidates make statements concerning their valence. We show that if voters are standard expected utility maximizers, politicians' statements lack any credibility and no information transmission takes place. By introducing *reference-dependent preferences and loss aversion* a là Kőszegi and Rabin, we show that full revelation is possible. Indeed, if the electorate believes to candidates' announcements, such announcements will affect its reference point. As a result, if voters find out that a candidate lied, pretending to be high valence when she is not, they may decide to support the opponent in order to avoid the loss associated with appointing a candidate worse than expected.

1 Introduction

"We must not promise what we ought not, lest we be called on to perform what we cannot."
Abraham Lincoln

Electoral announcements and candidates' promises concerning their ability to perform if elected are key aspects of electoral competitions: they polarize voters's attention, attract media's scrutiny and lead to heated debates about their feasibility and truthfulness.

Interestingly, conventional wisdom makes two, partially contradictory, statements about these announcements: on the one hand, it is claimed that they have no informational content and should be ignored as politicians are ready to promise everything in order to be elected; on the other hand, it

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is often suggested that excessive electoral promises may turn against the politician if the electorate realizes that the candidate is unable to deliver what she promised; the opening quote by Abraham Lincoln supports this latter view.

In this paper, we rationalize this second view building a model of electoral competition in which the electorate exhibits *reference dependence and loss aversion a là Kőszegi and Rabin*.

In our setting, two candidates (A and B) compete for a public office; each candidate is characterized by one of two possible valences, high (θ_H) or low (θ_L). *Coeteris paribus*, voters prefer candidates with higher valence. Although valences are candidates' private information, they can make a public announcement about them. Furthermore, after candidates' announcements, voters may learn candidates' true valence with some probability p. This probability can be interpreted as the degree of media's scrutiny or as the candidates' propensity to commit actions that may reveal their type.

Electoral competition is modelled with probabilistic voting; thus, although voters prefer high-valence candidates to low-valence ones, ideological biases and a random shock to candidates' popularity may lead a low-valence candidate to win elections.

If voters are standard expected utility maximizer, the only equilibrium entails no information transmission. Indeed, since both candidates are ready to claim to be high-valence in order to maximize their probability of winning, they lose any credibility and, in equilibrium, voters ignore their announcements.

We depart from the literature assuming that voters have reference-dependent preferences a là Kőszegi and Rabin, namely they evaluate outcomes with respect to a reference point determined through a rational expectation approach. Thus, whenever the utility they experience exceeds (respectively, falls short of) the reference utility determined according to equilibrium analysis, they incur a gain (respectively, a loss). We further assume that voters are loss averse, namely they dislike losses more than what they like equal-size gains.

Under these assumptions, we prove that a fully revealing equilibrium is possible and we characterize it. This enables us to highlight the forces behind its existence and to identify the circumstances under which truthtelling is more likely to arise. The mechanism behind this result can be described as follows. Candidates' announcements, if credible, modify voters' reference points. Then, if the electorate were to find out that candidate j pretended to be high valence when she is not, it may decide to support candidate $i \neq j$ in order to avoid the loss associated with appointing a candidate worse than anticipated. Remarkably, this mechanism leads to the election of i even for realizations of the popularity shock that would have determined the victory of j, were she had been sincere from the beginning. As a result, the interaction of electoral announcements with reference dependence and loss aversion introduces a *cost of lying* which can push candidates to reveal their valence in the first place.

Intuitively, if the electorate exhibits reference dependence and loss aversion, a low-valence candidate who is deciding whether to announce her valence truthfully or to lie, faces a trade-off. If she lies and her lie goes undetected, her probability of winning increases with respect to the truthtelling strategy. If instead the lie is detected, such probability may decrease as voters may decide to support the other candidate to avoid harmful losses. In the paper we identify a range of realization of the popularity shock for which the electorate is willing to support a low-valence candidate against a high-valence one only if the former told the truth from the beginning.

Our main result shows that a fully revealing equilibrium exists if the cost of lying introduced by reference dependence and loss aversion is sufficiently large. This, in turn, requires a sufficiently high probability of learning the true type of the candidate.

We want to stress that the cost of lying is determined by the joint effect of reference dependence and loss aversion. Indeed, if the electorate were loss-neutral, gains and losses would receive the same weight and the incremental utility associated with electing a high-valence candidate as opposed to a low-valence one would be independent of the initial announcements. As a result, full revelation would not be an equilibrium.

Furthermore, we show that the cost of lying varies non-monotonically with loss aversion. This is a consequence of the two-sided effect that this behavioral bias plays in our model. On the one hand, as we described above, it makes voters unwilling to accept *unexpected losses* leading to an increase in the cost of lying. On the other hand, it makes voters unwilling to accept *expected losses* and pushes them to formulate equilibrium strategies which induce little volatility in payoffs. As a result, high degrees of loss aversion will result in equilibrium strategies that pick a high-valence candidate over a low-valence one for most realizations of the popularity shock lowering candidates' expected utility from announcing to be low-valence. Since the former effect dominates when loss aversion is low, while the latter prevails when it is high, the cost of lying first increases and then decreases with the degree of loss aversion. Thus, full revelation will be most likely when the electorate is moderately loss averse.

Furthermore, we also show that an increase in the uncertainty of the electoral outcomes (as measured by the support of the popularity shock that determines the electoral outcome) may increase the likelihood of a fully revealing equilibrium. Indeed, as the range of popularity shocks grows bigger, the electorate will be relatively more likely to support the low-valence candidate when the opponent is high-valence. This will, in turn, decrease the disadvantage associated with the announcement of being low-valence.

In addition to the characterization of fully revealing equilibria, we show that other equilibria are possible. In particular, uninformative equilibria exist for every profile of parameters, while partially revealing equilibria arise when the probability of detecting a lie takes intermediate values. We deal with such equilibrium multiplicity by providing conditions under which the fully revealing equilibrium is the only one satisfying standard equilibrium refinements proposed for communication games.

The paper is organized as follows. In the remaining of the Introduction, we review the relevant literature. Section 2 describes the model and highlights the interaction between candidates' announcements and the formation of the reference point. In Section 3, we characterize the equilibria of the game and we provide a comparison among them. Section 4 discusses the assumptions of our model. Section 5 concludes. The Appendix collects all the proofs.

1.1 Related Literature

This paper focuses on strategic information transmission between candidates and voters. In this respect our paper is related to the literature on strategic information transmission pioneered by Crawford and Sobel, 1982 and Green and Stokey, 2007.[1] We depart from this literature assuming that the uninformed party (in our model, voters) exhibits reference dependence and loss aversion and we show how these assumptions can lead to credible information transmission.[2,3]

The political science literature has studied extensively how discrepancies between candidates' promises and actual performance can affect the electoral competition. A fruitful line of research started by Farejohn, 1986 addresses the conflict of interest between voters and politicians lacking any commitment power; in this context voters can discipline the incumbent politician by conditioning their electoral behavior on her performance while in office.[4] In this paper, we assume that candidates have an incentive to lie and lack any instrument to commit themselves to truthtelling; nevertheless credible information transmission can be attained thanks to the endogenous effect that announcements have on the reference point of the electorate.

In our model voters evaluate their actions based not only on the final outcome they induce, but also on the comparison between these outcomes and a reference point. This idea dates back at least to Kahneman and Tversky, 1979 and, since then, an extensive experimental evidence has confirmed the importance of reference points and loss aversion in determining agents' behavior.[5] In this paper, we follow Kőszegi and Rabin, 2006, 2007, 2009 and assume that the reference point is endogenously determined through a rational expectation approach;[6] however, we further embed the formation of the reference point into a communication game between informed and uninformed players (respectively, politicians and voters).[7] The relevance of players' behavior in the formation of reference points has been studied both theoretically and experimentally by Gill and Stone, 2010 and Gill and Prowse, 2012, who investigate tournament settings.

Our work is also related to Kőszegi, 2006 as it studies the role that communication and anticipatory utilities[8] can play in an agency problem; however, whereas Kőszegi, 2006 focuses on environments in which the interests of the two parties are perfectly aligned, our paper assumes conflicting interests and tackles the issue of credible information transmission when two informed

[1] Farrell and Rabin, 1996 and Krishna and Morgan, 2008 provide a review of this literature.

[2] In a similar vein, Grillo, 2012 shows how reference dependence and loss aversion can yield to truthtelling through a change in the risk attitudes of players.

[3] In doing so, we assume that the the content of communication is verifiable with some probability. In this respect, our work is related to Dziuda, 2011, Ottaviani and Sorensen, 2006, Seidmann and Winter, 1997.

[4] See also Banks and Sundaram, 1998, Berganza, 2000, Duggan, 2000 and Schwabe, 2011.

[5] See, for instance Kahneman et al., 1990, Kahneman et al., 1991, van Dijk and van Knippenberg, 1996 and Fehr et al., 2011.

[6] Alternatively, the literature has also identified the reference point as the status quo. On this approach, see Kahneman and Tversky, 1991 and Sugden, 2003.,

[7] For a different approach, see Shalev, 2000.

[8] On anticipatory utilities see Loewenstein, 1987, Loewenstein and Prelec, 1992. For an axiomatic treatment see Caplin and Leahy, 2001, Epstein, 2008.

parties compete against each others.

Insofar we model a situation in which voters' beliefs concerning their own electoral behavior affect their preferences over final outcomes, our paper belongs to the literature on psychological games started by Geanakoplos et al., 1989 and extended to dynamic environments by Battigalli and Dufwenberg, 2009.[9] In particular, Battigalli et al., 2013 shows how guilt aversion can help attaining credible information transmission. The difference with our setting is not only semantic: our approach could be labelled as "independent of opponents' intentions", as voters' strategies do not depend on candidates' intentions. On the contrary, guilt aversion requires modelling players' higher-order belief about opponents' intentions.

Political scientists have long recognized the role played by expectations management in electoral competitions. In particular, Kimball and Patterson, 1997 show that the gap between expectations and politicians' real performance play an important role in determining voters' attitude toward Congress.[10] Waterman et al., 1999 extend this analysis by showing that this expectation gap is important in explaining voters' electoral behavior.[11] On a similar note, a growing literature has documented the role played by expectations in the evaluation of public services.[12]

Nevertheless, to the best of our knowledge, there has been little theoretical work on the role played by reference points in determining electoral outcomes and affecting political equilibria. Some noticeable exceptions are Banks, 1990, Lindstadt and Staton, 2010 and Passarelli and Tabellini, 2013. Banks, 1990 builds a model in which candidates' valence is unknown and candidates incur a cost from delivering an outcome different from what announced; in our paper, we explicitly model the channel through which false announcements can generate such a cost. In Lindstadt and Staton, 2010 candidates are explicitly involved in expectations' manipulation and the paper shows how downward management of expectations can increase candidates' electoral prospects. By characterizing the actual channel through which expectations can affect electoral behavior, our model endogenizes the formation of the reference point and shows how upward management of expectations can be counterproductive. Finally, Passarelli and Tabellini, 2013 build a model in which losses with respect to the citizens' reference point may generate political unrest and use this channel to explain distortions in the level of public expenditure with respect to the Benthamite benchmark and excessive debt accumulation. Besides obvious differences in the research question, our model differs from Passarelli and Tabellini, 2013 also in the choice of the reference point. Whereas they assume that the reference point of a citizen is given by what a utilitarian social planner biased in favor of that citizen would choose, we assume that the reference point is determined in equilibrium by the strategic interaction between candidates and voters.

[9] On psycholigcal games see also Charness and Dufwenberg, 2006, 2010, 2011, Battigalli and Dufwenberg, 2007 and Rabin, 1994.

[10] See also G.R. Boynton and Patterson, 1969.

[11] See also Sigelman and Knight, 1983.

[12] See, for instance, James, 2009 and the references therein.

2 The Model

Two candidates, A and B, compete to get elected. Each candidate can be high or low valence. Formally, a candidate's valence is represented by her type $\theta \in \{\theta_L, \theta_H\}$: if type θ_k is elected, the electorate experiences a consumption utility equal to g_k, $k \in \{L, H\}$. We assume that $g_H > g_L$ and we refer to g_H (respectively, g_L) as to the level of consumption utility yielded by the high (respectively, low) valence candidate. To simplify notation, we define $G = g_H - g_L$. We can interpret valences as the amount of public good that candidates can provide per unit of taxation.[13]

Candidates' types are determined independently according to the same distribution: each candidate has a probability q (respectively, $1-q$) to be high (respectively, low) valence. The type of a candidate is her own private information. At the beginning of the electoral competition, candidates can make simultaneous and public announcements concerning their types. We assume that communication is costless: candidates do not incur any direct cost from making these announcements. A candidate is elected if she gets 50% + 1 of the votes and in this case she gets a payoff equal to 1; otherwise her payoff is normalized to 0.

The electorate is made by a unit mass of voters; each voter is identified by an ideological bias in favor of candidate B, ϕ^j, which is assumed to be uniformly distributed in the interval $\left[-\frac{1}{2\varphi^i}, \frac{1}{2\varphi^i}\right]$. Voters vote sincerely based on their beliefs about candidates' valences, on their ideolgical bias ϕ^j and on the realization of a random variable δ distributed uniformly in the interval $\left[-\frac{1}{2\psi}, \frac{1}{2\psi}\right]$. δ can be thought as a popularity shock that hits voters' preferences after candidates made their announcements and affects electorate's willingness to vote for candidate B. Distributions are assumed to be uniform about 0 for analytical tractability, but the main results of the paper can be generalized to other absolutely continuous distributions. We will assume that voters interpret messages in the same way and that there is common knowledge of this and of the fact that they vote sincerely.

Timing is as follows. In period 0, each candidate makes a statement concerning her own valence. In period 1, three random variables are independently realized: each candidate i generates a signal t^i, that may reveal her true valence to the electorate and the random variable δ is also realized. In period 2, elections take place and utilities are realized.

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[13] For instance, assume that voters have a constant income level y and that their utilty is given by:

$$(1-\tau)\cdot y + G(h)\,, \text{ with } G'(\cdot) > 0 \text{ and } G''(\cdot) < 0,$$

where τ is a proportional tax rate and h is the level of public good provided by the politician in office. Assume futher that the pair (τ, h) is chosen by the elected politician in order to maximize voters' payoff subject to the budget constraint $\tau \cdot y = \frac{h}{\theta}$. Candidates' type are given by $\theta \in \{\theta_L, \theta_H\}$ with $\theta_L < \theta_H$; thus a high-valence candidate is able to provide higher levels of public good, h, for a given level of taxation, τ.

Then, we can define:

$$\begin{aligned} g_L &= (1-\tau^*(\theta_L))\, y + G(h^*(\theta_L)) \\ g_H &= (1-\tau^*(\theta_H))\, y + G(h^*(\theta_H)) \end{aligned}$$

where $(\tau^*(\theta), h^*(\theta))$ is the solution to the problem:

$$\arg\max_{(\tau,g)} (1-\tau)\, y + G(h) \text{ s.t. } \tau \cdot y = \frac{h}{\theta}.$$

It is immediate to verify that in this setting $g_L < g_H$.

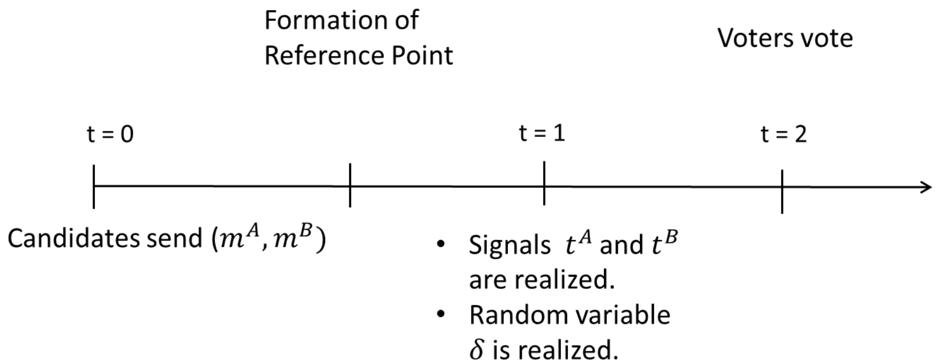

Figure 1: Timeline

We want to stress that, whereas signals t^i ($i \in \{$A,B$\}$) may reveal something about the valence of a candidate, δ is independent of candidates' actual types. For instance, δ could represent some personal trait of the candidate that is uncorrelated with her ability to provide the public good (e.g., her empathy or her ability to communicate effectively), some external event that makes the platform of one of the candidates more appealing to the electorate, or some scandal that hits the party to which candidate i belongs without directly affecting the candidate. The timing of the model is summarized in Figure 1.

Signals t^i are generated according to the following technology:

$$\Pr\{t_k \mid \theta_\ell\} = \begin{cases} p & k = \ell \\ \\ 1-p & k = 0 \\ \\ 0 & \text{otherwise} \end{cases}$$

In words, if a candidate has type θ_k, she will send signal t_k with probability p and an uninformative signal, t_0, with probability $(1-p)$. Thus, the set of signals is given by $T = \{t_L, t_0, t_H\}$ and p *captures the probability with which candidates' true type is revealed to the voter.* In this setting, p can be interpreted as a measure of the media's scrutiny (e.g., fact checking activity) and/or as the propensity of candidates' to make blunders, which can reveal their true valence.[14] For simplicity, we assume that p is exogenously given.

A pure communication strategy for candidate $i \in \{$A,B$\}$ is a function $s^i : \{\theta_L, \theta_H\} \to M$, where M is a finite set of messages. The set of pure strategies is denoted with S, while the set of mixed strategies is given by $\Sigma = \Delta(S)$ and its generic element is denoted with σ^i.

Departing from the previous literature, we assume that voters have reference dependent preferences a là Kőszegi and Rabin. In particular, for any pair $(g, r) \in \{g_L, g_H\} \times \{g_L, g_H\}$ the utility

[14] As it will become clear, the choice of the actual signaling technology is irrelevant as long as, in equilibirum, there exists a positive probability, say p, of detecting the lies of low-valence candidates.

function of the electorate is given by:

$$v(g \mid r) = g + \mu(g - r) \tag{1}$$

where:

$$\mu(x) = \eta \cdot \max\{0, x\} + \eta\lambda \min\{0, x\} \;\; \forall x \in \mathbb{R} \tag{2}$$

with $\eta \in [0, 1)$, and $\lambda > 1$. Thus, the electorate's preferences are described by the function $v(\cdot \mid \cdot)$: $\{g_L, g_H\}^2 \to \mathbb{R}$, in which the first argument, g, represents the actual level of public good experienced by the electorate and the second argument, r, is its reference level. We refer to $v(\cdot \mid \cdot)$ as to the *total utility*. Electorate's total utility can be separated in two components: the *consumption utility*, represented by g, and the *gain/loss utility*, represented by $\mu(g - r)$. Intuitively, whenever the actual level of public good experienced by the electorate, g, exceeds (respectively, falls short of) the reference valence, r, the agent experiences a gain (respectively, a loss). In this setting η measures the relative weight of the gain/loss utility compared to the consumption utility, while $\lambda > 1$ captures *loss aversion*, namely the fact that voters dislike losses more than they like equal-size gains. Following Kőszegi and Rabin, 2007, we extend the utility function to random outcomes and random reference points as follows. For every $(\tilde{g}, \tilde{r}) \in \Delta(\{g_L, g_H\}) \times \Delta(\{g_L, g_H\})$:[15]

$$V(\tilde{g} \mid \tilde{r}) = \sum_{g \in \{g_L, g_H\}} \sum_{r \in \{g_L, g_H\}} v(g \mid r) \cdot \tilde{g}[g] \cdot \tilde{r}[r]\,.^{16} \tag{3}$$

Obviously, if $\eta = 0$, the electorate behaves as a standard expected utility maximizer with linear vNM utility indexes. The assumption that deviations from the reference point are evaluated according to a piecewise linear function can be relaxed at the cost of an increase in analytical complexity.

Let $(\sigma^A, \sigma^B) \in \Sigma^2$ be the (independent) conjecture concerning the communication strategy followed by candidates.[17] By Bayes rule, the probability the electorate assigns to candidate $i \in$ {A,B} being high-valence after announcement pair (m^A, m^B) is given by:[18]

$$\pi_1^i\left(m^i \mid \sigma^i\right) = \frac{q \cdot \sum_{s_i \in S_i} \sigma^i[s_i] \cdot s_i(\theta_H)\left[m^i\right]}{q \cdot \sum_{s_i \in S_i} \sigma^i[s_i] \cdot s_i(\theta_H)[m^i] + (1-q)\sum_{s_i \in S_i} \sigma^i[s_i] \cdot s_i(\theta_L)[m^i]} \tag{4}$$

if m^i has positive probability under σ^i and by $\pi_1^i\left(m^i \mid \sigma^i\right) \in [0, 1]$ if $q \cdot \sum_{s_i \in S_i} \sigma^i[s_i] \cdot s_i(\theta_H)\left[m^i\right] + (1-q)\sum_{s_i \in S_i} \sigma^i[s_i] \cdot s_i(\theta_L)\left[m^i\right] = 0$.

Similarly, $\pi_2^i\left(m^i, t^i \mid \sigma^i\right)$ is the probability that the electorate assigns to the candidate of party i being high valence after announcements m^i and signal t^i given conjecture σ^i. This can be written

[15] In what follows, we will sometimes abuse notation writing $V(g \mid \tilde{r})$ and $V(\tilde{g} \mid r)$ to denote the utility associated with a degenerate distribution over an actual outcome g or a reference outcome r.

[17] In our analysis, we take the shortcut of defining beliefs when players hold independent conjectures about their opponents' behavior. This approach is sufficient in the equilibrium analysis and simplifies the notation. However, it is straightforward to extend the notation to allow for correlated conjectures.

[18] Since the probability associated with candidate i depends neither on m^j, nor on σ^j, $j \neq i$, we write $\pi_1^i\left(m^i \mid \sigma^i\right)$ instead of $\pi_1^i\left(m^A, m^B \mid \sigma^A, \sigma^B\right)$.

as:

$$\pi_2^i\left(m^i, t^i \mid \sigma^i\right) = \begin{cases} 0 & \text{if } t^i = t_L \\ \pi_1^i\left(m^i \mid \sigma^i\right) & \text{if } t^i = t_0 \\ 1 & \text{if } t^i = t_H \end{cases}. \tag{5}$$

In words, if the signal reveals the candidate's type, the electorate will update its belief accordingly; otherwise it will maintain the belief generated by the announcement.[19]

Finally, given $\left(\pi_1^A\left(m^A \mid \sigma^A\right), \pi_1^B\left(m^B \mid \sigma^B\right)\right)$, let $\hat{\pi}\left(t^A, t^B \mid m^A, m^B, \sigma^A, \sigma^B\right)$ be the probability the electorate assigns to signals $\left(t^A, t^B\right)$ being generated when it holds conjectures $\left(\sigma^A, \sigma^B\right)$ and it received announcements $\left(m^A, m^B\right)$. $\hat{\pi}\left(t^A, t^B \mid m^A, m^B, \sigma^A, \sigma^B\right)$ is summarized in the following table:[20]

	t_L	t_0	t_H
t_L	$p^2\left(1-\pi_1^A\right)\left(1-\pi_1^B\right)$	$p\left(1-\pi_1^A\right)(1-p)$	$p^2\left(1-\pi_1^A\right)\pi_1^B$
t_0	$(1-p)\,p\left(1-\pi_1^B\right)$	$(1-p)^2$	$(1-p)\,p\pi_1^B$
t_H	$p^2\pi_1^A\left(1-\pi_1^B\right)$	$p\pi_1^A(1-p)$	$p^2\pi_1^A\pi_1^B$

Under the assumption of sincere voting, a voter with ideological bias f^j who holds (independent) conjectures $\left(\sigma^A, \sigma^B\right)$ on the candidates' communication strategies and has reference point $\tilde{r}$ will vote for A (B) at information set $\left(m^A, m^B, t^A, t^B, f^j, d\right)$ if:

$$\begin{aligned}&\pi_2^A\left(m^A, t^A \mid \sigma^A\right) V\left(g_H \mid \tilde{r}\right) + \left(1-\pi_2^A\left(m^A, t^A \mid \sigma^A\right)\right) V\left(g_L \mid \tilde{r}\right) > \ (<) \\ &\qquad \pi_2^B\left(m^B, t^B \mid \sigma^B\right) V\left(g_H \mid \tilde{r}\right) + \left(1-\pi_2^B\left(m^B, t^B \mid \sigma^B\right)\right) V\left(g_L \mid \tilde{r}\right) + f^j + d\end{aligned}$$

or equivalently if:

$$\left(\pi_2^A\left(m^A, t^A \mid \sigma^A\right) - \pi_2^B\left(m^B, t^B \mid \sigma^B\right)\right) \cdot \left(V\left(g_H \mid \tilde{r}\right) - V\left(g_L \mid \tilde{r}\right)\right) > \ (<) \ f^j + d \tag{6}$$

We will further assume that if the two sides of (6) are equal, a voter will randomize between candidates with equal probability.[21] As a result, for every realization d, the vote share in favor of candidate A is given by

$$\begin{aligned}&Q\left(m^A, m^B, t^A, t^B \mid \sigma^A, \sigma^B\right) = \\ &\qquad = \frac{1}{2} + \varphi \cdot \left(\pi_2^A\left(m^A, t^A \mid \sigma^A\right) - \pi_2^B\left(m^B, t^B \mid \sigma^B\right)\right) \cdot \left(V\left(g_H \mid \tilde{r}\right) - V\left(g_L \mid \tilde{r}\right)\right) - \varphi \cdot d\end{aligned}$$

Thus, the probability with which candidate A is elected after message-signal profile $\left(m^A, m^B, t^A, t^A\right)$

[19] These beliefs will arise through equilibrium analysis, if we were to use an equilibrium concept similar to sequential equilibrium in which all information sets arise with positive provability.

[20] To simplify notation we omit to specify the dependence of $\pi_1^i(\cdot)$ on m^i and σ^i.

[21] The actual tie-breaking rule does not play any role in the analysis.

is given by:

$$W^A\left(m^A,m^B,t^A,t^B\mid\sigma^A,\sigma^B\right)=\Pr\left\{Q\left(m^A,m^B,t^A,t^B\mid\sigma^A,\sigma^B\right)>\frac{1}{2}\right\}=$$
$$=\frac{1}{2}+\psi\cdot\left[\pi_2^A\left(m^A,t^A\mid\sigma^A\right)-\pi_2^B\left(m^B,t^B\mid\sigma^B\right)\right]\cdot\left[V\left(g_H\mid\tilde{r}\right)-V\left(g_L\mid\tilde{r}\right)\right],$$

whereas the probability that voters assign to candidate A winning after message $\left(m^A,m^B\right)$ is given by:

$$W^A\left(m^A,m^B\mid\sigma^A,\sigma^B\right)=\sum_{t^A,t^B}\hat{\pi}\left(t^A,t^B\mid m^A,m^B,\sigma^A,\sigma^B\right)\cdot$$
$$\cdot\left(\frac{1}{2}+\psi\cdot\left[\pi_2^A\left(m^A,t^A\mid\sigma^A\right)-\pi_2^B\left(m^B,t^B\mid\sigma^B\right)\right]\cdot\left[V\left(g_H\mid\tilde{r}\right)-V\left(g_L\mid\tilde{r}\right)\right]\right)$$

Although election takes place at the end of period 2, the reference point of voters is determined after candidates make their announcements. This is a sensible assumption: if the announcements have some informational content, voters will update their beliefs according to these announcements and such a mental process will modify their reference point. In line with Kőszegi and Rabin, 2006, 2007, 2009, we endogenize the formation of the reference point assuming rational expectations: the reference point is determined by voters' beliefs concerning the valence of the elected candidate under sincere voting. We say that sincere voting is *reference-point consistent* if voters behave according to 6 when $\tilde{r}$ is determined through equilibrium analysis under the assumption that other voters vote sincerely.

In particular, let $\left(\sigma^A,\sigma^B\right)$ be the electorate's (independent) conjecture about the candidates' communication strategy. Then, after announcements $\left(m^A,m^B\right)$, each voter will assign probability $\hat{\pi}\left(t^A,t^B\mid m^A,m^B,\sigma^A,\sigma^B\right)$ to pair $\left(t^A,t^B\right)$ being generated. As a result, his reference point, $\tilde{r}\left(m^A,m^B\mid\sigma^A,\sigma^B\right)$ will be given by a probability measure that assigns probability

$$\sum_{t^A,t^B}\Big[\hat{\pi}\left(t^A,t^B\mid m^A,m^B,\sigma^A,\sigma^B\right)\cdot\left(W^A\left(m^A,m^B,t^A,t^B\mid\sigma^A,\sigma^B\right)\cdot\pi_2^A\left(m^A,t^A\mid\sigma^A\right)+\right.$$
$$\left.+\left(1-W^A\left(m^A,m^B,t^A,t^B\mid\sigma^A,\sigma^B\right)\right)\cdot\pi_2^B\left(m^B,t^B\mid\sigma^B\right)\right)\Big]$$

to g_H and complementary probability to g_L. Intuitively, for every pair $\left(t^A,t^B\right)$ (which arise with probability $\hat{\pi}\left(t^A,t^B\mid\cdot\right)$) the electorate will get utility g_H either if candidate A is elected and turns out to be high-valence (which happens with probability $W^A\cdot\pi_2^A$) or if B is elected and turns out to be high-valence (which happens with probability $\left(1-W^A\right)\cdot\pi_2^B$).

Definition 1 *Sincere voting is reference point consistent at* $\left(m^A,m^B\right)$ *given* $\left(\sigma^A,\sigma^B\right)$ *if for every*

$\left(t^A, t^B, d\right)$, *a voter with ideological bias* σ^j *will vote for candidate A (B) if*

$$\left(\pi_2^A\left(m^A, t^A \mid \sigma^A\right) - \pi_2^B\left(m^B, t^B \mid \sigma^B\right)\right) \cdot$$
$$\cdot \left(V\left(g_H \mid \tilde{r}\left(m^A, m^B \mid \sigma^A, \sigma^B\right)\right) - V\left(g_L \mid \tilde{r}\left(m^A, m^B \mid \sigma^A, \sigma^B\right)\right)\right) > \ (<) \ f^j + d$$

and randomize with equal probability if

$$\left(\pi_2^A\left(m^A, t^A \mid \sigma^A\right) - \pi_2^B\left(m^B, t^B \mid \sigma^B\right)\right) \cdot$$
$$\cdot \left(V\left(g_H \mid \tilde{r}\left(m^A, m^B \mid \sigma^A, \sigma^B\right)\right) - V\left(g_L \mid \tilde{r}\left(m^A, m^B \mid \sigma^A, \sigma^B\right)\right)\right) = \ f^j + d$$

Sincere voting is reference-point consistent given $\left(\sigma^A, \sigma^B\right)$ *if it is reference-point consistent at* $\left(m^A, m^B\right)$ *given* $\left(\sigma^A, \sigma^B\right)$ *for every* $\left(m^A, m^B\right)$.

We want to stress that the reference point of the electorate is determined through a *forward looking* approach: it is given by the distribution over outcomes induced by the electorate's beliefs after announcements $\left(m^A, m^B\right)$. Nevertheless, once established, the reference point does not change and, in particular, does not adjust to the additional information conveyed by signals $\left(t^A, t^B\right)$; in this respect, in period $t = 2$, the reference point is inherited from the previous periods. This is not a contradictory feature of our model. Indeed, our paper characterizes a channel through which communication may affect the behavior of the uninformed party and modify the equilibrium communication strategy of the informed one. Thus, although it is true that our mechanism work insofar *past* announcements have some persisting saliency in the mind of the electorate, such persistency stems from the fact that the electorate updates its *beliefs about the future* in response to such announcements. Moreover, if we allow for a partial revision of the reference point upon receiving signals $\left(t^A, t^B\right)$, the main qualitative findings of our model would go through.[22]

Candidates are modelled as standard expected utility maximizers.[23] Thus, if candidate A has type θ and sends message m and believes that the other candidate is following strategy σ^B, her

[22] For instance, we could assume that for each outcome $g \in \{g_L, g_H\}$, the electorate's reference point in period 2 is given by:

$$\alpha \cdot \tilde{r}\left(m^A, m^B \mid \sigma^A, \sigma^B\right)[g] + (1-\alpha) \cdot \tilde{r}\left(m^A, m^B, t^A, t^B, d \mid \sigma^A, \sigma^B\right)[g]$$

where $\alpha \in (0,1)$ and

$$\begin{aligned}\tilde{r}\left(m^A, m^B, t^A, t^B, d \mid \sigma^A, \sigma^B\right)[g] &= W^A\left(m^A, m^B, t^A, t^B \mid \sigma^A, \sigma^B\right) \cdot \pi_2^A\left(m^A, t^A \mid \sigma^A\right) + \\ &\quad + \left(1 - W^A\left(m^A, m^B, t^A, t^B \mid \sigma^A, \sigma^B\right)\right) \cdot \pi_2^B\left(m^B, t^B \mid \sigma^B\right).\end{aligned}$$

This would correspond to a situation in which the reference point is determined partially (with weight α) just after candidates' announcements and partially (with complementary weight) after that signals are generated.

[23] Nothing would change if we were to impose reference dependence on the side of candidates as well.

expected utility would be given by:

$$U^A\left(m,\sigma^B \mid \theta\right)=\sum_{s\in S}\sigma^B\left[s\right]\left[q\cdot W^A\left(m,s\left(\theta_H\right)\mid\sigma^A,\sigma^B\right)+\right.$$
$$\left.+\left(1-q\right)\cdot W^A\left(m,s\left(\theta_L\right)\mid\sigma^A,\sigma^B\right)\right].$$

Similarly, for candidate B:

$$U^B\left(m,\sigma^A \mid \theta\right)=\sum_{s\in S}\sigma^A\left[s\right]\left[q\cdot\left(1-W^A\left(s\left(\theta_H\right),m\mid\sigma^A,\sigma^B\right)\right)+\right.$$
$$\left.+\left(1-q\right)\cdot\left(1-W^A\left(s\left(\theta_L\right),m\mid\sigma^A,\sigma^B\right)\right)\right].$$

We are now ready to define the solution concept we will be using throughout the paper.[24]

Definition 2 *A profile of communication strategies $\left(\sigma^A,\sigma^B\right)$ is an equilibrium if:*
(i) for every $i\in\{A,B\}$, if $\sigma^i[s]>0$ then

$$\forall\theta\in\{\theta_L,\theta_H\},\ s\left(\theta\right)\in\arg\max_{m\in M}U^i\left(m,\sigma^j\mid\theta\right),\ i\neq j;$$

(ii) sincere voting is reference-point consistent given $\left(\sigma^A,\sigma^B\right)$.

In the paper, we will be particularly interested in two types of equilibria: *uninformative equilibria* and *fully revealing* ones. Their formal definition is given below..

Definition 3 *Let $\left(\sigma^A,\sigma^B\right)$ be an equilibrium. Then:*
(i) the equilibrium is uninformative if for every $i\in\{A,B\}$ and every $m\in M$,

$$\sum_{s:s(\theta_L)=m}\sigma^i\left[s\right]=\sum_{s:s(\theta_H)=m}\sigma^i\left[s\right]$$

(ii) the equilibrium is fully informative if for every player i, every message m and every pair $\theta,\theta'\in\{\theta_L,\theta_H\}$ with $\theta\neq\theta'$, $\sigma^i[s]>0$ and $s(\theta)=m$, then $s'\left(\theta'\right)\neq m$, for every s' such that $\sigma^i[s']>0$.

In words, in an uninformative equilibrium, voters do not change their prior belief after any message m (namely, $\pi^i\left(m^i\mid\sigma^i\right)=q$ for every i and every message m). In this case, we can assume $M=\{\bar m\}$ and focus on uninformative communication strategies: $s^i_U(\theta)\equiv\bar m$.[25] On the contrary, in a *fully revealing* equilibrium, message pair $\left(m^A,m^B\right)$ truthfully reveals candidates' type. In this

[24] In the equilibrium definition, we omit to specify beliefs and to impose their consistency with Bayes rule as implied by (4) and (5).

[25] To this goal, we will assume that any out-of-equilibrium message $m\neq\bar m$ is interpreted by the electorate exactly as message $\bar m$, namely that $\pi^i_1\left(m\mid s^i_U\right)=q$ for every $i\in\{A,B\}$.

case, we can assume $M = \{m_L, m_H\}$, where m_k should be interpreted as "my type is θ_k" and focus on fully revealing communication strategies: $s_R^i(\theta_L) = m_L$ and $s_R^i(\theta_H) = m_H$; obviously, $\pi^i\left(m_H^i \mid s_R^i\right) = 1$ and $\pi^i\left(m_L^i \mid s_R^i\right) = 0$.[26]

We conclude this section imposing an assumption that guarantees a sufficient degree of uncertainty in the electoral outcome: the support of the popularity shock must be sufficiently large to guarantee that a low-valence candidate can win against a high-valence one if the popularity shock δ take extreme values. Section 3 will discuss the role of this assumption in more details.

Assumption 1 $\frac{1}{2\psi} > G(1+\eta\lambda)$.

Notice that Assumption 1 also puts an upper bound on the degree of loss aversion: $\lambda < \frac{1}{\eta}\left(\frac{1}{2\psi G} - 1\right) = \bar{\lambda}$. It is immediate to check that $\bar{\lambda} > 1$.

3 Equilibrium Analysis

In this section, we characterize the equilibria of the game. We start showing that without reference dependence the unique equilibrium is uninformative (Proposition 1). Then, we introduce reference dependence and we show that fully revealing equilibria may arise (Proposition 3). Obviously, under reference dependence, the uninformative equilibrium will still exists as the electorate is always free to ignore candidates' announcements (Proposition 4). Finally, we characterize symmetric partially revealing equilibria in which low-valence candidates randomize between a message that reveals them as such and a message that is sent by high-valence candidates (Proposition 5).

3.1 Equilibrium without Reference Dependence

First consider the special case in which the electorate does not exhibit reference dependence ($\eta = 0$). Under this assumption, candidates' announcements have no long-lasting effect on the electorate's preference and, as a result, they lack any credibility. The intuition is straightforward: without reference dependence, claiming to be high-valence increases the probability of being elected if the lie is not detected. On the other hand, even if the electorate realizes that candidate i lied (by receiving a signal t^i that contradicts the initial announcement m^i), the candidate would not be worse off than if he had been sincere from the beginning. Consequently, if a message m^i could increase $\pi_1^i(\cdot \mid \cdot)$, both types of candidate i would send it and the announcement would not be credible. The next proposition formalizes this result.

Proposition 1 *Let $\eta = 0$. Then the unique equilibria of the game are uninformative. Thus, (i) all equilibria are equivalent to $\left(s_U^A, s_U^B,\right)$,[27] and (ii) $W^A\left(\cdot \mid s_U^A, s_U^B\right)$ can be summarized in the following*

[26] In this case, we can assume that any out-of-equilibrium message $m \notin \{m_L, m_H\}$ is interpreted by the electorate as message m_L, namely that $\pi_1^i\left(m \mid s_R^i\right) = 0$ for every $i \in \{\text{A,B}\}$ and every message $m \neq m_L, m_H$.

[27] Strategies s_U^i have been defined after Definition 3.

table:[28]

$(\bar{m},\bar{m})$	t_L	t_0	t_H
t_L	$\frac{1}{2}$	$\frac{1}{2}-\psi qG$	$\frac{1}{2}-\psi G$
t_0	$\frac{1}{2}+\psi qG$	$\frac{1}{2}$	$\frac{1}{2}-\psi\left(1-q\right)G$
t_H	$\frac{1}{2}+\psi G$	$\frac{1}{2}+\psi\left(1-q\right)G$	$\frac{1}{2}$

3.2 Full Revelation under Reference Dependence

Now, suppose that voters exhibit reference dependence, namely suppose that $\eta > 0$. Assume further that they believe candidates are following strategy $\left(s_R^A, s_R^B\right)$, namely that each candidate is announcing her valence truthfully. The following proposition characterizes the probability with which candidates will win given $\left(s_R^A, s_R^B\right)$.

Proposition 2 *Suppose assumption 1 holds. Define*

$$\begin{aligned} W^+ &= W^+\left(\eta,\lambda,G\right) = \frac{1}{2}+\psi\left(1+\eta\lambda\right)G \\ W^- &= W^-\left(\eta,G\right) = \frac{1}{2}+\psi\left(1+\eta\right)G \\ W_R &= W_R\left(\eta,\lambda,G\mid\psi\right) = \frac{\frac{1}{2}+\psi\left(1+\eta\right)G}{\left(1-\psi\cdot\eta\left(\lambda-1\right)\cdot G\right)}. \end{aligned}$$

Then $W^A\left(\cdot\mid s_R^A,s_R^B\right)$ can be summarized in the following tables:

(m_H,m_H)	t_L	t_0	t_H
t_L	$\frac{1}{2}$	$1-W^+$	$1-W^+$
t_0	W^+	$\frac{1}{2}$	$\frac{1}{2}$
t_H	W^+	$\frac{1}{2}$	$\frac{1}{2}$

(m_H,m_L)	t_L	t_0	t_H
t_L	$\frac{1}{2}$	$\frac{1}{2}$	$1-W_R$
t_0	W_R	W_R	$\frac{1}{2}$
t_H	W_R	W_R	$\frac{1}{2}$

(m_L,m_H)	t_L	t_0	t_H
t_L	$\frac{1}{2}$	$1-W_R$	$1-W_R$
t_0	$\frac{1}{2}$	$1-W_R$	$1-W_R$
t_H	W_R	$\frac{1}{2}$	$\frac{1}{2}$

(m_L,m_L)	t_L	t_0	t_H
t_L	$\frac{1}{2}$	$\frac{1}{2}$	$1-W^-$
t_0	$\frac{1}{2}$	$\frac{1}{2}$	$1-W^-$
t_H	W^-	W^-	$\frac{1}{2}$

Furthermore, $W_R\left(\eta,\lambda,G\mid\psi\right)\in\left(W^-\left(\eta,G\right),W^+\left(\eta,\lambda,G\right)\right)$ for every $\lambda\in\left(1,\bar{\lambda}\right)$.

The statement of proposition 2 have some interesting properties. First of all, it is easy to see that *initial announcements may have a long-lasting effect on electoral outcomes.* Indeed, although $\pi_2^i\left(m_H,m_H,t_L,t_H\right)=\pi_2^i\left(m_L,m_H,t_L,t_H\right)$ for every $i\in\{A,B\}$, $W^A\left(m_H,m_H,t_L,t_H\mid s_R^A,s_R^B\right)\neq W^A\left(m_L,m_H,t_L,t_H\mid s_R^A,s_R^B\right)$ for every $\lambda\in\left(1,\bar{\lambda}\right)$. Intuitively, initial announcements modify not only voters' belief, but also their reference points and this latter channel has a persistent effect on voters' electoral behavior.

[28] The t_i-th row and t_j-th column in matrix $\left(m^A,m^B\right)$ represents $W^A\left(m^A,m^B,\cdot,\cdot\mid s_U^A,s_U^B\right)$. A similar notation holds for the following propositions.

Moreover, *lies may hurt candidate's electoral prospects.* More precisely, if a candidate lies, her probability of winning the election may fall below the one she could have guaranteed to herself by revealing her valence truthfully. To see this, suppose candidate A has low valence and believes B is following strategy $s_R^B(\cdot)$. Then, if she reveals her type truthfully, she wins either with probability $1 - W_R(\eta, \lambda, G \mid \psi)$ (if B has high valence) or with probability $\frac{1}{2}$ (if B has low valence). Instead, if she lies, her probability of winning depends both on her opponent's valence and on the signal she generates. In particular, if the lie is detected (that is, if she generates signal t_L), her probability of winning is either equal to $1 - W^+(\eta, \lambda, G)$ (if the opponent has high valence) or to $\frac{1}{2}$ (if the opponent is low valence). Since $W_R(\eta, \lambda, G \mid \psi) < W^+(\eta, \lambda, G)$, we conclude that lies may lower the probability of winning the election. Let $S(\eta, \lambda, G \mid \psi) = W^+(\eta, \lambda, G) - W_R(\eta, \lambda, G \mid \psi)$; we will refer to it as to the *cost of lying*.

Notice that *lying is costly* $(S(\eta, \lambda, G \mid \psi) > 0)$ *if and only if voters exhibit both reference dependence* $(\eta > 0)$ *and loss aversion* $(\lambda > 1)$. To understand why, observe that with loss-neutral voters $(\lambda = 1)$, $S(\eta, 1, G \mid \psi) = 0$ and $W^+(\eta, \lambda, G) = W_R(\eta, \lambda, G \mid \psi) = W^-(\eta, G) = G(1 + \eta)$. Thus, even if the lie were detected, the low-valence candidate would not be worse off than under a truthtelling strategy. Consequently, lies would have no downsides. Intuitively, without loss aversion the gain voters get by supporting an high-valence candidate and the loss they incur by supporting a low-valence one have the same magnitude; thus, the net effect in favor of the high valence candidate will be the same independently of the reference point and its actual position would not play any role. Instead, if the agent is loss averse $(\lambda > 1)$, the actual reference point matters. In particular, the higher is the probability assigned to g_H (for instance, because a low-valence candidate lied and, by doing so, she raised voters reference point), the higher will be the advantage in favor of high-valence candidates. Thus, the detection of a lie could significantly decrease the electoral prospects of low valence candidates.

Furthermore, *the cost of lying is largest for intermediate values of loss aversion.* Recall that $\bar{\lambda}$ is the highest value of loss aversion compatible with assumption 1. Then, it is immediate to verify that $S(\eta, 1, G \mid \psi) = S\left(\eta, \bar{\lambda}, G \mid \psi\right) = 0$, $\left.\frac{\partial S(\eta,\lambda,G|\psi)}{\partial \lambda}\right|_{\lambda=1} > 0$ and $\left.\frac{\partial S(\eta,\lambda,G|\psi)}{\partial \lambda}\right|_{\lambda=\bar{\lambda}} < 0$. We conclude that the switching range is maximized for some value of $\lambda \in \left(1, \bar{\lambda}\right)$. In other words, the cost of lying first increases and then decreases in λ reaching a maximum for some intermediate value $\lambda \in \left(1, \bar{\lambda}\right)$. The intuition behind this result hinges on the double role played by loss aversion. On the one hand, a high level of loss aversion makes the voter less willing to accept *unexpected losses*; thus, if the electorate finds out that a candidate overstated her valence, it will be more willing to vote for her opponent as long as she can reduce such losses. On the other hand, an increase in loss aversion makes the electorate less willing to formulate strategies that can yield *expected losses*; as a result, when loss aversion is maximal $\left(\lambda = \bar{\lambda}\right)$, the electorate will never support low-valence candidates when a high-valence candidate is available. As a result $W^+(\eta, \lambda, G) = W_R(\eta, \lambda, G \mid \psi) = 1$ and $S\left(\eta, \bar{\lambda}, G \mid \psi\right) = 0$.

Finally, it is useful to point out *that the voters do not decrease their willingness to support a candidate just because she lied.* Indeed, if the candidate turns out to be better than what initially announced, such willingness could even increase. Instead, lying is costly if (i) the lie is detected, (ii) the lie would generate a loss for the voter, and (iii) electing the other candidate could reduce this loss. These features distinguish our setting from one in which voters exhibit preferences for honesty and enable us to highlight the circumstances under which truthtelling is likely to arise.

Given our characterization of election probabilities under truthtelling, we can further characterize the conditions under which $\left(s_R^A, s_R^B\right)$ is an equilibrium.

Proposition 3 *Suppose assumption 1 holds. Then there exists $p^*(\eta, \lambda, G, q \mid \psi) < 1$ such that a fully revealing equilibrium exists if and only if $p \in (p^*(\eta, \lambda, G, q \mid \psi), 1)$. Furthermore $p^*(\eta, \cdot, G, q \mid \psi)$ is minimized at some $\lambda \in \left(1, \bar{\lambda}\right)$.*

Thus, under assumption 1, *a fully revealing equilibrium exists if and only if the probability of detecting a lie is sufficiently high.* The actual value of $p^*(\eta, \lambda, G, q \mid \psi)$ is the solution of the following equation:

$$(1 - p^*(\eta, \lambda, G, q \mid \psi)) \cdot \left(W_R(\eta, \lambda, G \mid \psi) - \frac{1}{2}\right) = p^*(\eta, \lambda, G, q \mid \psi) \cdot q \cdot \left(W^+(\eta, \lambda, G) - W_R(\eta, \lambda, G \mid \psi)\right) \tag{7}$$

which yields:

$$p^*(\eta, \lambda, G, q \mid \psi) = \frac{2 + \eta + \lambda\eta}{(2 + \eta + \lambda\eta) + q\eta(\lambda - 1)(1 - 2\psi G(1 + \eta\lambda))}. \tag{8}$$

Equation (7) captures the key trade off faced by a low valence candidate. If she lies and the lie is not detected (which happens with probability $(1 - p)$), her probability of winning increases by $W_R(\eta, \lambda, G \mid \psi) - \frac{1}{2}$.[29] However, if the lie is detected (which happens with probability p), her probability of winning decreases by $q \cdot S(\eta, \lambda, G \mid \psi)$.[30] $p^*(\eta, \lambda, G, q \mid \psi)$ is the probability level that equates the expected benefit from lying with its expected cost. Figure 2 captures the trade-off between truthtelling and lying. It depicts the probability of winning of candidate A if B follows a fully revealing communication strategy, sincere voting is reference point consistent given $\left(s_R^A, s_R^B\right)$ and A is either high-valence (left) or low-valence (right). In this case the probability of winning depends on A's communication strategy (blue lines correspond to truthtelling, while red lines correspond to lying), the valence of the other candidate and the possibility that the electorate detects a lie.

[29] In particular, the probability of winning goes from $\frac{1}{2}$ to $W_R(\eta, \lambda, G \mid \psi)$ if the opponent is low valence (which happens with probability $1 - q$) and from $(1 - W_R(\eta, \lambda, G \mid \psi))$ to $\frac{1}{2}$ if the opponent is high valence (which happens with probability q).

[30] In particular, the probability of winning stays constant at $\frac{1}{2}$ if the opponent has low valence (which happens with probability $(1 - q)$) and goes from $(1 - W_R(\eta, \lambda, G \mid \psi))$ to $\left(1 - W^+(\eta, \lambda, G)\right)$ if the opponent has high valence (which happens with probability q).

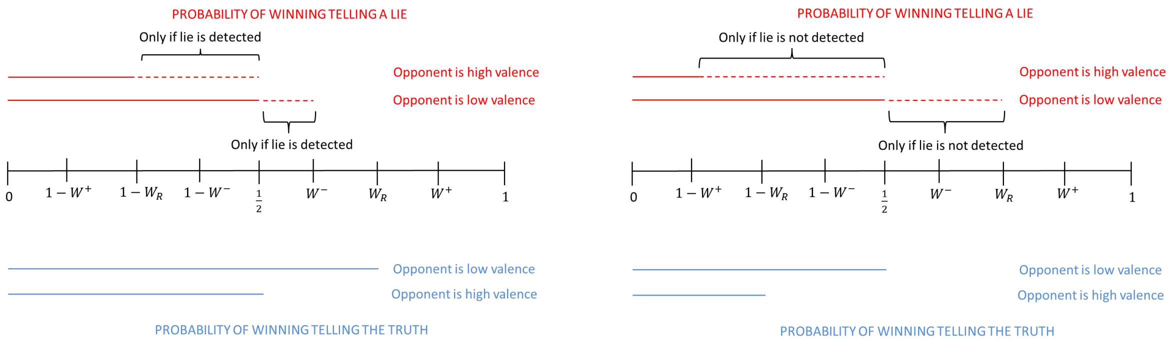

Figure 2: Candidate A's Trade-off between Truthtelling and Lying

An immediate implication of the previous discussion is that *the only relevant incentive compatibility constraint is the one associated with low-valence candidates.* To put it differently, a high valence candidate has no incentive to understate her actual valence in order to subsequently surprise the voter.[31] Intuitively, announcing to have high valence from the beginning raises the electorate's expectation in favor of high-valence candidates and this increases the winning probability of high-valence candidates more than what positive surprises with respect to a reference point that assigns higher probability to g_L could do.

Notice that $p^*(0, \lambda, G, q \mid \psi) = 1$, $p^*(\eta, 1, G, q \mid \psi) = 1$, $p^*\left(\eta, \bar{\lambda}, G, q \mid \psi\right) = 1$. Thus, fully revealing equilibria do not exist in either cases. In the former case announcements cannot have any long-lasting effect on the electorate's preferences, while in the latter case they do affect reference points, but overstating one's valence is not worse than being sincere from the beginning as the cost from lying is 0. Instead, if $\lambda \in \left(1, \bar{\lambda}\right)$, $p^*(\eta, \lambda, G, q \mid \psi) < 1$. Moreover, $p^*(\eta, \lambda, G, q \mid \psi)$ is minimized at:

$$\lambda^*(\eta, \psi, G) = \frac{\left(\sqrt{G\psi(1+\eta)(2\psi G(1+\eta)+1)}\right)}{G\psi\eta} - \frac{2+\eta}{\eta}$$

Taking the limit of as $\psi \to 0$, we get:

$$\lim_{\psi \to 0} p^*(\eta, \lambda, G, q \mid \psi) = \frac{2+\eta+\lambda\eta}{(2+\eta+\lambda\eta)+q\eta(\lambda-1)},$$

which is decreasing in λ. Since $\lim_{\psi \to 0} \bar{\lambda} = \infty$, we can also conclude that:

$$\lim_{\lambda \to \infty}\left(\lim_{\psi \to 0} p^*(\eta, \lambda, G, q \mid \psi)\right) = \frac{1}{1+q}.$$

Thus, as we increase the uncertainty of the electoral outcome (namely, we decrease ψ) and the degree of loss aversion (namely, we increase λ), the range of detecting probabilities for which fully revealing equilibria exists (namely, $(p^*(\eta, \lambda, G, q \mid \psi), 1)$) gets larger; in particular, the lower bound on $p^*(\eta, \lambda, G, q \mid \psi)$ is given by $\frac{1}{1+q} > \frac{1}{2}$. In words, *an increase in electoral uncertainty favors*

[31] This follows from $W^-(\eta, G) < W_R(\eta, \lambda, G \mid \psi)$.

truthtelling equilibria. Indeed, as ψ increases extreme realizations of δ becomes relatively more likely and the probability that a low-valence candidate could win against a high-valence one increases, reducing the disadvantage associated with announcing to be low-valence.

Figure 3 plots $p^*(\eta, \lambda, G, q \mid \psi)$ as a function of the parameters in our model. The non-monotonic pattern of $p^*(\eta, \lambda, G, q \mid \psi)$ with respect to loss aversion (λ) and its decreasing pattern with respect to electoral uncertainty ($\frac{1}{\psi}$) have already been justified. The non-monotonicity with respect to the degree of reference dependence (η) follows from the same arguments we highlighted λ. Then, we can simply notice that $p^*(\eta, \lambda, G, q \mid \psi)$ is increasing in G and decreasing in q. The former result follows from the fact that a bigger difference in the skills of the two types makes lies more attractive, whereas the latter one hinges on the fact that the cost of lying is incurred only if the opponent is high valence (which happens with probability q).

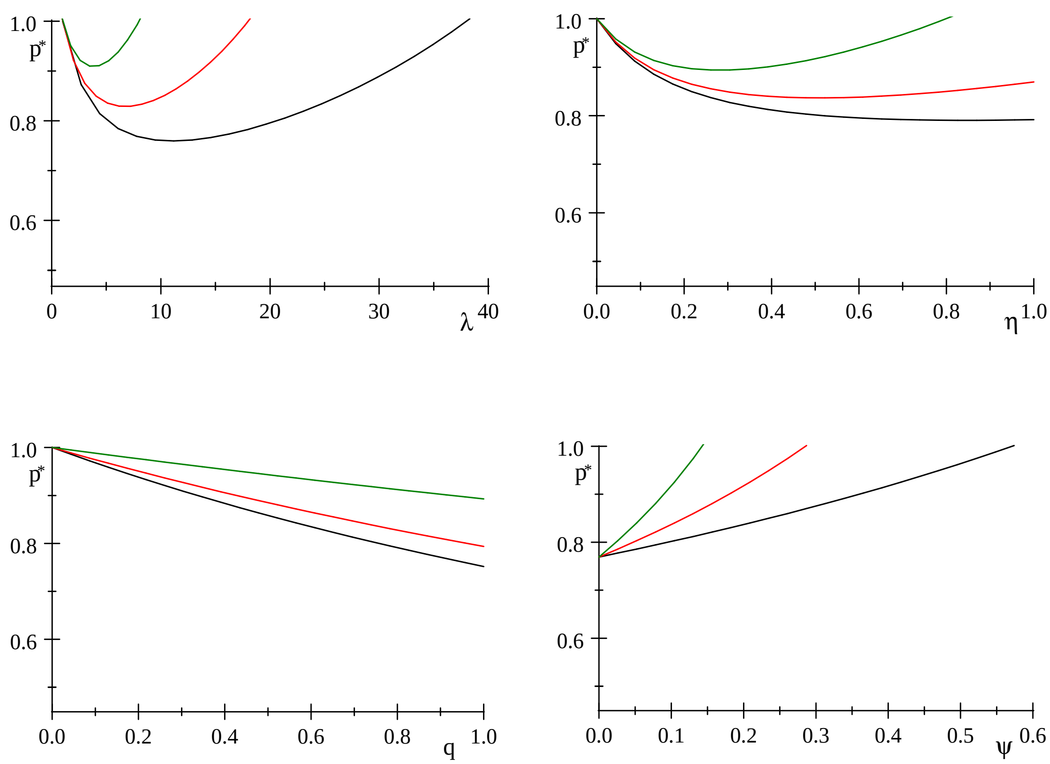

Figure 3: $p^*(\eta, \lambda, G, q \mid \psi)$. Not varying parameters are set equal to $\eta = \frac{1}{2}$, $\lambda = 5$, $q = \frac{3}{4}$, $\psi = \frac{1}{10}$, $G = \frac{1}{4}$ (black line), $G = \frac{1}{2}$ (red line), $G = 1$ (green line).

3.3 Uninformative Equilibrium

Proposition 3 shows that reference dependence and loss aversion can yield full revelation in a setting where this would not be possible under standard utility functions. Nevertheless, the equilibrium is not unique: an uninformative equilibrium also exists for any set of parameters. This is standard in communication games: if the electorate believes that candidates' announcements do not entail any relevant information and ignores them (that is, if voters do not update their beliefs based on such announcements), uninformative communication strategies would be trivially optimal and this would, in turn, justify the electorate's initial conjectures. The characterization of the uninformative equilibrium is provided in the following proposition:

Proposition 4 *Let*

$$W_{U,\kappa} = W_{U,\kappa}(\eta, \lambda, G, q, p \mid \psi) = \frac{1}{2} + \psi\kappa \cdot \frac{(1 + \eta\lambda q + \eta(1-q))}{1 - 2\psi\eta(\lambda - 1)p(1-q)qG} \cdot G > \frac{1}{2} + \psi\kappa G$$

and suppose assumption 1 holds. Then, there exists an uninformative equilibrium $\left(s_U^A, s_U^B\right)$ *and the probability with which candidate A wins the election* $W^A\left(m^A, m^B, t^A, t^B \mid s_U^A, s_U^B\right)$ *can be summarized as follows:*

$(\bar{m}, \bar{m})$	t_L	t_0	t_H
t_L	$\frac{1}{2}$	$1 - W_{U,q}$	$1 - W_{U,1}$
t_0	$W_{U,q}$	$\frac{1}{2}$	$1 - W_{U,(1-q)}$
t_H	$W_{U,1}$	$W_{U,(1-q)}$	$\frac{1}{2}$

Furthermore, (i) $W_{U,1}(\eta, \lambda, G, q, p \mid \psi)$ *is increasing in* q*, (ii)* $W_{U,1}(\eta, \lambda, G, 0, p \mid \psi) = W^-(\eta, G)$*, and (iii)* $W_{U,1}(\eta, \lambda, G, 1, p \mid \psi) = W^+(\eta, \lambda, G)$*.*

An immediate implication of Proposition 4 is that in an uninformative equilibrium the probability with which candidate A wins depends only on the signals candidates generate. Furthermore, it is straightforward to check that $W_{U,\kappa}(0, \lambda, G, q, p \mid \psi) = \frac{1}{2} + \psi\kappa G$ and that $W_{U,\kappa}(\eta, \lambda, G, q, p \mid \psi)$ is increasing in η. Thus, *the advantage that high-valence candidates have against low-valence ones in an uninformative equilibrium is increasing in the importance of reference dependence* ($\eta > 0$). To understand why, observe that voters assign positive probability to both types of candidates being elected. Thus reference dependence favours high-valence candidates for two reasons: on the one hand, they generate gains vis-a-vis low valence candidates, on the other hand low valence candidates generate losses vis-a-vis high valence ones.

Proposition 4 also implies that there exists a cutoff $q^*(\eta, \lambda, G, p \mid \psi)$ implicitly defined by

$$W_{U,1}(\eta, \lambda, G, q^*(\eta, \lambda, G, p \mid \psi), p \mid \psi) = W_R(\eta, \lambda, G \mid \psi)$$

such that $W_{U,1}(\eta, \lambda, G, q, p \mid \psi) > \ (<)\ W_R(\eta, \lambda, G \mid \psi)$ if $q > \ (<)\ q^*(\eta, \lambda, G, p \mid \psi)$. In words, if *voters* are certain about candidates' types, their *likelihood of voting for a high-valence candidate against a low-valence one will be higher in a fully revealing equilibrium than in an informative one if and only if* q *is sufficiently low.* To get the intuition behind this result, suppose that the candidate pair is (θ_H, θ_L). Then, the effect of announcement pair (m_H, m_L) over $(\bar{m}, \bar{m})$ is twofold. On the one hand, it raises $\pi_2^A(\cdot)$ yielding to an increase in A's probability of winning $W^A(m_H, m_L \mid t_H, t_L) = W_R(\eta, \lambda, G \mid \psi)$. On the other hand, it modifies voters reference point making them used to the idea that a low-valence candidate exist and may be elected. This second effect may decrease $W_R(\eta, \lambda, G \mid \psi)$; in particular, this will happen if low types have low *ex-ante* probability (q high). If p is close to 1, the first effect will be almost irrelevant as voters will be able to acquire the information they need through the signal t. Thus, if q is sufficiently high, the reference point given $\left(s_U^A, s_U^B\right)$ will assign a higher probability to g_H than the one given $\left(s_R^A, s_R^B\right)$ and, for this reason, $W_{U,1}(\eta, \lambda, G, q, p \mid \psi)$ will be high and close to $W^+(\eta, \lambda, G)$. Moreover, it is easy to check that $q^*(\eta, \lambda, G, p \mid \psi) > \frac{1}{2}$.

3.4 Partially Revealing Equilibria

Although fully revealing and uninformative equilibria represent useful benchmarks, other, *partially revealing equilibria* may also exist. In these equilibria probabilities $\left(\pi_1^i(\cdot)\right)_{i\in\{\mathrm{A,B}\}}$ depend on candidates' announcements, but do not jump to 0 or 1 after all announcements. In principle, the class of partially revealing equilibria may include equilibria in which candidates play complicated mixed strategies.

A full characterization of partially revealing equilibria is beyond the scope of this paper and we will focus only on symmetric partially revealing equilibria, namely equilibria in which both candidates follow the same communication strategy. Formally, $\left(\sigma^A, \sigma^B\right)$ is a symmetric partially revealing equilibria if $\sigma_P^A = \sigma_P^B = \sigma_P$. To further simplify the analysis we strenghten Assumption 1 as follows.

Assumption 2 $\frac{1}{2\psi} > G\left(2 + \frac{1}{2}\eta + \frac{3}{2}\lambda\eta\right).$

Under Assumption 2, one can prove that the probability that the reference point assigns to g_H is increasing in $\pi_1^i\left(m^i \mid \sigma_P\right)$ for every $i \in \{\mathrm{A,B}\}$ is high-valence.

Lemma 1 *Let (σ_P, σ_P) be a symmeytic equilibrium. Then, under assumption 2, for every m^i, $\left(m^i\right)' \in M$ and for every $m^j \in M$*

$$\pi_1^i\left(m^i \mid \sigma^i\right) > \pi_1^i\left(\left(m^i\right)' \mid \sigma^i\right) \Longrightarrow \tilde{r}\left(m^i, m^j \mid \sigma^A, \sigma^B\right)[g_H] > \tilde{r}\left(\left(m^i\right)', m^j \mid \sigma^A, \sigma^B\right)[g_H]$$

To understand why the statement in Lemma 1 is not always true, consider an increase in the probability that candidate A is high valence, $\pi_1^A\left(m^A \mid \sigma^A\right)$. This leads to an increase in $W^A(\cdot \mid \sigma_P, \sigma_P)$ and to a decrease in $W^B(\cdot \mid \sigma_P, \sigma_P)$. On the one hand, this will determine a raise in $\tilde{r}\left(m^A, m^B \mid \sigma^A, \sigma^B\right)[g_H]$ as high-valence candidates are more likely. However, if $\pi_1^A\left(m^A \mid \sigma^A\right)$ is relatively low and $\pi_1^B\left(m^B \mid \sigma^B\right)$ is relatively high, the change in $W^A(\cdot \mid \sigma_P, \sigma_P)$ and $W^B(\cdot \mid \sigma_P, \sigma_P)$ will lower $\tilde{r}\left(m^A, m^B \mid \sigma^A, \sigma^B\right)[g_H]$ shifting the probability of winning from a candidate who is likely to be high-valence to one who is likely to be low-valence. The net effect of these two forces is, in general, ambiguous; Assumption 2 guarantees that the former effect dominates. Intuitively, it states that the electoral outcome is so uncertain that voters' reference points already assign sufficiently high probability to both g_L and g_H.

Given Lemma 1, we can show that our analysis of symmetric partially revealing equilibria can focus without loss of generality on equilibria in which: (i) for each candidate $i \in \{\text{A,B}\}$, $M = \{m_*, m^*\}$, (ii) high-valence candidates always send m^*, (iii) low-valence candidates randomize with probability in $[0,1]$ between m^* and m_*.

Lemma 2 *Suppose assumption 2 holds. Then, if (σ_P, σ_P) is a partially revealing equilibrium, we can assume without loss of generality that: (i) $M = \{m_*, m^*\}$, (ii) if $s(\theta_H) = m_*$, $\sigma_P[s] = 0$.*

By lemma 2, symmetric partially revealing equilibria can be indexed by the common probability $\pi_1(m^* \mid \sigma_P) = \pi$ or, equivalently, by the probability with which low-valence candidates send message m^*. Let this probability be z. By Bayes rule $z_\pi = \frac{q}{1-q} \cdot \frac{(1-\pi)}{\pi}$. We refer to these equilibria as to *π-symmetric partially revealing equilibria*. Moreover, Lemma 2 shows that in π-symmetric partially revealing equilibria the only relevant incentive compatibility constraint is the one of low-valence candidates. In particular, by sending message m_*, low-valence candidates reveal their types and the probability of being elected depends only on the information the electorate gathers on her opponent; if instead they send message m^*, the probability of winning could raise or decrease with respect to the truthtelling benchmarl depending on whether she generates signal t_0 or signal t_L.

It is easy to see that, in a π-symmetric partially revealing equilibrium, the reference-point after message pair (m_*, m_*), is identical to the one arising in a fully revealing equilibrium after pair (m_L, m_L). Similarly, if the message pair is (m^*, m^*), the reference-point will be equal to the one arising in an uninformative equilibrium when the prior probability of high-valence candidates is π. Finally, the reference point after pairs (m_*, m^*) and (m^*, m_*) can be characterized by the probability $W_P(\eta, \lambda, G, \pi, p \mid \psi) \in (W^-(\eta, G), W_U(\eta, \lambda, G, \pi, p \mid \psi))$. The next proposition provides a formal statement of these results.

Proposition 5 *Let (σ_P, σ_P) be a π-symmetric partially revealing equilibrium. Let:*

$$W_{U,\kappa}^{\pi} = W_{U,\kappa}(\eta, \lambda, G, \pi, p \mid \psi)$$

$$W_{P,\kappa} = W_{P,\kappa}(\eta, \lambda, G, \pi, p \mid \psi) = \frac{1}{2} + \psi \cdot \kappa \cdot \left(\frac{(1+\eta) + \frac{\pi}{2}\eta(\lambda - 1)}{1 - \psi\eta(\lambda-1)(\pi^2 + p\pi(1-\pi))G} \right) \cdot G$$

Then, $W_{U,1}^{\pi} \in (W_{U,1}(\eta, \lambda, G, q, p \mid \psi),\ W_R(\eta, \lambda, G \mid \psi))$ and $W_{P,1} \in \left(W^-(\eta, G), \hat{W}_1\right)$. Furthermore, the reference-point consistent strategy given (σ_P, σ_P) is characterized by the following cutoffs:

(m^*, m^*)	t_L	t_0	t_H
t_L	$\frac{1}{2}$	$1 - W_{U,\pi}^{\pi}$	$1 - W_{U,1}^{\pi}$
t_0	$W_{U,\pi}^{\pi}$	$\frac{1}{2}$	$1 - W_{U,(1-\pi)}^{\pi}$
t_H	$W_{U,1}^{\pi}$	$W_{U,(1-\pi)}^{\pi}$	$\frac{1}{2}$

(m^*, m_*)	t_L	t_0	t_H
t_L	$\frac{1}{2}$	$\frac{1}{2}$	$1 - W_{P,1}$
t_0	$W_{P,\pi}$	$W_{P,\pi}$	$1 - W_{P,(1-\pi)}$
t_H	$W_{P,1}$	$W_{P,1}$	$\frac{1}{2}$

(m_*, m^*)	t_L	t_0	t_H
t_L	$\frac{1}{2}$	$1-W_{P,\pi}$	$1-W_{P,1}$
t_0	$\frac{1}{2}$	$1-W_{P,\pi}$	$1-W_{P,1}$
t_H	$W_{P,1}$	$W_{P,(1-\pi)}$	$\frac{1}{2}$

(m_*, m_*)	t_L	t_0	t_H
t_L	$\frac{1}{2}$	$\frac{1}{2}$	$1-W^-$
t_0	$\frac{1}{2}$	$\frac{1}{2}$	$1-W^-$
t_H	W^-	W^-	$\frac{1}{2}$

Since in a π-symmetric partially revealing equilibrium, low-valence candidates randomize between two messages (m_* and m^*), they must be indifferent between making these two announcements. Define:

$$d_P(\eta,\lambda,G,\pi,p\mid\psi) = \frac{(1+\eta)+\frac{\pi}{2}\eta(\lambda-1)}{1-\psi\eta(\lambda-1)\left(\pi^2+p\pi(1-\pi)\right)G}\cdot G$$

$$d_U(\eta,\lambda,G,\pi,p\mid\psi) = \frac{1+\eta\lambda\pi+\eta(1-\pi)}{1-2\psi\eta(\lambda-1)p(1-\pi)\pi G}\cdot G$$

Since $W_{U,1}(\eta,\lambda,G,\pi,p\mid\psi) > W_{P,1}(\eta,\lambda,G,\pi,p\mid\psi)$, it is immediate to show $d_U(\eta,\lambda,G,\pi,p\mid\psi) > d_P(\eta,\lambda,G,\pi,p\mid\psi)$. Then, if low valence candidates send m_*, their expected utility will be given by $(i,j\in\{\text{A,B}\},\ i\neq j)$:

$$U^i(m_*,\sigma_P\mid\theta_L) = \frac{1}{2} - q\cdot\psi\cdot d_P(\eta,\lambda,G,\pi,p\mid\psi)\cdot G,$$

Instead, if they send message m^*, low-valence candidates pool with high-valence ones and her expected utility becomes $(i,j\in\{\text{A,B}\},\ i\neq j)$:

$$\begin{aligned}U^i(m^*,\sigma_P\mid\theta_L) &= \frac{1}{2}+(1-p)\cdot(\pi-q)\cdot\psi\cdot d_P(\eta,\lambda,G,\pi,p\mid\psi)\cdot G-\\ &\quad -q\cdot p\cdot\psi\cdot d_U(\eta,\lambda,G,\pi,p\mid\psi)\cdot G\end{aligned}$$

Thus, the indifference condition for the low candidates requires:

$$(1-p)\pi\cdot d_P(\eta,\lambda,G,\pi,p\mid\psi) = qp\cdot\left(d_U(\eta,\lambda,G,\pi,p\mid\psi)-d_P(\eta,\lambda,G,\pi,p\mid\psi)\right) \tag{9}$$

Notice that, if $p=1$, the right hand side of (9) is bigger than the left hand one; on the contrary, if $p=0$, the opposite is true. Moreover, keeping all the other parameters constant and exploiting Assumption 2, we can conclude that the left hand side of (9) is decreasing in p, while the right hand side is increasing in it.[32]. Therefore, for every profile of parameters $(\eta,\lambda,G,q,\pi,\psi)$, there exists a unique $p^{**}(\eta,\lambda,G,q,\pi,\psi)\in(0,1)$ such that (9) holds if and only if $p=p^{**}(\eta,\lambda,G,q,\pi,\psi)$.

Now, consider the expected utility of a high-valence candidate in a π-symmetric partially re-

[32] To see this last point, observe that:

$$\frac{\partial(qpd_U)}{\partial p} = Gq\cdot\frac{(1+\eta)+\pi(\lambda-1)\eta}{(1-2\psi\eta(\lambda-1)p(1-\pi)\pi G)^2}$$

whereas:

$$\frac{\partial(qpd_P)}{\partial p} = Gq\cdot\frac{\left(1-\pi^2\eta(\lambda-1)\psi G\right)}{\left(1-\psi\eta(\lambda-1)(\pi^2+p\pi(1-\pi))G\right)^2}\cdot\left((1+\eta)+\frac{1}{2}\pi(\lambda-1)\eta\right)$$

vealing equilibrium. If she sends message m^*, her utility will be given by:

$$\begin{aligned} U\left(m^*, \sigma_P \mid \theta_H\right) &= \frac{1}{2} + (1-q) \cdot \psi \cdot z_\pi \cdot p \cdot d_U\left(\eta, \lambda, G, \pi, p \mid \psi\right) + \\ &\quad + (1-q) \cdot \psi \cdot \left(1 - z_\pi\right) \cdot \left(p + (1-p)\,\pi\right) \cdot d_P\left(\eta, \lambda, G, \pi, p \mid \psi\right). \end{aligned}$$

Using equation (9), we can rewrite the previous expression as:[33]

$$U\left(m^*, \sigma_P \mid \theta_H\right) = \frac{1}{2} + (1-q)\,\psi \cdot d_P\left(\eta, \lambda, G, \pi, p \mid \psi\right)$$

On the contrary, if she sends message m_*, her expected utility will be given by:

$$U\left(m_*, \sigma_P \mid \theta_H\right) = \frac{1}{2} - q\,(1-p)\,\pi\psi \cdot d_P\left(\eta, \lambda, G, \pi, p \mid \psi\right).$$

Since $d_P\left(\eta, \lambda, G, \pi, p \mid \psi\right) > 0$, we conclude that the high valence candidate will be better off sending message m^*.

We summarize the previous discussion in the following proposition:

Proposition 6 *Let s' and s'' be two strategies such that $s'\left(\theta_H\right) = m^*$, $s'\left(\theta_L\right) = m_*$ and $s''\left(\theta_H\right) = s''\left(\theta_L\right) = m^*$. Suppose Assumption 2 holds. Then, $\left(\sigma_P, \sigma_P\right)$ is a π-symmetric partially revealing equilibrium if: (i) $\sigma_P\left[s''\right] = \frac{q\cdot(1-\pi)}{(1-q)\cdot\pi}$, (ii) $p = p^{**}\left(\eta, \lambda, G, q, \pi, \psi\right) \in (0,1)$. This is also the unique π-symmetric partially revealing equilibrium in the sense of Lemma 2.*

3.5 Equilibrium Comparison

The analysis developed in the previous sections highlighted that multiple equilibria may exist if the probability of detecting the true type of the candidate is sufficiently high. Now, we will derive some results concerning the welfare implications of the two types of equilibria. To this goal, we will compare the expected utility of candidates at the *interim* stage (namely after that they learnt their type) and the total utility of voters before listening to the actual announcements sent by candidates. We regard both these assumptions as sensible. Indeed, the interim comparison is justified by the fact that candidates can choose how much information to reveal after having acquired it. Similarly, as voters represent the receivers of the information, they can decide whether to listen or ignore the announcements only before the actual messages are sent. Intuitively, if voters pay attention to what candidates say, this will affect their beliefs and, through this channel, their reference point.[34]

The result follows from noticing that Assumption 1 implies

$$\frac{\left(1 - \pi^2\eta\left(\lambda-1\right)\psi G\right)}{\left(1 - G\eta\left(\lambda-1\right)\left(p + (1-p)\,\pi\right)\pi\right)^2} < \frac{1}{\left(1 - 2G\left(\lambda-1\right)\left(1-\pi\right)\pi p\psi\eta\right)^2}.$$

[33] The actual steps are shown in the proof of Proposition 7.

[34] This is a by-product of the fact that in this model we abstract from the use of rethorical tools and from the choice of messages' clarity; thus, the informational content of a message is a property of the equilibrium construction and not of the actual announcement sent by candidates. For a model in which agents strategically choose the clarity of their messages, see Blume and Board, 2009

To understand the next proposition, recall that $q^*(\eta, \lambda, G, p \mid \psi)$ is the cutoff on the prior probability of high-types that determines whether $W_R(\eta, \lambda, G \mid \psi)$ is greater $(q < q^*(\eta, \lambda, G, p \mid \psi))$ or lower $(q > q^*(\eta, \lambda, G, p \mid \psi))$ than $W_{U,1}(\eta, \lambda, G, q, p \mid \psi)$.

Proposition 7 *If $q < q^*(\eta, \lambda, G, p \mid \psi)$, high-valence candidates are better off in a fully revealing equilibrium than in an uninformative equilibrium. Furthermore, if Assumption 2 holds, high-valence candidates are always better off in a fully revealing equilibrium than in a π-partially revealing equilibrium with $\pi \in (q, 1)$. Low-valence candidates have opposite preferences*

Thus, if $q < q^*(\eta, \lambda, G, p \mid \psi)$ high-valence candidates' preferred equilibrium is fully revealing. The next proposition shows that voters share the same preferences.

Proposition 8 *If $q < q^*(\eta, \lambda, G, p \mid \psi)$, voters are better off in a fully revealing equilibrium than in an uninformative equilibrium. Furthermore, if Assumption 2 holds, voters are always better off in a fully revealing equilibrium than in a π-partially revealing equilibrium with $\pi \in (q, 1)$. Low-valence candidates have opposite preferences*

Given the statement of Propositions 7 and 8, we can conclude that if $q < q^*(\eta, \lambda, G, p \mid \psi)$, standard equilibria refinements for communication games would select the fully revealing equilibrium whenever such equilibrium exists.[35]

If $q^*(\eta, \lambda, G, p \mid \psi) > q$, we can find profiles of parameters for which both high-valence candidates and voters are better off in the uninformative equilibrium than in the fully revealing one; as a result, fully revealing equilibria will no longer satisfy standard equilibrium refinements. In particular, this will happen if q is sufficiently high and $p \simeq 1$. The intuition is similar to the one we provided after Proposition 4. Suppose $p \simeq 1$. Then, the difference in voters' consumption utility between the two equilibria will be very low as, in both cases, voters will be almost certain about candidates' true types. Consider a high valence-candidate. If she faces another high-valence candidate (which happens with probability q), her expected probability of winning the election will be equal to $\frac{1}{2}$ in both equilibria. If instead she faces a low-valence candidate, she will have an electoral advantage determined by the gain/loss component and such advantage will be proportional to the weight the reference point assigns to g_H. If q is sufficiently high, $r\left(\bar{m}, \bar{m} \mid s_U^A, s_U^B\right)[g_H] > r\left(m_H, m_L \mid s_R^A, s_R^B\right)[g_H]$ as in the latter case the reference point will be able to incorporate the existence of a low-valence candidate. As a result, high-valence candidates will be better off in the uninformative equilibrium.

4 Discussion

4.1 Distribution over Types

In our model the valences of candidates are drawn independently from the same distribution. All our results can be easily extended to deal with the case of different, but independent distributions.

[35] For instance, the fully revealing equilibrium would satisfy neologism-proofness (Farrell, 1993), announcement-proofness (Matthews et al., 1991) and NITS (namely, "No Incentive to Separate", Chen et al., 2008)., whereas uninformative equilibria would not.

In this case, the candidate with the lowest *ex-ante* probability of being low-valence is the one with the highest incentive to lie as it assigns a lower probability to her opponent being high-valence and, consequently, to her lie being harmful in terms of winning probability.

Our analysis would also go through if we assume that valences are independent conditional on some common shock, ζ. This could happen if, for instance, the cost of providing a certain public good depends both on the politician's idiosyncratic skills ($\theta \in \{\theta_L, \theta_H\}$) and on some macroeconomic shock capturing the status of the economy (ζ). In such a context, fully revealing equilibria would still exist if ζ were observable to both candidates before they make their electoral announcements and candidates' valences remain sufficiently important in determining voters' utility.[36]

Instead, our results are robust to the introduction of positive correlation among agents' types only if the degree of such correlation is not too high.[37] To understand why, recall that a low-valence candidate incurs the cost of lying only if her opponent turns out to be high-valence as her lie could shift voters' preferences in favor of the contendant. Thus, consider the extreme case in which valences are perfectly correlated (this could also be interpreted as a situation in which the amount of public good provided fully depends on the realization of the macroeconomic shock ζ and individual skills play no role). In such a situation, a low-valence candidate is certain that her opponent is also low-valence and lying does not entail any cost. As a result, only uninformative equilibria would be possible.

4.2 Voting Behavior

In the paper, we modeled the electorate as a continuum of agents who cast their vote sincerely. Alternatively, we could have analyzed a setting in which the electoral outcome is determined by the voting behavior of a well identified median voter. One can show that this approach would lead to exactly the same results, but would entail a greater notational complexity. Indeed, the reference point would now depend not only by the announcements of candidates and by (the conjectures over) their comunication strategies, but also on the voting strategy of the median voter. Formally, the reference point would now be a random distribution $\tilde{r}\left(m^A, m^B \mid \gamma, \sigma^A, \sigma^B\right)$, where $\gamma : M^2 \times T^2 \times \left[-\frac{1}{2\psi}, \frac{1}{2\psi}\right] \to [0, 1]$ is a function representing the electoral strategy of the median voter: for every profile of messages and signal pairs $\left(m^A, m^B, t^A, t^B\right)$ and for every realization of the popularity shock, d, $\gamma\left(m^A, m^B, t^A, t^B, d\right)$ is the probability with which the median voter will vote in favor of candidate i.

A similar approach could be used to model a setting in which the identity of the median voter is uncertain, but it is known that it belongs to a finite set of individuals. In this case, the reference point $\tilde{r}(\cdot \mid \cdot)$ will depend on the profile of strategies of all these possible median voters. Although conceptually straightforward, this last extension would hardly lead to tractable analytical solutions.

[36] The case in which ζ is realized after candidates announcements, could require an enlargement of the message space to allow for announcements conditional on the realization of ζ. In particular, this would be relevant if ζ were observable to voters as well. We conjecture that fully revealing equilibria would still arise.

[37] Instead, negative correlation can be easily accomodated.

4.3 Voters' Heterogeneity

In our model, the only source of heterogeneity among voters is given by the ideological bias ϕ^j. This is done as we are more interested in the communication game between candidates and the electorate than in the redistributive conflict among voters. Nevertheless, heterogeneity in this last dimension can be incorporated in our setting. For instance, suppose that for every level of ideological bias, f^j, there exists a continuum of voters indexed by income levels and distributed according to an absolutely continuous cdf $H(\cdot)$ with support in the interval $[0,\infty)$.[38] Assume that the consumption utility of a voter is given by $c^i + G(h)$, where c^i denotes the private consumption level, $G(\cdot)$ is a continuous, strictly increasing and strictly concave function with $\lim_{x\to 0} G'(x) = \infty$ and h is a public good that must be financed through a proportional tax τ. Thus $c^i = y^i \cdot (1-\tau)$.

The government budget constraint is affected by the type of the elected politician as $\tau \cdot \int_0^\infty y dH(y) \geq \frac{h}{\theta}$. Thus, a high-valence candidate ($\theta = \theta_H$) is more effective in transforming tax revenue into public good and all voters agree on this. However, income heterogeneity yields a standard disagreement on the level of public good: high-income voters would prefer a lower h than low-income voters.

In this setting, we can interpret candidates' messages as an announcement concerning the total level of utility they can provide to various agents. Thus, we can assume candidates announce with commitment the total level of public good they will buy, h, and further announce, without commitment, the level of taxation necessary to attain such a goal. If elected, a candidate will choose the actual pair (τ, h) in order to maximize political consensus or total welfare.[39] Under these assumptions, one can easily adapt Section 3 and obtain the very same conclusions concerning candidates' communication strategies and truthfulness.

4.4 Signal Technology

The previous discussion assumed that the types of candidates are revealed with an exogenous probability equal to p. This assumption can be relaxed in several dimensions. First of all, as the proofs of our Propositions make clear, the main result of the paper extends to any signal technology that reveals the lies of a low-valence candidate with some positive probability ν.

Moreover, one can allow the probability p^i with which the type of candidate i is revealed to depend negatively on some costly effort exerted by agent i, e^i. Effort e^i could be intepreted as the amount of resources invested by the candidate to improve his ability to communicate (e.g., hirings of spin doctors) or to lower media's scrutiny (e.g., lobbying activities with journalists). Formally, we could assume $p^i = p^i\left(e^i\right)$ with $\frac{\partial p^i(\cdot)}{\partial e^i} < 0$ and $\frac{\partial^2 p^i(\cdot)}{\partial (e^i)^2} > 0$. In this case, full revelation arises if the cost associated with a decrease in p^i is sufficiently high to prevent candidates from choosing extremely low values of p^i.

Furthermore, one could assume that p^i depends positively on some costly effort exerted by

[38] Notice that we are assuming that the distribution of income levels is independent of ideological biases. None of the results hinges on this.

[39] The actual choice of candidates' obejctive function is irrelevant as long as the value of the candidate's problem is increasing in her own type.

candidate j, e^j. In this case, e^j could represent the amount of resources spent by candidate j to run a negative campaign against i. Formally, $p^i\left(e^j\right)$ with $\frac{\partial p^i(\cdot)}{\partial e^j} > 0$ and $\frac{\partial^2 p^i(\cdot)}{\partial (e^j)^2} > 0$. In this setting, fully revealing equilibria will exist for the same set of parameters we characterized in Proposition 3.

4.5 Reference Dependence and Other Behavioral Biases

In our setting, false announcements modify the electorate's reference point and, through this channel, generate a cost for low-valence candidate. This cost, in turn, pushes candidates toward truthtelling. Other models explain truthtelling using different behavioral biases. For instance, Charness and Dufwenberg, 2006, 2010, 2011 and Battigalli et al., 2013 attain truthtelling through guilt aversion. In such a setting, candidates would not lie in order to avoid the guilt associated with letting down voters. This approach would require to model players' higher order beliefs as voters beleifs about candidates' intentions and candidates beliefs about these beliefs would matter. Our modelling choice, instead, does not require to model players' intentions: the change in the electorate's reference point depends only on the information content that voters assign to candidates' statements.

Alternatively, one could also assume that voters have preferences for honesty and punish candidates for not delivering what they promised.[40] Although this assumption is sensible in many settings, we believe that our approach represents a step forward. First of all, preferences for honesty would, strictly speaking, lead voters to punish candidates even when they deliver a positive surprise, whereas our approach is able to distinguish between gains and losses. Moreover, by modelling the formation of reference points and the mechanism through which it affects voters preferences, we provide a justification behind preferences for honesty and, consequently, we can make better predictions on the circumstances under which lies are most likely to hurt candidates' electoral prospects. Finally, it is important to stress that, although in our model *voters may react to a lie as if they were punishing candidates*, they are not realy carrying out a punsihment strategy. Instead, *their behavior follows from the joint effect of a change in the reference point* induced by the lie *and of the desire of avoiding painful losses.*

5 Conclusion

In this paper, we provide a model in which politicians are held accountable for their electoral announcements even though there is a single electoral round. To be more precise, we build a simple probabilistic voting model in which two candidates compete to get elected. If voters care about consumption utility only, politicians' announcements would be uninformative: since politicians always have an incentive to pretend to be high valence, their statements will lack any credibility and voters will ignore them. The introduction of reference dependence and loss aversion overcome this problem by adding an additional channel through which politicians' announcements affect voters behavior, namely the formation of reference point. Indeed, if a candidate announce to be

[40] See Banks, 1990.

high valence, she raises electorate's expectations; if voters subsequently find out that she cannot deliver such payoff because her valence is lower than what initially claimed, they may vote for the opponent to avoid experiencing harmful disappointment. This effect may induce candidates to reveal their valence sincerely. Furthermore, the range of parameters for which full revelation arises is largest when voters are moderately loss averse.

A natural direction for future research would be to extend the model to a multiple-elections setting in which the true type of a candidate is more likely to be revealed when she is elected and voters can see her perfomance while in office. Such analysis would require additional assumptions on the formation and dynamic updating of the reference point, as well as on the degree of voters' sophistication in anticipating the changes in their preferences induced by these processes.

6 Appendix

6.1 Proof of Proposition 1

Let $\left(\sigma^A, \sigma^B\right)$ be an equilibrium. First notice that for every message m^i, $\pi_2^i\left(m^i, t_L \mid \sigma^i\right) = 0$, $\pi_2^i\left(m^i, t_0 \mid \sigma^i\right) = \pi_1^i\left(m^i \mid \sigma^i\right)$ and $\pi^i\left(m^i, t_H \mid \sigma^i\right) = 1$. Therefore, $\pi_2^i\left(m^i, t^i \mid \sigma^i\right)$ depends on m^i only if $t^i = t_0$.

Consider candidate A (the reasoning for B is analogous and omitted). Her expected utility when her type is θ and she sends message $m \in M$ is given by:

$$V_A\left(m, \sigma^B \mid \theta\right) = \sum_{s \in S} \sigma^B[s]\left[qW^A\left(m, s\left(\theta_H\right)\right) + (1-q) \cdot W^A\left(m, s\left(\theta_L\right)\right)\right].$$

which is increasing in $\pi_1^A(\cdot)$ as by Assumption 1, $W^A\left(m^A, m^B\right)$ is strictly increasing in $\pi_1^A(\cdot)$. Thus, suppose that there exists a message m_H sent with positive probability such that $\pi_1^A\left(m_H \mid \sigma^A\right) > q$. Then, there must exists another message m_L, sent with positive probability, such that $\pi_1^A\left(m_L \mid \sigma^A\right) < q$. Therefore, message m_L must be sent with positive probability by a candidate with low valence. Then, the low valence candidate could modify her strategy and send message m_H every time she was supposed to send message m_L. Obviously, $\pi_1^A\left(m_H \mid \sigma^A\right) > \pi_1^A\left(m_L \mid \sigma^A\right)$ and this deviation would increase candidates' expected utility and contradict the definition of equilibrium.

Thus, for every message m, $\pi_1^A\left(m \mid \sigma^A\right) = \pi_1^B\left(m \mid \sigma^B\right) = q$ and

$$\pi_2^i\left(m^i, t^i \mid \sigma^i\right) = \begin{cases} 1 & t^i = 1 \\ q & t^i = t_0 \\ 0 & t^i = t_L \end{cases}, \ i \in \{\text{A,B}\}$$

and the communication strategies can be assumed to be uninformative. Then the probability that candidates A wins after message-signal pair $\left(\bar{m}, \bar{m}, t^A, t^B\right)$ can be represented by cutoffs given by:

$$\left(\pi_2^A\left(\bar{m}, t^A \mid \sigma^A\right) - \pi_2^B\left(\bar{m}, t^B \mid \sigma^B\right)\right) \cdot G$$

The statement of the theorem follows immediately. ∎

6.2 Proof of Proposition 2

Suppose voters holds conjecture $\left(s_R^A, s_R^B\right)$. Then, for every $i \in \{\text{A,B}\}$, $\pi_1^i\left(m_H, \mid s_R^i\right) = 1$, $\pi_1^i\left(m_L \mid s_R^i\right) = 0$. Recall that (i) given a message pair $\left(m^A, m^B\right)$ the reference point assigns probability

$$\sum_{t^A,t^B}\Big[\hat{\pi}\left(t^A,t^B \mid m^A,m^B,s_R^A,s_R^B\right)\cdot\left(W^A\left(m^A,m^B,t^A,t^B \mid s_R^A,s_R^B\right)\cdot\pi_2^A\left(m^A,t^A \mid s_R^A\right)+\right.$$

$$\left.+\left(1-W^A\left(m^A,m^B,t^A,t^B \mid s_R^A,s_R^B\right)\right)\cdot\pi_2^B\left(m^B,t^B \mid s_R^B\right)\right)\Big]$$

to g_H and complementary probability to g_L, and (ii)

$$W^A\left(m^A,m^B,t^A,t^B \mid \sigma^A,\sigma^B\right) =$$

$$= \Big[\frac{1}{2}+\psi\cdot\left(\pi_2^A\left(m^A,t^A \mid s_R^A\right)-\pi_2^B\left(m^B,t^B \mid s_R^B\right)\right)\cdot$$

$$\cdot\left(V\left(g_H \mid \tilde{r}\left(m^A,m^B \mid s_R^A,s_R^B\right)\right)-V\left(g_L \mid \tilde{r}\left(m^A,m^B \mid s_R^A,s_R^B\right)\right)\right)\Big]$$

We will analyze each messages pair separately.

First, consider message pair is (m_H, m_H). Notice that $\hat{\pi}\left(t^A,t^B \mid m_H,m_H,s_R^A,s_R^B\right) > 0$ if and only if $\left(t^A,t^B\right) \in \{(t_H,t_H),(t_H,t_0),(t_0,t_H),(t_0,t_0)\}$ and that, for all these signals pairs, $\pi_2^i\left(m_H,t^i \mid s_R^i\right) = 1$ for every $i \in \{\text{A,B}\}$. Thus, the reference point will be a degenerate probability measure that assigns mass 1 to g_H. Therefore:

$$W^A\left(m_H,m_H,t^A,t^B \mid s_R^A,s_R^B\right) = \frac{1}{2}\ \forall\left(t^A,t^B\right) \in \{(t_H,t_H),(t_H,t_0),(t_0,t_H),(t_0,t_0)\}$$

Suppose instead that A generates signal t_L, while B generates either t_0 or t_H. Then $\pi_2^A\left(m_H,t_L \mid s_T^A\right) = 0$, while $\pi_2^B\left(m_H,t_H \mid s_T^B\right) = \pi_2^B\left(m_H,t_0 \mid s_T^B\right) = 1$. Thus,

$$W^A\left(m_H,m_H,t_L,t_0 \mid s_R^A,s_R^B\right) = W^A\left(m_H,m_H,t_L,t_H \mid s_R^A,s_R^B\right) = \frac{1}{2}-\psi\cdot G\cdot(1+\eta\lambda)$$

which is greater than $-\frac{1}{2\psi}$ by assumption 1. A symmetric reasoning allows us to conclude that

$$W^A\left(m_H,m_H,t_H,t_L \mid s_R^A,s_R^B\right) = W^A\left(m_H,m_H,t_0,t_L \mid s_R^A,s_R^B\right) = \frac{1}{2}+\psi\cdot G\cdot(1+\eta\lambda)$$

Finally if both candidates generate signal t_L, then for every $i \in \{\text{A,B}\}$ $\pi_2^i\left(m_H,t_L \mid s_R^i\right) = 0$ and it is easy to verify that $W^A\left(m_H,m_H,t_L,t_L \mid s_R^A,s_R^B\right) = \frac{1}{2}$.

Now, consider message pair (m_L, m_L). In this case, $\hat{\pi}\left(t^A,t^B \mid m_L,m_L,s_R^A,s_R^B\right) > 0$ if and only if $\left(t^A,t^B\right) \in \{(t_L,t_L),(t_L,t_0),(t_0,t_L),(t_0,t_0)\}$ and for every $i \in \{\text{A,B}\}$ and every $t^i \in \{t_L,t_0\}$, $\pi^i\left(m_L,t^i \mid s_R^i\right) = 0$. Then, the reference point at (m_L, m_L) will be a degenerate measure that assigns mass 1 to g_L. Therefore, for every $\left(t^A, t^B\right) \in \{(t_L, t_L), (t_L, t_0), (t_0, t_L), (t_0, t_0)\}$, $W^A\left(m^A, m^B, t^A, t^B \mid s_R^A, s_R^B\right) = \frac{1}{2}$. If instead candidate A generates signal t_H, while candidate B generates signal t_L or t_0, we would have $\pi_2^A\left(m_L, t_H \mid s_R^A\right) = 1$ and $\pi_2^B\left(m_L, t_0 \mid s_R^B\right) = \pi_2^B\left(m_L, t_L \mid s_R^B\right) = 0$. Thus,

$$W^A\left(m_L, m_L, t_H, t_0 \mid s_R^A, s_R^B\right) = W^A\left(m_L, m_L, t_H, t_L \mid s_R^A, s_R^B\right) = \frac{1}{2} + \psi \cdot G \cdot (1+\eta)$$

By symmetricity:

$$W^A\left(m_L, m_L, t_0, t_H \mid s_R^A, s_R^B\right) = W^A\left(m_L, m_L, t_L, t_H \mid s_R^A, s_R^B\right) = \frac{1}{2} - \psi \cdot G \cdot (1+\eta)$$

Finally if both candidates generate signal t_H, then for every $i \in \{\text{A,B}\}$ $\pi_2^i\left(m_L, t_H \mid s_R^i\right) = 1$ and it is immediate to verify that $W^A\left(m_L, m_L, t_H, t_H \mid s_R^A, s_R^B\right) = \frac{1}{2}$.

Finally, let the messages pair be (m_H, m_L) (the case (m_L, m_H) is symmetric and omitted). Then $\hat{\pi}\left(t^A, t^B \mid m_H, m_L, s_R^A, s_R^B\right) > 0$ if and only if $\left(t^A, t^B\right) \in \{(t_0, t_0), (t_H, t_L), (t_H, t_0), (t_0, t_L)\}$ and after these signal pairs we have $\pi_2^A\left(m_H, t^A \mid s_R^A\right) = 1$ and $\pi_2^B\left(m_L, t^B \mid s_R^B\right) = 1$. As a result the reference point, $\tilde{r}\left(m_H, m_L \mid s_R^A, s_R^B\right)$ will assigns probability $\sum_{t^A, t^B}\left[\hat{\pi}\left(t^A, t^B \mid m_H, m_L, s_R^A, s_R^B\right) \cdot W^A\left(m_H, m_L, t^A, t^B \mid s_R^A, s_R^B\right)\right]$ to g_H and complementary probability to g_L. Furthermore, since for each $i \in \{\text{A,B}\}$, $\pi_2^i\left(m_H, t^i \mid s_R^i\right)$ is the same across these signal pairs, we can conclude that $W^A\left(m_H, m_L, t^A, t^B \mid s_R^A, s_R^B\right)$ will also be the same for every $\left(t^A, t^B\right) \in \{(t_0, t_0), (t_H, t_L), (t_H, t_0), (t_0, t_L)\}$. Thus $\sum_{t^A, t^B}\left[\hat{\pi}\left(t^A, t^B \mid m_H, m_L, s_R^A, s_R^B\right) \cdot W^A\left(m_H, m_L, t^A, t^B \mid s_R^A, s_R^B\right)\right] = W^A\left(m^A, m^B \mid s_R^A, s_R^B\right)$. As a result, $\tilde{r}\left(m_H, m_L \mid s_R^A, s_R^B\right)$ will assign probability $W^A\left(m_H, m_L \mid s_R^A, s_R^B\right)$ to g_H and complementary probability to g_L. Thus, using the expression for $W^A\left(m_H, m_L \mid s_R^A, s_R^B\right)$, we can conclude that for every signal pair $\left(t^A, t^B\right) \in \{(t_0, t_0), (t_H, t_L), (t_H, t_0), (t_0, t_L)\}$, the probability of electing candidate A will solve the following equation

$$\begin{aligned} &W^A\left(m_H, m_L, t^A, t^B \mid s_R^A, s_R^B\right) = \\ &= \left(\frac{1}{2} + \psi \cdot \left(1 + \eta \cdot \left(1 - W^A\left(m_H, m_L, t^A, t^B \mid s_R^A, s_R^B\right)\right) + \eta\lambda \cdot W^A\left(m_H, m_L, t^A, t^B \mid s_R^A, s_R^B\right)\right) \cdot G\right) \end{aligned}$$

which leads to:

$$W^A\left(m_H, m_L, t^A, t^B \mid s_R^A, s_R^B\right) = \frac{\frac{1}{2} + \psi\left(1+\eta\right)G}{\left(1 - \psi \cdot \eta\left(\lambda - 1\right) \cdot G\right)}$$

Notice that $W^A\left(m_H, m_L, t^A, t^B \mid s_R^A, s_R^B\right)$ (i) is increasing in λ, and (ii) by Assumption 1, it belongs to the open inverval $\left(\frac{1}{2} + \psi\left(1+\eta\right)G, \frac{1}{2} + \psi\left(1+\eta\lambda\right)G\right)$ for every $\lambda \in \left(1, \bar{\lambda}\right)$. Now suppose A generates signal t_H or t_0, while candidate B generates signal t_H. Then $\pi_2^A\left(m_H, t_H \mid s_R^A\right) = \pi_2^A\left(m_H, t_0 \mid s_R^A\right) = 1$ and $\pi_2^B\left(m_L, t_H \mid s_R^B\right) = 1$ and we can conclude that:

$$W^A\left(m_H, m_L, t_H, t_H \mid s_R^A, s_R^B\right) = W^A\left(m_H, m_L, t_0, t_H \mid s_R^A, s_R^B\right) = \frac{1}{2}$$

Following a similar reasoning:

$$W^A\left(m_H, m_L, t_L, t_L \mid s_R^A, s_R^B\right) = W^A\left(m_H, m_L, t_L, t_0 \mid s_R^A, s_R^B\right) = \frac{1}{2}$$

Finally, consider signal pair (t_L, t_H). Then, the probability with which A wins will be given by:

$$\begin{aligned} &W^A\left(m_H, m_L, t_L, t_H \mid s_R^A, s_R^B\right) = \\ &= \left(\frac{1}{2} - \psi \cdot \left(1 + \eta \cdot \left(1 - W^A\left(m_H, m_L, t_H, t_L \mid s_R^A, s_R^B\right)\right) + \eta\lambda \cdot W^A\left(m_H, m_L, t_H, t_L \mid s_R^A, s_R^B\right)\right) \cdot G\right) \end{aligned}$$

Using the expression for $W^A\left(m_H, m_L, t_H, t_L \mid s_R^A, s_R^B\right)$, we characterized before, we can conclude that $W^A\left(m_H, m_L, t_L, t_H \mid s_R^A, s_R^B\right) = \frac{\frac{1}{2} - \psi(1+\eta\lambda)G}{1 - \psi\eta(\lambda-1)G}$. ∎

6.3 Proof of Proposition 3

Consider candidate A (the analysis for candidate B is similar and omitted) and suppose she conjectures that B is following communication strategy s_R^B. Then by proposition 2, the difference in expected utility between truthtelling and lying is given by:

$$\begin{aligned} &U^A\left(m_H, s_R^B \mid \theta_H\right) - U^A\left(m_L, s_R^B \mid \theta_H\right) = \frac{q}{2} + (1-q)\, W_R\left(\eta, \lambda, G \mid \psi\right) - \\ &\quad - q\left(\frac{p}{2} + (1-p)\left(1 - W_R\left(\eta, \lambda, G \mid \psi\right)\right)\right) - (1-q)\left(pW^-\left(\eta, G\right) + \frac{(1-p)}{2}\right) \end{aligned}$$

if the candidate has high valence and by

$$\begin{aligned} &U^A\left(m_L, s_R^B \mid \theta_L\right) - U^A\left(m_H, s_R^B \mid \theta_L\right) = q\left(1 - W_R\left(\eta, \lambda, G \mid \psi\right)\right) + \frac{(1-q)}{2} - \\ &\quad - q\left(p\left(1 - W^+\left(\eta, \lambda, G\right)\right) + \frac{(1-p)}{2}\right) - (1-q)\left(\frac{p}{2} + (1-p)\, W_R\left(\eta, \lambda, G \mid \psi\right)\right) \end{aligned}$$

if the candidate has low valence.

Since $W_R\left(\eta, \lambda, G \mid \psi\right) > W^-\left(\eta, G\right) > \frac{1}{2}$, we can easily conclude that $U^A\left(m_H, s_R^B \mid g_H\right) > U^A\left(m_L, s_R^B \mid g_H\right)$. Therefore truthtelling is optimal for high-valence candidates.

Define $h(p) = U^A\left(m_L, s_R^B \mid \theta_L\right) - U^A\left(m_H, s_R^B \mid \theta_L\right)$. Thus,

$$\begin{aligned} &h(p) = q\left(\left(1 - W_R\left(\eta, \lambda, G \mid \psi\right)\right) - p\left(1 - W^+\left(\eta, \lambda, G\right)\right) - \frac{(1-p)}{2}\right) - \\ &\quad - (1-q)(1-p)\left(W_R\left(\eta, \lambda, G \mid \psi\right) - \frac{1}{2}\right) \end{aligned}$$

Obviously, $h(\cdot)$ is continuous in p. Furthermore since $W^+(\eta,\lambda,G) > W_R(\eta,\lambda,G \mid \psi) > \frac{1}{2}$,

$$\begin{aligned} h(0) &= q\left(\frac{1}{2} - W_R(\eta,\lambda,G \mid \psi)\right) - (1-q)\left(W_R(\eta,\lambda,G \mid \psi) - \frac{1}{2}\right) < 0 \\ h(1) &= q\left(W^+(\eta,\lambda,G) - W_R(\eta,\lambda,G \mid \psi)\right) > 0 \end{aligned}$$

Furthermore:

$$h'(p) = q\left(W^+(\eta,\lambda,G) - \frac{1}{2}\right) + (1-q)\left(W_R(\eta,\lambda,G \mid \psi) - \frac{1}{2}\right) > 0.$$

Thus, there exists a unique $p^*(\eta,\lambda,G,q \mid \psi) < 1$, such that $U^A\left(m_L, s_R^B, \gamma \mid \theta_L\right) = U^A\left(m_H, s_R^B, \gamma \mid \theta_L\right)$. If $p > (<)\ p^*(\eta,\lambda,G,q \mid \psi)$, then $U^A\left(m_L, s_R^B, \gamma \mid \theta_L\right) > (<)\ U^A\left(m_H, s_R^B, \gamma \mid \theta_L\right)$. As a result, if $p \in [p^*(\eta,\lambda,G,q \mid \psi), 1]$, then $U^A\left(m_L, s_R^B, \gamma \mid \theta_L\right) \geq U^A\left(m_H, s_R^B, \gamma \mid \theta_L\right)$ and $U^A\left(m_H, s_R^B, \gamma \mid \theta_H\right) \geq U^A\left(m_L, s_R^B, \gamma \mid \theta_H\right)$ so that a fully revealing equilibrium exists.[41]

On the contrary, if a fully revealing equilibrium exists, then we need $U^A\left(m_L, s_R^B, \gamma \mid \theta_L\right) \geq U^A\left(m_H, s_R^B, \gamma \mid \theta_L\right)$ and $U^A\left(m_H, s_R^B, \gamma \mid \theta_H\right) \geq U^A\left(m_L, s_R^B, \gamma \mid \theta_H\right)$. By the previous reasoning, we can conclude that p must belong to the interval $[p^*(\eta,\lambda,G,q \mid \psi), 1]$.

Also notice that $p^*(\eta,1,G,q \mid \psi) = 1$ and $p^*\left(\eta,\bar{\lambda},G,q \mid \psi\right) = 1$ (this last result follows from the fact that $W_R\left(\eta,\bar{\lambda},G \mid \psi\right) = W^+\left(\eta,\bar{\lambda},G \mid \psi\right) = 1$). Furthermore, by the implicit function theorem

$$\left.\frac{\partial p^*(\eta,\lambda,G,q \mid \psi)}{\lambda}\right|_{\lambda=1} < 0, \quad \left.\frac{\partial p^*(\eta,\lambda,G,q \mid \psi)}{\lambda}\right|_{\lambda=\lambda} > 0,$$

Thus, $p^*(\eta,\lambda,G,q \mid \psi)$ is minimized for some value of loss aversion $\lambda \in \left(1,\bar{\lambda}\right)$. ∎

6.4 Proof of Proposition 4

To prove the existence of the uninformative equilibrium, it is sufficient to show that the probabilities $W^A\left(\bar{m},\bar{m},t^A,t^B \mid s_U^A, s_U^B\right)$ are the ones described in the statement of the proposition as the optimality of uninformative strategies follows immediately from voters' behavior.

Obviously, for every $i \in$ {A,B} $\pi_1^i\left(\bar{m} \mid s_U^i\right) = q$, $\pi_2^i\left(\bar{m}, t_L \mid s_U^i\right) = 0$, $\pi_2^i\left(\bar{m}, t_0 \mid s_U^i\right) = q$, $\pi_2^i\left(\bar{m}, t_H \mid s_U^i\right) = 1$. Furthermore, $\hat{\pi}\left(t^A, t^B \mid m^A, m^B, s_U^A, s_U^B\right)$ will be given by:

$\left(m^A, m^B\right)$	t_L	t_0	t_H
t_L	$p^2(1-q)^2$	$p(1-q)(1-p)$	$p^2(1-q)q$
t_0	$(1-p)p(1-q)$	$(1-p)^2$	$(1-p)pq$
t_H	$p^2q(1-q)$	$pq(1-p)$	p^2q^2

Notice that for any reference point and for any signal $t \in \{t_L, t_0, t_H\}$, $\pi_2^A\left(\bar{m}, t \mid s_U^A\right) = \pi_2^B\left(\bar{m}, t \mid s_U^B\right)$.

[41] In the knife-edge case in which $p = p^*(\eta,\lambda,G,q \mid F)$, we assume that type θ_L sends message m_L. Obviously, none of our results hinges on this tie-breaking rule.

Thus, we can immediately conclude that for every $\left(t^A, t^B\right) \in \{(t_L, t_L), (t_0, t_0), (t_H, t_H)\}$:

$$W^A\left(\bar{m}, \bar{m}, t^A, t^B \mid s_U^A, s_U^B\right) = \frac{1}{2}$$

Now, consider signal pair (t_H, t_L). Then, $\pi_2^A\left(\bar{m}, t_H \mid s_U^A\right) = 1$, $\pi_2^A\left(\bar{m}, t_L \mid s_U^A\right) = 0$ and we can conclude that:

$$W^A\left(\bar{m}, \bar{m}, t_H, t_L \mid s_U^A, s_U^B\right) = \frac{1}{2} + \psi \cdot \left[1 + \eta + \eta(\lambda - 1) \cdot \tilde{r}\left(\bar{m}, \bar{m} \mid s_U^A, s_U^B\right)[g_H]\right] \cdot G \tag{10}$$

Symmetrically, we can easily conclude that for signal pair (t_L, t_H):

$$\begin{aligned} W^A\left(\bar{m}, \bar{m}, t_L, t_H \mid s_U^A, s_U^B\right) &= 1 - W^A\left(\bar{m}, \bar{m}, t_H, t_L \mid s_U^A, s_U^B\right) \\ &= \frac{1}{2} - \psi \cdot \left[1 + \eta + \eta(\lambda - 1) \cdot \tilde{r}\left(\bar{m}, \bar{m} \mid s_U^A, s_U^B\right)[g_H]\right] \cdot G \end{aligned} \tag{11}$$

Let $\Upsilon = \left(1 + \eta + \eta(\lambda - 1) \cdot \tilde{r}\left(\bar{m}, \bar{m} \mid s_U^A, s_U^B\right)[g_H]\right) G$

Following similar steps we can conclude that:

$$W^A\left(\bar{m}, \bar{m}, t_H, t_0 \mid s_U^A, s_U^B\right) = \frac{1}{2} + \psi \cdot (1 - q) \cdot \Upsilon \tag{12}$$

$$W^A\left(\bar{m}, \bar{m}, t_0, t_H \mid s_U^A, s_U^B\right) = \frac{1}{2} - \psi \cdot (1 - q) \cdot \Upsilon \tag{13}$$

and

$$W^A\left(\bar{m}, \bar{m}, t_0, t_L \mid s_U^A, s_U^B\right) = \frac{1}{2} + \psi \cdot q \cdot \Upsilon \tag{14}$$

$$W^A\left(\bar{m}, \bar{m}, t_L, t_0 \mid s_U^A, s_U^B\right) = \frac{1}{2} - \psi \cdot q \cdot \Upsilon \tag{15}$$

Equations (10)-(15), together with $\hat{\pi}\left(t^A, t^B \mid m^A, m^B, s_U^A, s_U^B\right)$ allow us to compute the reference point of voters in an uninformative equilibrium. together with define the reference point consistent strategy as a function of the reference point. Substituting $\hat{\pi}\left(t^A, t^B \mid \bar{m}, \bar{m}, s_U^A, s_U^B\right)$ in the definition of the reference point, we get:

$$\tilde{r}\left(\bar{m}, \bar{m} \mid s_U^A, s_U^B\right)[g_H] = \frac{q\left(1 + 2\psi p(1 - q)(1 + \eta) G\right)}{1 - 2\psi pq(1 - q)\eta(\lambda - 1) G}$$

The expressions for $W^A\left(\cdot \mid s_U^A, s_U^B\right)$ follow from substituting $\tilde{r}\left(\bar{m}, \bar{m} \mid s_U^A, s_U^B\right)[g_H]$ into equations (10)-(15).

By Assumption 1, $W_{U,\kappa}(\eta, \lambda, G, q, p \mid \psi)$ is greater than $\frac{1}{2}$ and increasing in q (to see this last point, notice that $\frac{\partial W_{U,\kappa}(\eta,\lambda,G,q,p|\psi)}{\partial q}$ has the same sign of the expression

$$\left(1 + 2Gp\psi(1 + \eta) - 4Gpq\psi(1 + \eta) - 2Gpq^2(\lambda - 1)\psi\eta\right)$$

This last term is greater or equal than $1 - 2\psi p(1 + \eta\lambda) G$ which is positive by Assumption 1).

Furthermore, $W_{U,1}(\eta,\lambda,G,0,p \mid \psi) = W^{-}(\eta,G)$ and $W_{U,1}(\eta,\lambda,G,1,p \mid \psi) = W^{+}(\eta,\lambda,G)$. ∎

6.5 Proof of Lemma 1

Fix an equilibrium (σ^A,σ^B). Then for every (m^A,m^B),

$$\begin{aligned} W^A\left(m^A,m^B,t^A,t^B \mid \sigma^A,\sigma^B\right) &= \frac{1}{2}+\psi\cdot\left[\pi_2^A\left(m^A,t^A \mid \sigma^A\right)-\pi_2^B\left(m^B,t^B \mid \sigma^B\right)\right]\cdot \\ &\quad \cdot\left[1+\eta+\eta\left(\lambda-1\right)\cdot\tilde{r}\left(m^A,m^B \mid \sigma^A,\sigma^B\right)[g_H]\right]\cdot G \end{aligned}$$

In particular, let $\Upsilon = \left[1+\eta+\eta(\lambda-1)\cdot\tilde{r}\left(m^A,m^B \mid \sigma^A,\sigma^B\right)[g_H]\right]\cdot G$. Then using the expression for $\tilde{r}\left(m^A,m^B \mid \sigma^A,\sigma^B\right)[g_H]$ and the one for $\hat{\pi}\left(t^A,t^B \mid m^A,m^B,\sigma^A,\sigma^B\right)$, we can conclude that:[42]

$$\tilde{r}\left(m^A,m^B \mid \sigma^A,\sigma^B\right)[g_H] = \frac{\pi_1^A+\pi_1^B}{2}+\psi\cdot\left(\left(\pi_1^A-\pi_1^B\right)^2+p\cdot\left(\pi_1^A\cdot\left(1-\pi_1^A\right)+\pi_1^B\cdot\left(1-\pi_1^B\right)\right)\right)\cdot\Upsilon$$

Substituting the expression for Υ and rearranging terms we get:

$$\tilde{r}\left(m^A,m^B \mid \sigma^A,\sigma^B\right)[g_H] = \frac{\frac{\pi_1^A+\pi_1^B}{2}+\psi(1+\eta)\left[\left(\pi_1^A-\pi_1^B\right)^2+p\left(\pi_1^A\left(1-\pi_1^A\right)+\pi_1^B\left(1-\pi_1^B\right)\right)\right]G}{1-\psi\eta(\lambda-1)\left[\left(\pi_1^A-\pi_1^B\right)^2+p\left(\pi_1^A\left(1-\pi_1^A\right)+\pi_1^B\left(1-\pi_1^B\right)\right)\right]G}$$

Notice that if $\pi_1^A = \pi_1^B = q$, the previous expression is identical to the one we derived for the uninformative equilibrium. Deriving the previous expression with respect to π_1^A and imposing symmetricity, we can conclude that $\tilde{r}\left(m^A,m^B \mid \sigma^A,\sigma^B\right)[g_H]$ is everywhere increasing in π_1^A if:

$$\frac{1}{2\psi}-G\left(2+\frac{1}{2}\eta+\frac{3}{2}\lambda\eta\right)>0$$

(this follows from noticing that the derivative is minimized when $\pi_1^A=0$, $\pi_1^B=1$ and $p=0$). The previous inequality is guaranteed by Assumption 2. This concludes the proof. ∎

6.6 Proof of Lemma 2

Let (σ_P,σ_P) be a symmetric equilibrium. Pick any player i and define $\pi^{i,*} = \max_{m\in M}\pi_1^i\left(\cdot \mid \sigma^i\right)$. The maximum exists since the message space is finite. Obviously $\pi^{i*}>0$. By symmetricity $\pi^{A,*} = \pi^{B,*} = \pi^*$.

First, we show that high-valence candidates will only send messages that yield probability π^*. Formally, we show that for every i, $\sigma^i\left[s^i\right]>0$ if and only if $\pi_1^i\left(s^i(g_H) \mid \sigma_P\right)=\pi^*$. Thus, we will be able to focus on equilibria in which high-types only send message m^*, where $\pi_1^i\left(m^* \mid \sigma_P^i\right)=\pi^*$.

Suppose not. Then we can find a message m such that: (i) $s^i(g_H)=m$ for some s^i such that $\sigma^i\left[s^i\right]>0$, and (ii) $\pi_1^i\left(m \mid \sigma^i\right)<\pi^*$. Thus, high valence candidate must be indifferent between inducing belief π^* and inducing belief $\pi_1^i\left(m \mid \sigma^i\right)$. Pick any message m^* such that $\pi_1^i\left(m^* \mid \sigma^i\right)=\pi^*$

[42] To simplify notation, we omit to specify the dependency of π_1^i on message m^i and communication strategy σ^i.

and consider the strategy that always sends message m^*. Recall that the probability with which candidate i wins against candidate j is given by:

$$\begin{aligned}W^i\left(m^i, m^j, t^i, t^j \mid \sigma_P, \sigma_P\right) &= \frac{1}{2} + \psi \cdot \left[\pi_2^i\left(m^i, t^i \mid \sigma^i\right) - \pi_2^j\left(m^j, t^j \mid \sigma^j\right)\right] \cdot \\ &\cdot \left[1 + \eta + \eta\left(\lambda - 1\right) \cdot \tilde{r}\left(m^i, m^j \mid \sigma^i, \sigma^j\right)\left[g_H\right]\right] \cdot G\end{aligned}$$

Notice that $\pi_2^i\left(m^*, t_0 \mid \sigma^i\right) = \max_{m \in M} \pi_2^i\left(m^i, t_0 \mid \sigma^i\right)$, $\pi_2^i\left(m^*, t_L \mid \sigma^i\right) = \pi_2^i\left(m^i, t_L \mid \sigma^i\right) = 0$ and $\pi_2^i\left(m^*, t_H \mid \sigma^i\right) = \pi_2^i\left(m^i, t_H \mid \sigma^i\right) = 1$ and that Lemma 1 implies that $\tilde{r}\left(m^i, m^j \mid \sigma^i, \sigma^j\right)\left[g_H\right]$ is increasing in π_1^i. Therefore, $W^i\left(m^i, m^j, t^i, t^j \mid \sigma_P, \sigma_P\right)$ is increasing in π_1^i and we conclude that high valence candidate will always prefer sending message m^* instead of message m, contradicting our initial hypothesis. As a result, $\sigma^i\left[s^i\right] > 0$ if and only if $\pi_1^i\left(s^i\left(g_H\right) \mid \sigma^i\right) = \pi^*$.

Now, consider low-valence candidate. Three cases are possible. If low-valence candidates never (respectively, always) send message m^*, then the equilibrium is fully informative (respectively, uninformative). Then consider the case in which low-valence candidates send both m^* and some other messages. In the case, we can assume that she is playing only one additional message $m_* \neq m^*$ as our previous result implies that $\pi_1^i\left(m \mid \sigma^i\right) = 0$ for every $m \neq m^*$. By construction $\pi_1^i\left(m_* \mid \sigma^i\right) = 0$. ∎

6.7 Proof of Proposition 5

Let (σ_P, σ_P) be a π-symmetric partially revealing equilibrium. By Lemma 2, we can focus our attention on message spaces $M = \{m_*, m^*\}$. We will consider the four possible message pairs independently.

If the message pair is (m_*, m_*), probabilities are identical to the one generated in a fully revealing equilibrium after message pair (m_L, m_L). If instead the message pair is (m^*, m^*), the analysis is identical to the one we developed for an uninformative equilibrium in which $q = \pi$. Thus, $W^A\left(m^*, m^*, \cdot, \cdot \mid \sigma_P, \sigma_P\right)$ would be given by:

(m^*, m^*)	t_L	t_0	t_H
t_L	$\frac{1}{2}$	$1 - \hat{W}_\pi$	$1 - \hat{W}_1$
t_0	$\hat{W}_\pi$	$\frac{1}{2}$	$1 - \hat{W}_{(1-\pi)}$
t_H	$\hat{W}_1$	$\hat{W}_{(1-\pi)}$	$\frac{1}{2}$

where

$$\begin{aligned}\hat{W}_\kappa &= \hat{W}_\kappa\left(\eta, \lambda, G, \pi, p \mid \psi\right) = \\ &= \frac{1}{2} + \psi \cdot \kappa \cdot \frac{\left(1 + \eta\kappa\pi + \eta\left(1 - \pi\right)\right)}{1 - 2\psi\left(1 - \pi\right)\pi p \eta\left(\lambda - 1\right) G} \cdot G = W_U\left(\eta, \lambda, G, q, p \mid \psi\right)\end{aligned}$$

It is immediate to check that $\hat{W}_1\left(\eta, \lambda, G, \pi, p \mid \psi\right) \in \left[W_{1,U}\left(\eta, \lambda, G, q, p \mid \psi\right), W^+\left(\eta, \lambda, G\right)\right]$ as $\pi > q$, $W_{1,U}\left(\eta, \lambda, G, q, p \mid \psi\right)$ is increasing in q and reaches $W^+\left(\eta, \lambda, G\right)$ at $q = 1$.

Consider, message pair (m^*, m_*) (the case (m_*, m^*) is symmetric and omitted). In this case $\hat{\pi}\left(t^A, t^B \mid m^*, m_*, \sigma_P, \sigma_P\right)$ is given by

(m^*, m_*)	t_L	t_0	t_H
t_L	$p^2(1-\pi)$	$p(1-p)(1-\pi)$	0
t_0	$(1-p)p$	$(1-p)^2$	0
t_H	$p^2\pi$	$p(1-p)\pi$	0

Furthermore, given the expression for $W^A\left(m^A, m^B, t^A, t^B\right)$ we can conclude that:

$$\begin{aligned} W^A(m^*, m_*, t_H, t_L) &= W^A(m^*, m_*, t_H, t_0) \\ &= \frac{1}{2} + \psi \cdot (1 + \eta + \eta(\lambda - 1) \cdot \tilde{r}(m^*, m_* \mid \sigma_P, \sigma_P)[g_H]) \cdot G \end{aligned}$$

$$\begin{aligned} W^A(m^*, m_*, t_0, t_L) &= W^A(m^*, m_*, t_0, t_0) = \\ &= \frac{1}{2} + \psi \cdot \pi \cdot (1 + \eta + \eta(\lambda - 1) \cdot \tilde{r}(m^*, m_* \mid \sigma_P, \sigma_P)[g_H]) \cdot G \end{aligned}$$

and

$$\begin{aligned} W^A(m^*, m_*, t_L, t_0) &= W^A(m^*, m_*, t_L, t_L) = W^A(m^*, m_*, t_H, t_H) = \frac{1}{2} \\ W^A(m^*, m_*, t_0, t_H) &= \frac{1}{2} - \psi \cdot (1-\pi) \cdot (1 + \eta + \eta(\lambda - 1) \cdot \tilde{r}(m^*, m_* \mid \sigma_P, \sigma_P)[g_H]) \cdot G \\ W^A(m^*, m_*, t_L, t_H) &= \frac{1}{2} - \psi \cdot (1 + \eta + \eta(\lambda - 1) \cdot \tilde{r}(m^*, m_* \mid \sigma_P, \sigma_P)[g_H]) \cdot G \end{aligned}$$

Substituting these expressions in the one for $\tilde{r}(m^*, m_* \mid \sigma_P, \sigma_P, \gamma_P)[g_H]$ and rearranging terms, we get:

$$\tilde{r}\left(m^A, m^B \mid \sigma^A, \sigma^B\right)[g_H] = \frac{\frac{\pi}{2} + \psi(1+\eta)\left(\pi^2 + p\pi(1-\pi)\right)G}{1 - \psi\eta(\lambda-1)\left(\pi^2 + p\pi(1-\pi)\right)G}$$

Thus, if we define:

$$\begin{aligned} W_{P,\kappa} &= W_{P,\kappa}(\eta, \lambda, G, \pi, p \mid \psi) \\ &= \frac{1}{2} + \psi \cdot \kappa \cdot \left(\frac{(1+\eta) + \frac{\pi}{2}\eta(\lambda-1)}{1 - \psi\eta(\lambda-1)\left(\pi^2 + p\pi(1-\pi)\right)G}\right) \cdot G \end{aligned}$$

$W^A(m^*, m_*, \cdot, \cdot \mid \sigma_P, \sigma_P)$ can be summarized in the following table:

(m^*, m_*)	t_L	t_0	t_H
t_L	$\frac{1}{2}$	$\frac{1}{2}$	$1 - W_{P,1}$
t_0	$W_{P,\pi}$	$W_{P,\pi}$	$1 - W_{P,(1-\pi)}$
t_H	$W_{P,1}$	$W_{P,1}$	$\frac{1}{2}$

Notice that $W_{P,1}(\eta,\lambda,G,\pi,p\mid\psi)$ is increasing in π and reaches $W_R(\eta,\lambda,G\mid\psi)$ when $\pi=1$. Thus, $W_{P,1}(\eta,\lambda,G,\pi,p\mid\psi)<W_R(\eta,\lambda,G\mid\psi)$ for every π and p. Furthermore $W_{P,\kappa}(\eta,\lambda,G,\pi,p\mid\psi)<W_{U,\kappa}(\eta,\lambda,G,\pi,p\mid\psi)$ if and only if:

$$1-2\psi G\left(\pi(1+\eta)-(1-\pi)p(1+\eta)+\pi^2(\lambda-1)\eta\right)>0$$

which is guaranteed by assumption 1. ∎

6.8 Proof of Proposition 7

We will only prove the result for high-valence candidates as the result for low-valence candidates can be derived in a similar way.

Given our previous analysis, in a fully revealing equilibrium, if agent i is high-valence, he would get an expected utility equal to:

$$\begin{aligned} U^i(m_H,s_R\mid\theta_H) &= \frac{q}{2}+(1-q)\cdot W_R= \\ &= \frac{1}{2}+(1-q)\cdot\psi\cdot\frac{2+\lambda\eta+\eta}{2(1-\psi\eta(\lambda-1)G)}\cdot G \end{aligned}$$

On the other hand, her expected utility in an uninformative equilibrium would be given by:

$$U^i(\bar{m},s_U\mid\theta_H)=\frac{1}{2}+(1-q)\cdot p\cdot\psi\cdot\frac{1+\eta\lambda q+\eta(1-q)}{1-2\psi\eta(\lambda-1)p(1-q)qG}\cdot G$$

Thus, high-valence candidates will be better off in a fully revealing equilibrium if and only if:

$$\frac{2+\lambda\eta+\eta}{2(1-\psi\eta(\lambda-1)G)}\geq p\cdot\frac{1+\eta\lambda q+\eta(1-q)}{1-2\psi\eta(\lambda-1)p(1-q)qG}$$

If $q\leq q^*(\eta,\lambda,G,p\mid\psi)$, then $\frac{2+\lambda\eta+\eta}{2(1-\psi\eta(\lambda-1)G)}\geq\frac{1+\eta\lambda q+\eta(1-q)}{1-2\psi\eta(\lambda-1)p(1-q)qG}$ and the previous inequality is always satisfied.

Furthermore, the payoff of a high-valence candidate in π-symmetric partially revealing equilibrium is given by:

$$\begin{aligned} U^i(m^*,\sigma_P\mid\theta_H) &= \frac{1}{2}+(1-q)\cdot\psi\cdot z_\pi\cdot p\cdot d_U(\eta,\lambda,G,\pi,p\mid\psi)\cdot G+ \\ &\quad +(1-q)\cdot\psi\cdot(1-z_\pi)\cdot((1-p)\pi+p)\cdot d_P(\eta,\lambda,G,\pi,p\mid\psi)\cdot G \end{aligned}$$

Now notice that:

$$z_\pi\cdot p\cdot d_{U,1}(\eta,\lambda,G,\pi,p\mid\psi)+(1-z_\pi)\cdot((1-p)\pi+p)\cdot d_P(\eta,\lambda,G,\pi,p\mid\psi)$$

can be rewritten as:

$$z_\pi \cdot p \cdot \left(d_U\left(\eta,\lambda,G,\pi,p\mid\psi\right) - d_P\left(\eta,\lambda,G,\pi,p\mid\psi\right)\right) + \\ + \left(\left(1-p\right)\pi + p\right) \cdot d_P\left(\eta,\lambda,G,\pi,p\mid\psi\right) - z_\pi \cdot \left(1-p\right)\pi \cdot d_P\left(\eta,\lambda,G,\pi,p\mid\psi\right)$$

Substituting the expression for z_π and using equation (9) on the first term, we can conclude that the previous expression is equal to $d_P\left(\eta,\lambda,G,\pi,p\mid\psi\right)$. Thus:

$$U^i\left(m^*,\sigma_P^B\mid\theta_H\right) = \frac{1}{2} + \left(1-q\right)\cdot\psi\cdot d_P\left(\eta,\lambda,G,\pi,p\mid\psi\right)\cdot G$$

One can show that $d_P\left(\eta,\lambda,G,\pi,p\mid\psi\right)$ is increasing in π and equals $\frac{2+\lambda\eta+\eta}{2(1-\psi\eta(\lambda-1)G)}$ when $\pi=1$. As a result, $U^i\left(m_H,s_R\mid\theta_H\right) > U^i\left(m^*,\sigma_P^B\mid\theta_H\right)$. ∎

6.9 Proof of Proposition 8

The utility of every voter in a fully revealing equilibrium is equal to:

$$g_L + q^2\cdot G + 2\cdot q\cdot\left(1-q\right)\cdot W_R\left(\eta,\lambda,G\mid\psi\right)\cdot G \\ - 2\cdot q\cdot\left(1-q\right)\cdot\eta\left(\lambda-1\right)\cdot W_R\left(\eta,\lambda,G\mid\psi\right)\cdot\left(1-W_R\left(\eta,\lambda,G\mid\psi\right)\right)G,$$

Instead, in an uninformative equilibrium it is given by:

$$g_L + q^2\cdot G + 2\cdot q\cdot\left(1-q\right)\cdot\left(g_L + K\cdot G\right) + \\ + \left(q^2\eta\cdot\tilde{r}\left(\bar{m},\bar{m}\mid s_U,s_U\right)\left[g_L\right] - \left(1-q\right)^2\eta\lambda\cdot\tilde{r}\left(\bar{m},\bar{m}\mid s_U,s_U\right)\left[g_H\right]\right)\cdot G + \\ + 2q\left(1-q\right)\cdot\left(\eta K\cdot\tilde{r}\left(\bar{m},\bar{m}\mid s_U,s_U\right)\left[g_L\right] - \eta\lambda\left(1-K\right)\cdot\tilde{r}\left(\bar{m},\bar{m}\mid s_U,s_U\right)\left[g_H\right]\right)G$$

where K is the probability with which the high-valence candidate is chosen when one candidate is high-valence and the other one is low valence. Formally:

$$\begin{aligned} K &= p^2\cdot W_{U,1}\left(\eta,\lambda,G,q,p\mid\psi\right) + \frac{\left(1-p\right)^2}{2} + \\ &\quad + p\left(1-p\right)\cdot W_{U,(1-q)}\left(\eta,\lambda,G,q,p\mid\psi\right) + \left(1-p\right)p\cdot W_{U,q}\left(\eta,\lambda,G,q,p\mid\psi\right) = \\ &= \frac{1}{2} + \psi\cdot p\cdot d_U\left(\eta,\lambda,G,q,p\mid\psi\right)\cdot G \end{aligned}$$

Furthermore,

$$\tilde{r}\left(\bar{m},\bar{m}\mid s_U,s_U\right)\left[g_H\right] = q + 2q\left(1-q\right)\cdot p\cdot\psi\cdot d_U\left(\eta,\lambda,G,q,p\mid\psi\right)$$

Using the definition of reference points and simplifying, we can conclude that the total utility of the electorate in the fully revealing equilibrium is greater than the one in the uninformative equilibrium if and only if:

$$2 \cdot (W_R - K) > \eta (\lambda - 1) \cdot \Big(2 \cdot W_R \cdot (1 - W_R) \\ - q(1-q) - 2q^2 (1-K) - 2(1-q)^2 K - 4q(1-q) K (1-K) \Big)$$

Notice that $W_R, K > \frac{1}{2}$. Since we are assuming $q < q^* (\eta, \lambda, G, p \mid \psi)$, $W_R > W_{U,1} > K$. Thus, the left hand side of the previous inequality is positive. Instead, the right-hand side is lower or equal than:

$$\eta (\lambda - 1) \cdot \Big(2 \cdot K \cdot (1-K) - q(1-q) - 2q^2 (1-K) - 2(1-q)^2 K - 4q(1-q) K (1-K) \Big)$$

which is always negative (indeed, the previous expression is maximized when $K = \max \left\{ \frac{1}{2}, \frac{q^2}{1-2q(1-q)} \right\}$ and, in both these cases, it is negative). Weconclude that voters are better off in the fully revealing equilibrium than in the uninformative one.

Now consider a π-symmetric partially revealing equilibrium. To simplify notation, we will denote the threshold of Proposition with d_P and d_U instead of $d_P (\eta, \lambda, G, \pi, p \mid \psi)$ and $d_U (\eta, \lambda, G, \pi, p \mid \psi)$. Moreover, let $W_R = W_R (\eta, \lambda, G \mid \psi)$. In such an equilibrium, the probability with which a high-valence candidate gets elected is given by:

$$q^2 + 2q(1-q)(1-z_\pi) \cdot (pW_{P,1} + (1-p) W_{P,1}) + \\ + 2q \cdot (1-q) \cdot z_\pi \cdot \left(p^2 W^\pi_{U,1} + \frac{(1-p)^2}{2} + p(1-p) W^\pi_{U,(1-\pi)} + (1-p) p W^\pi_{U,\pi} \right)$$

which can be simplified to:

$$q^2 + 2q(1-q) z_\pi \left(\frac{1}{2} + p\psi d_U \right) + 2q(1-q)(1-z_\pi) \left(\frac{1}{2} + p\psi d_P + (1-p) \pi \psi d_P \right)$$

Similarly, the probability of electing a low-valence candidate can be written as:

$$(1-q)^2 + 2q(1-q) z_\pi \cdot \left(\frac{1}{2} - p\psi d_U \right) + 2q(1-q)(1-z_\pi) \left(\frac{1}{2} - p\psi d^\pi_P - (1-p) \psi \pi d^\pi_P \right)$$

Thus, the consumption utility that voters get in a π-symmetric partially revealing equilibrium is given by:

$$g_L + qG + 2\psi q(1-q) ((1-z_\pi) \cdot (p + (1-p)\pi) \cdot d_P + z_\pi \cdot p \cdot d_U) \cdot G$$

which can be simplified to:[43]

$$g_L + qG + 2\psi q(1-q) d_P G$$

[43] This follows using equation (9) as we did in the proof of Proposition 7.

while the gain/loss utility is given by:

$$-\eta\left(\lambda-1\right)\left(q^{2}+2q\left(1-q\right)z_{\pi}\left(\frac{1}{2}+p\psi d_{U}\right)+2q\left(1-q\right)\left(1-z_{\pi}\right)\left(\frac{1}{2}+p\psi d_{P}+\left(1-p\right)\pi\psi d_{P}\right)\right)\cdot$$
$$\cdot\left(\left(1-q\right)^{2}+2q\left(1-q\right)z_{\pi}\left(\frac{1}{2}-p\psi d_{U}\right)+2q\left(1-q\right)\left(1-z_{\pi}\right)\left(\frac{1}{2}-p\psi d_{P}-\left(1-p\right)\psi\pi d_{P}\right)\right)G$$

Observe that the consumption utility in a fully revealing equilibrium is higher than the one in a π-symmetric partially revealing equilibrium if and only if:

$$2W_{R}\geq 1+2\psi d_{P}$$

or equivalently if and only if:

$$\frac{\left(2+\eta+\eta\lambda\right)G}{2\left(1-\psi\eta\left(\lambda-1\right)G\right)}\geq d_{P}$$

which is always satisfied since $d_{P}\left(\eta,\lambda,G,\pi,p\mid\psi\right)$ is increasing in π and equals $\frac{(2+\eta+\eta\lambda)G}{2(1-\psi\eta(\lambda-1)G)}$ at $\pi=1$.

Furthermore, exploiting equality 9, the gain/loss utility in a fully revealing equilibrium will be higher (namely, lower in absolute value) than in a π-symmetric partially revealing one if and only if:

$$2\left(\frac{1}{2}+\psi\cdot\frac{\left(2+\eta+\eta\lambda\right)G}{2\left(1-\psi\eta\left(\lambda-1\right)G\right)}\right)\cdot\left(\frac{1}{2}-\psi\cdot\frac{\left(2+\eta+\eta\lambda\right)G}{2\left(1-\psi\eta\left(\lambda-1\right)G\right)}\right)<\left(1+2\psi\left(1-q\right)d_{P}\right)\cdot\left(1-2\psi q d_{P}\right) \tag{16}$$

The right-hand side of (16) is decreasing in q. Thus a sufficient condition for (16) is:

$$2\cdot\left(1-\psi\cdot\frac{\left(2+\eta\lambda\pi+\eta\left(2-\pi\right)\right)}{1-\psi\eta\left(\lambda-1\right)\left(\pi^{2}+p\pi\left(1-\pi\right)\right)G}\cdot G\right)>$$
$$>\left(1+\psi\cdot\frac{\left(2+\eta+\eta\lambda\right)G}{\left(1-\psi\eta\left(\lambda-1\right)G\right)}\right)\cdot\left(1-\psi\cdot\frac{\left(2+\eta+\eta\lambda\right)G}{\left(1-\psi\eta\left(\lambda-1\right)G\right)}\right)$$

which follows from noticing that $2>\left(1+\psi\frac{G(2+\eta+\lambda\eta)}{(1-G(\lambda-1)\psi\eta)}\right)$ by Assumption 2 and that $\frac{G(2+\eta\lambda\pi+\eta(2-\pi))}{1-G(\lambda-1)(p+(1-p)\pi)\pi\psi\eta}$ is increasing in π and equals $\frac{G(2+\eta+\lambda\eta)}{(1-G(\lambda-1)\psi\eta)}$ when $\pi=1$.

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