

# ELECTORAL COMPETITION WITH RATIONALLY INATTENTIVE VOTERS

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## Abstract

This paper studies how voters' selective ignorance interacts with policy design by political candidates. It shows that the selectivity empowers voters with extreme preferences and small groups, that divisive issues attract most attention, and that public goods are underfunded. Finer granularity of information increases these inefficiencies. Rational inattention can also explain why competing opportunistic candidates do not always converge on the same policy issues. (JEL: H00, P16)

## Teaching Slides

A set of Teaching Slides to accompany this article are available online as [Supplementary Data](#).

## 1. Introduction

As a result of the digital revolution, the supply of political information has become virtually unlimited and almost free. One would think that this has greatly increased

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voters' information and awareness of political processes. Yet, the major observed changes have been compositional. As emphasized by Prior (2007), some individuals have become much more informed, others less. Informational asymmetries across issues (what one is informed about) have also become more prominent. On average, however, Americans' public knowledge did not increase relative to the late 1980s (Pew Research Center 2007).

A plausible explanation of these patterns is that the availability and granularity of information has vastly increased, but at the same time it has become easier to avoid being informed. The provision of information has been disintermediated (Prior 2007; Sunstein 2017). What we know is mainly determined by what and where we search of our own initiative. Because information remains costly to absorb and process, however, individuals can be very selective in the information that they acquire (according to Pew Research Center (2020), two-thirds of Americans feel worn out by the amount of news there is). When network television and newspapers were the main sources of political information, instead, it was more difficult to become very well informed about narrow and specific issues; at the same time, individuals could not avoid being exposed to general news while searching for specific bits of information or seeking entertainment. As a result, political information was more uniform across individuals and issues.

In other words, the digital revolution had the following important implication. The patterns of information that bear on the political process (who is informed and over what) are now largely determined by the individual demand for information, whereas the supply of information by the media has become less important.<sup>1</sup>

What effect does the possibility of selective ignorance have on political and policy outcomes? In particular, who is informed and over what, in a world in which information is easy to obtain but remains costly to absorb? And how do these informational patterns interact with and affect policy choices in a representative democracy? Could better information technology have adverse effects on the functioning of representative democracies, as many commentators suggest?

The goal of this paper is to address these questions. We study a general and unified theoretical framework where rationally inattentive voters allocate costly attention to political news, and politicians take this into account in setting policies. An important advantage of our framework is that voters' information is derived directly from first principles, that is, from voters' preferences and their rational expectations of political outcomes. Thus, our results are applicable to a broad range of issues and do not require additional assumptions on voters' information when a new situation is studied.

Policy is set in the course of electoral competition by two candidates, who maximize the probability of winning and commit to policy platforms ahead of elections. As in standard probabilistic voting, voters trade off their policy preferences against their (random) preferences for one candidate or the other—see Persson and Tabellini (2000) and Lindbeck and Weibull (1987). The novelty is that here rational but uninformed voters

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1. According to Pew Research Center (2019), more than half of US adults get news from social media often or sometimes.

also decide how to allocate costly attention. Voters cannot perfectly predict equilibrium policies, either because candidates make random implementation errors or because candidates have private information over their type. Attention is modeled as the precision of the noisy signals that voters receive about the candidates' policies. More precise signals are more costly, and voters optimally choose the precision of the signals they receive.

Voters' attention and public policies are jointly determined. Because attention is scarce, voters optimally allocate it to what is most important to them. Their priorities are not exogenously given, however, but depend on expected policy choices. In turn, voters' attention affects the incentives of political candidates, who design their policies taking into account who is informed about what. This interaction between candidates and optimally inattentive voters gives rise to systematic patterns of information acquisitions and deviations of equilibrium policies from the full information benchmark. These patterns are endogenous, and we study how they react if the granularity of available information increases (e.g., because of the diffusion of the internet), if the cost of information drops, or if the economy is hit by shocks.

We assume that candidates are opportunistic and maximize the probability of winning, and derive two general results. First, attention is not uniform, but differs across voters and policy issues. Voters are more attentive if they have higher stakes from observing a deviation from the expected equilibrium policy. Second, the equilibrium maximizes a modified "perceived" social welfare function that reflects voters' attention strategies. Thus, perceived welfare reacts to policy announcements in ways that differ across voters and policy issues. Where attention is higher, perceived welfare is more responsive to policy changes, and political candidates take this into account by catering more to the more attentive voters.

We then illustrate the general implications of these results with two examples. First, we study conflict over a single policy dimension. Here, the focus is on which voters are more attentive and hence more influential. The main point is that rational inattention amplifies the effects of preference intensity and dampens the effects of group size on equilibrium outcomes, relative to full information. A group can have high policy stakes (and hence high attention) at the expected equilibrium policy for one of two reasons: Because its preferences are very different from the rest of the population—it is an extremist group; or because it is small in size, so that political candidates can afford to neglect it. Thus, minorities and extremists tend to be more attentive and more influential in the political process, compared to full information. If the distribution of voters' policy preferences is not symmetric, this moves the equilibrium policy away from the full (or uniform) information benchmark.

The prediction that extremists and minorities are more informed and attentive is consistent with evidence from survey data. Using data from the American National Election Studies (ANES) survey, we show that individuals who hold more extreme policy views declare to pay more attention to what is going on in government and politics. This result is consistent with other empirical findings in the literature. First, voters with more extreme partisan preferences or with more polarized policy views are more informed about the policy positions of presidential candidates (Palfrey and Poole 1987) and of members of Congress (Lauderdale 2013). Second, they also

consume more media (blogs, television [TV], radio, and newspapers; Ortoleva and Snowberg 2015). Third, ethnic minorities generally are more informed about racial issues (Carpini and Keeter 1996).

Rational inattention also implies that the equilibrium can display policy divergence, even if candidates only care about winning the election and not about the policy *per se*, and they are equally popular.<sup>2</sup> Suppose that candidates differ in their informational attributes (e.g., one candidate has more media coverage and hence a lower cost of attention), and that the distribution of voters' policy preferences is asymmetric. Then the candidate with less media coverage caters to the relatively more attentive voters, namely, those at one of the extremes, whereas his opponent chooses more centrist policies and is thus favored at the elections. An implication is that political entrants, who are likely to have less media coverage, tend to choose more extreme policies, and are less likely to win the election. This prediction is consistent with the finding that in US Congressional elections, incumbents take less extreme positions compared to candidates running in open seat elections, and the latter in turn take less extreme positions than challengers (Ansolobehere et al. 2001, Stone and Simas 2010). According to our model, this effect is weaker when policy stakes are particularly high, that is, when a new important issue comes up or in unusual times such as in a crisis. Such times provide windows of opportunity for the less established candidates.

We then consider a second example, where policy is multi-dimensional. The policy instruments consist of a general public good that benefits all, and that can be financed by a uniform but distorting tax and by non distorting taxes targeted to specific groups. In equilibrium, voters are more attentive to the policy instruments over which they have higher stakes, namely, the group specific taxes. They instead pay minimal attention to the public good and to the uniform tax. The reason is that, because these instruments have the same effect on everyone, voters expect them to be set close to their bliss point. In other words, controversial or special interest policies receive more attention by potential beneficiaries, compared to general interest policies. The reason is not only that targeted taxes or transfers provide significant benefits to specific groups, but also that they are opposed by everyone else. This widespread opposition implies that in equilibrium, these targeted policies are always insufficient from the perspective of the beneficiaries, who are thus very attentive to detecting possible deviations. This allocation of attention in turn distorts the incentives of political candidates. As a result, the equilibrium is Pareto inefficient: Public goods that benefit all are under-provided, general tax distortions affecting everyone are too high, whereas there is excessive targeting to specific groups through tax credits or transfers. The final policy distortion is similar to that in Gavazza and Lizzeri (2009), but here informational asymmetries are endogenously determined in equilibrium, rather than assumed at the start, and we can do comparative statics. The normative implications are also different, as discussed in context.

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2. Groselcose (2001) explains policy divergence as due to differences in valence. In our model, valence can be captured by average popularity, which is assumed to be the same for the two candidates.

Some features of the equilibria we study are similar to those of models of lobbying, where organized groups exert a disproportionate influence over policy, directly through bribes, or indirectly by reducing the cost of information over some issues. Nevertheless there are some important differences. First, in a commonly used class of static models of lobbying (where lobbies commit to truthful and nonwasteful contributions, or if lobbies choose campaign contributions after policies have been announced by competing candidates), equilibrium policies are generally Pareto efficient (eg., Persson and Tabellini 2000 and Grossman and Helpman 2001a). With multidimensional policy instruments, instead, equilibria with rationally inattentive voters are generally not Pareto efficient. For instance, in the public good example summarized previously, a symmetric equilibrium where all groups are allowed to provide campaign contributions to either candidate, as in Persson and Tabellini (2000), would not lead to under-provision of the public good nor to distorting taxes, whereas this is the equilibrium outcome with rationally inattentive voters. Second, the mechanisms of political influence are very different, and this matters for the specific implications. Lobbying explains political influence as due to the ability of groups to get organized and overcome the collective action problem. In our setting, instead, political attention is the outcome of uncoordinated individual decisions in mass elections. Even dispersed clusters of unrelated individuals with little ability to get organized, such as minorities or home-owners, could be highly influential over specific policies that are important to them, such as cultural policies or property taxes (see the empirical evidence quoted in footnote 4). Third, even models of lobbying through information provision, such as Coate (2004), do not explain why voters pay attention to information provided by the lobbies. Fourth, the specific normative implications are quite different. We refer to Section 4.2 for a more detailed discussion of this point.

Our paper borrows analytical tools from the literature on rational inattention following Sims (2003) in other areas of economics.<sup>3</sup> This approach popularized and reinvented for economics the idea that attention is a scarce resource, and thus information can be imperfect even if it is freely available, such as on the internet or in financial journals.

The notion that voters are very poorly informed is widespread in political economy (e.g., Carpini and Keeter 1996), yet the traditional approach views political information as a by-product of other activities (Downs 1957). Trade policy is natural example, studied by Ponzetto (2011). In his model, workers acquire heterogeneous information about the positive effects of trade protection on their employment sector, and remain less informed about the cost of protection for their consumption. This asymmetry in information leads to a political bias against free trade. Thus information is endogenous but, unlike in our setting, it is not collected by citizens in order to cast a vote and this is reflected in the properties of the equilibrium. Moreover, such endogeneity requires a different model outside of electoral competition for each new issue studied.

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3. See also Mackowiak and Wiederholt (2009), Van Nieuwerburgh and Veldkamp (2009), Woodford (2009), Matějka and McKay (2015), and Caplin and Dean (2015).

A large literature has explored the political effects of information supplied by the media (Della Vigna 2010, Prat and Stromberg 2013 and Stromberg 2015 provide excellent surveys). All these contributions endogenize the cost of acquiring political information. One difference with our approach is that we look at how individuals process information, thus the source of the friction is different. A second important difference is that we look at voters' demand of information for purely political reasons. The media literature instead studies how the supply of information responds to demand, but information demand is a by-product of other private activities, the utility of which may depend on government policy. Thus, this literature concludes that large groups are more informed, because they are more relevant for profit maximizing media. We reach the opposite conclusion. Moreover, our approach allows us to study the effects of changes in the availability of information, when demand for political information responds endogenously to its cost or its granularity.

Yuksel (2014) studies a model where policy is perfectly observed but voters seek costly information over the state of nature (a shock to voters' policy preferences). When policy is multidimensional, voters specialize in gathering information over the state of nature in the policy dimension that is most important to them, and remain less informed about the other states of nature. This makes them less responsive to the remaining policy dimensions, and partisan candidates are free to set policy closer to their bliss points, compared to full information. In our paper, instead, political candidates only care about the probability of winning, and policy divergence occurs if candidates differ in their visibility.<sup>4</sup>

Our result on policy divergence due to differences in transparency between candidates is related to Glaeser, Ponzetto, and Shapiro (2005). That paper assumes that core party supporters are more informed about their own party than about the opponent, in a setting with endogenous turnout. Our model, instead, has the opposite feature: Because in equilibrium all voters have a positive probability of voting for either candidate, they pay more attention to the more distant candidate. The specific predictions of our paper are also quite different.<sup>5</sup>

A large theoretical literature studies voters' incentives to collect information and/or vote, starting with the seminal contribution by Ledyard (1984). Most research on costly information focuses on the welfare properties of the equilibrium (Martinelli 2006) or on small committees (Persico 2003); however, and does not ask how voters' endogenous information shapes equilibrium policies. The literature on endogenous participation studies the equilibrium interaction of voting and policy design, but without an explicit focus on information acquisition.

Finally, our paper is also related to a rapidly growing empirical literature on the economic and political effects of policy instruments with different degrees of visibility. The findings in that literature confirm that policy instruments with different

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4. Nunnari and Zapal (2017) and Hu and Li (2018) also study endogenous costly information in models of electoral competition.

5. Groseclose (2001) also predicts policy divergence, but based on differences in valence between candidates.

degrees of transparency are not politically equivalent, and directly or indirectly support the theoretical results of our paper.<sup>6</sup>

The outline of the paper is as follows. In Section 2, we describe the general theoretical framework, where policy is ex-ante uncertain because of implementation errors by candidates. Section 3 presents some general results. Section 4 illustrates two applications to specific policy issues. Section 5 concludes the paper. The Online Appendix contains the proofs and shows that our results generalize to a setting where voters' uncertainty reflects learning by the candidates about the state of nature, rather than implementation errors.

## 2. The General Framework

This section presents a general model of electoral competition with rationally inattentive voters. Two opportunistic political candidates  $C \in \{A, B\}$  maximize the probability of winning the election and set a policy vector  $q_C = \{q_{C,i}\}$  of  $L$  elements, for  $i = 1, 2, \dots, L$ . The elements may be targeted transfers to particular groups, tax rates, levels of public good, and so forth.

There are  $N$  distinct groups of voters, indexed by  $J = 1, 2, \dots, N$ . Each group has a continuum of voters with a mass  $m^J$ , indexed by the superscript  $v$ . Voters' preferences have two additive components, as in standard probabilistic voting models (Persson and Tabellini 2000). The first component  $U^J(q_C)$  is a concave and smooth function of the policy and is common to all voters in  $J$ . The second component is a preference shock  $x^v$  in favor of candidate  $B$ . Thus, the utility function of a voter of type  $\{v, J\}$  from voting for candidate  $A$  or  $B$  is, respectively:

$$U_A^{v,J}(q_A) = U^J(q_A), \quad U_B^{v,J}(q_B) = U^J(q_B) + x^v. \quad (1)$$

The preference shock  $x^v$  in favor of candidate  $B$  is the sum of two random variables:  $x^v = \tilde{x} + \tilde{x}^v$ , where  $\tilde{x}^v$  is a voter specific preference shock, whereas  $\tilde{x}$  is a shock common to all voters. We assume that  $\tilde{x}^v$  is uniformly distributed on  $[-1/(2\varphi), 1/(2\varphi)]$ , that is, it has mean zero and density  $\varphi$  and is iid across voters. The common shock  $\tilde{x}$  is distributed uniformly in  $[-1/(2\psi), 1/(2\psi)]$ . In what follows, we refer to  $\tilde{x}^v$  as an idiosyncratic preference shock and to  $\tilde{x}$  as a popularity shock.

The distinguishing feature of the model is that voters are uninformed about the candidates' policies, but they can choose how much of their costly attention to devote to these policies and their elements. To generate some voters' ex-ante uncertainty, we assume that candidates choose a policy target (which in equilibrium can be perfectly

6. Chetty et al. (2009) show that consumer purchases reflect the visibility of indirect taxes. Finkelstein (2009) shows that demand is more elastic to toll increases when customers pay in cash rather than by means of a transponder, and toll increases are more likely to occur during election years in localities where transponders are more diffuse. Cabral and Hoxby (2012) show that information costs on property taxes are reflected in knowledge of tax rates by home-owners. Moreover, in areas where information costs are higher, property tax rates are significantly higher. Bordignon, Grembi, and Piazza (2010) show that mayors in their first term of office rely on less visible tax instruments compared to mayors who have reached their term limit. Dollery and Worthington (1996) survey a related earlier literature on fiscal illusion.

predicted by voters), but the policy platform actually set by each candidate is drawn by nature from the neighborhood of the targeted policy. Specifically, each candidate commits to a target policy platform  $\hat{q}_C = [\hat{q}_{C,1}, \dots, \hat{q}_{C,L}]$ . The actual policy platform on which candidate  $C$  runs, however, is

$$q_{C,i} = \hat{q}_{C,i} + e_{C,i} \quad (2)$$

where  $e_{C,i} \sim N(0, \sigma_{C,i}^2)$  is a random variable that reflects implementation errors in the course of the campaign. For instance, the candidate announces a specific target tax rate on real estate,  $\hat{q}_{C,i}$ , but when all details are spelled out and implemented during the electoral campaign, the actual tax rate to which each candidate commits may contain additional provisions such as homestead exemptions, or for assessment of market value. Alternatively, one can think of the main political actors over which voters form rational expectations as parties. But policies are implemented by candidates, and parties can make unobserved errors in selecting candidates (Coate 2004 takes a related approach to study campaign advertising). The implementation errors  $e_{C,i}$  are independent across candidates  $C$  and policy instruments  $i$ , and their variance  $\sigma_{C,i}^2$  is given exogenously.<sup>7</sup>

As described more precisely in what follows, voters do not observe actual policies,  $q_C$ , they only observe noisy signals of such policies, and the precision of the signals is determined by their attention.

The sequence of events is as follows.

1. Voters form prior beliefs about the policy platforms of each candidate and choose attention strategies.
2. Candidates set policy (i.e., they choose *target* platforms, and *actual* policy platforms are determined as in equation (2)).
3. Voters observe noisy signals of the actual platforms.
4. The ideological bias  $x^v$  is realized and elections are held. Whoever wins the election enacts their announced actual policies.<sup>8</sup>

In Section 2.2, we define the equilibrium, which is a pair of targeted policy vectors chosen by the candidates, and a set of attention strategies chosen by each voter. The attention strategies are optimal for each voter, given their prior beliefs about policies, and policy vectors maximize the probability of winning for each candidate, given the voters' attention strategies. Moreover, voters' prior beliefs are consistent with the candidates' equilibrium policy targets.

### 2.1. Voters' Behavior

The voters' decision process has two stages: information acquisition and voting.

7. The assumption of independence could easily be dropped, and then  $e_C$  would be multivariate normal with a variance-covariance matrix  $\Sigma$ —see in what follows.

8. The assumption that  $\bar{x}^v$  is realized at the last stage is made just to simplify notation, so that attention strategies of voters are the same within each group.



*2.1.1. Imperfect Information and Attention.* All voters have identical prior beliefs about the policy vectors  $q_C$  of the two candidates. In the beliefs, elements of the policy vector are independent, and so are the policy vectors of the two candidates. Let each element of the vector of prior beliefs be drawn from  $N(\bar{q}_{C,i}, \sigma_{C,i}^2)$ , where  $\bar{q}_C = [\bar{q}_{C,1}, \dots, \bar{q}_{C,L}]$  is the vector of prior means, and  $\sigma_C^2 = [\sigma_{C,1}^2, \dots, \sigma_{C,L}^2]$  the vector of prior variances. Note that, to ensure consistency, the prior variances coincide with the variance of the implementation errors  $e_C$  in equation (2).<sup>9</sup>

In the first stage, voters choose attention, that is they choose how much information about each element of each policy vector to acquire. We model this as the choice of the level of noise in signals that the voters receive. Each voter ( $v, J$ ) receives a vector  $s^{v,J}$  of independent signals on all the elements  $\{1, \dots, L\}$  of both candidates,  $A$  and  $B$ ,

$$s_{C,i}^{v,J} = q_{C,i} + \varepsilon_{C,i}^{v,J},$$

where the noise  $\varepsilon_{C,i}^{v,J}$  is drawn from a normal distribution  $N(0, \gamma_{C,i}^J)$ , and is i.i.d across voters.<sup>10</sup>

It is convenient to define the following vector  $\xi^J \in [0, 1]^{2L}$ , which is the decision variable for attention in our model:  $\xi^J = \{\xi_{A,1}^J, \dots, \xi_{A,L}^J, \xi_{B,1}^J, \dots, \xi_{B,L}^J\}$ , where

$$\xi_{C,i}^J \equiv \frac{\sigma_{C,i}^2}{\sigma_{C,i}^2 + \gamma_{C,i}^J} \in [0, 1].$$

The more attention is paid by the voter to  $q_{C,i}$ , the closer is  $\xi_{C,i}^J$  to 1. This is reflected by the noise level  $\gamma_{C,i}^J$  being closer to zero, and also by a smaller variance  $\rho_{C,i}^J$  of posterior beliefs.<sup>11</sup> Naturally, higher attention is more costly; see in what follows. We also allow for some given level  $\xi_0 \in [0, 1)$  of minimal attention paid to each instrument, which is forced upon the voter exogenously, that is, the choice variables must satisfy  $\xi_{C,i}^J \geq \xi_0$ .

Higher levels of precision of signals are more costly. Here we employ the standard cost function in rational inattention (Sims, 2003), but this choice is not crucial. We assume that the cost of attention is proportional to the relative reduction of uncertainty upon observing the signal, measured by entropy. For uni-variate normal distributions of variance  $\sigma^2$ , entropy is proportional to  $\log(\pi e \sigma^2)$ . Thus, the reduction in uncertainty that results from conditioning on a normally distributed signal  $s$  is given by  $\log(\pi e \sigma^2) - \log(\pi e \rho)$ , where  $\sigma^2$  is the prior variance and  $\rho$  denotes the posterior variance. Because in a multivariate case of independent uncorrelated elements, the total entropy equals the sum of entropies of single elements, the cost of information

9. Like for the implementation errors, the assumption of independence could easily be dropped, and then  $\bar{q}_C$  would be multivariate normal with a variance-covariance matrix  $\bar{\Sigma}$ .

10. All voters belonging to the same group choose the same attention strategies, because ex-ante (i.e., before the realization of  $x^v$  and  $\varepsilon_{C,i}^{v,J}$ ) they are identical.

11. The posterior variance equals  $\rho_{C,i}^J = \gamma_{C,i}^J \sigma_{C,i}^2 / (\sigma_{C,i}^2 + \gamma_{C,i}^J)$ . Thus, the variable  $\xi_{C,i}^J$  also measures the relative reduction of uncertainty about  $q_{C,i}$ :  $\xi_{C,i}^J = 1 - \rho_{C,i}^J / \sigma_{C,i}^2$ . The more attention is paid, the closer is  $\xi_{C,i}^J$  to 1 and hence the lower is the posterior variance.

in our model is:

$$\sum_{C \in \{A, B\}, i \leq L} \lambda_{C,i}^J \log \left( \sigma_{C,i}^2 / \rho_{C,i}^J \right) = - \sum_{C \in \{A, B\}, i \leq L} \lambda_{C,i}^J \log \left( 1 - \xi_{C,i}^J \right).$$

The term  $-\log(1 - \xi_{C,i}^J)$  measures the relative reduction of uncertainty about the policy element  $q_{C,i}$ , and it is increasing and convex in the level of attention  $\xi_{C,i}^J$ . The parameter  $\lambda_{C,i}^J \in R_+$  scales the unit cost of information of voter  $J$  about  $q_{C,i}$ . It can be an objective cost (e.g., time or money) reflecting the supply of information from the media or other sources, and the transparency of the policy instrument  $q_{C,i}$ ; but it could also be a subjective and psychological cost, related to the ability of voter  $J$  to process information.

**2.1.2. Voting.** The second stage is a standard voting decision under uncertainty. After voters receive additional information of the selected form, and knowing the realization of the candidate bias  $x^v$ , they choose which candidate to vote for. Specifically, after a voter receives signals  $s^{v,J}$ , he forms posterior beliefs about utilities from policies that will be implemented by each candidate, and he votes for  $A$  if and only if:

$$E[U^J(q_A) | s_A^{v,J}] - E[U^J(q_B) | s_B^{v,J}] \geq x^v. \tag{3}$$

where the expectations operator refers to the posterior beliefs about the unobserved policy vectors  $q_C$ , conditional on the signals received.

**2.1.3. Voter's Objective.** In the first stage, the voter chooses an attention strategy to maximize expected utility in the second stage, considering what posterior beliefs and preference shocks can be realized, less the cost of information. Thus, voters in each group  $J$  choose attention strategy  $\xi^J$  that solves the following maximization problem:

$$\max_{\xi^J \in [\xi_0, 1]^{2L}} E \left[ \max_{C \in \{A, B\}} E[U_C^{v,J}(q_C) | s_C^{v,J}] \right] + \sum_{C \in \{A, B\}, i \leq L} \lambda_{C,i}^J \log \left( 1 - \xi_{C,i}^J \right). \tag{4}$$

The first term is the expected utility from the selected candidate (inclusive of the candidate bias  $x^v$ ), that is, it is the maximal expected utility from either candidate conditional on the received signals. The inner expectation is over a realized posterior belief. The outer expectation is determined by prior beliefs; it is over realizations of  $\varepsilon_C^{v,J}$  and  $x^v$ . The second term is minus the cost of information.

This formulation literally states that the voter chooses how much and what form of information to acquire as if he were pivotal in his subsequent voting decision. Because in a large election, the actual probability of being pivotal is close to zero, this can be interpreted as saying that voters are motivated by “sincere attention” and want to cast a meaningful vote. That is, they draw utility from voting for the right candidate (i.e., the one that is associated with higher expected utility), because they consider it their duty (cf. Feddersen and Sandroni 2006) or because they want to tell others (as in Della Vigna et al. 2015). In other words, individuals are motivated to acquire political information by exactly the same considerations that induce them to

vote one way or the other in the ballot. In the absence of a complete and satisfactory theory of voter behavior, this seems the most natural and least arbitrary assumption. In this interpretation, the parameter  $\lambda_{C,i}^J$  captures the cost of attention relative to the psychological benefit of voting for the right candidate.<sup>12</sup>

Note that, in line with our assumption that voters are motivated by the desire to cast a meaningful vote and not by the expectation of being pivotal, we also assume that voters do not condition their beliefs on being pivotal when they vote. This is the standard approach in the literature on electoral competition, and it is consistent with the fact that with a continuum of voters the probability of being pivotal is zero.<sup>13</sup>

We further discuss these assumptions on voters' behavior in the next subsection.

## 2.2. Equilibrium

In equilibrium, neither candidates nor voters have an incentive to deviate from their strategies. In particular, voters' prior beliefs are consistent with the equilibrium choice of targeted policy vectors of the candidates, and candidates select a best response to the attention strategies of voters and to each other's policies. Specifically, we have the following definition.

**DEFINITION 1.** *Given the level of noise  $\sigma_C^2$  in candidates' policies, the equilibrium is a set of targeted policy vectors chosen by each candidate,  $\hat{q}_A, \hat{q}_B$ , and of attention strategies  $\xi^J$  chosen by each group of voters, such that:*

- (a) *The attention strategies  $\xi^J$  solve the voters' problem (4) for prior beliefs with means  $\bar{q}_C = \hat{q}_C$  and noise  $\sigma_C^2$ .*
- (b) *The targeted policy vector  $\hat{q}_C$  maximizes the probability of winning for each candidate  $C$ , taking as given the attention strategies chosen by the voters and the policy platforms chosen by his opponent.*

## 2.3. Discussion

Here we briefly discuss some of the previous modeling assumptions. Most of our findings are robust to slight variations in these assumptions, however, because the results that follow are based on intuitive monotonicity arguments only.

12. An alternative interpretation is that voters expect to be pivotal with an exogenously given probability, say  $\delta > 0$ . Then the first term in equation (4), the expected utility from the selected policy, would be pre-multiplied by  $\delta$ . Such a modification would be equivalent to rescaling the cost of information  $\lambda$  by the factor  $1/\delta$ , with no substantive change in any result. If the probability of being pivotal was endogenous and part of the equilibrium, the model would become more complicated, but most qualitative implications discussed in what follows would again remain unchanged. The first-order condition (10) in what follows would still hold exactly.

13. If we allowed for learning from being pivotal, then under some assumptions voters could learn the policy exactly, and limited attention would have no effect. This assumption is more restrictive in asymmetric equilibria, where a lot of information may be revealed by discovering that the race is close.

*2.3.1. Noise in Prior Beliefs.* There are two primitive random variables in this set up: The campaign implementation errors  $e_{C,i} \sim N(0, \sigma_{C,i}^2)$ , which have an exogenously given distribution reflecting the process governing each electoral campaign. And the noise in the policy signals observed by the voters,  $\varepsilon_{C,i}^{v,J} \sim N(0, \gamma_{C,i}^J)$ , whose variance  $\gamma_{C,i}^J$  corresponds to the chosen level of attention,  $\xi_{C,i}^J$ . The distribution of voters' prior beliefs then reflects the distribution of the implementation errors,  $e_{C,i}$ .

The assumption that candidates make random mistakes or imprecisions in announcing the policies is used to generate uncertainty in prior beliefs. This assumption follows the well known notion of a trembling hand from game theory (Selten 1975, McKelvey and Palfrey 1995). There needs to be a source of uncertainty in the model, otherwise limited attention would play no role, but there are other ways of introducing it. A previous version also considered a model with no implementation errors, but where candidates have policy preferences that are unknown to voters. The main difference is that candidates maximize expected utility, rather than the probability of winning. This yields additional implications, but the main insights of Section 3 extend to that environment. The previous version considers yet another setting, where opportunistic candidates maximize the probability of winning and there are no implementation errors. Policy is ex-ante uncertain because candidates observe private signals of the environment. In particular, voters' policy preferences take the form:  $U^J(q - \eta)$ , where  $\eta$  is a random variable. Candidates observe a noisy private signal of  $\eta$  and set policy. Voters observe the realization of  $\eta$  and set attention strategies. They then observe the noisy signal of the actual policy platforms and vote.<sup>14</sup> The results discussed in the next section generalize almost identically to this setting, with one difference. If policy uncertainty is due to implementation errors, as in the baseline model, then it is entirely exogenous. If instead policy uncertainty reflects shocks to the preferences of voters, then policy volatility is endogenous: It is determined in equilibrium by how candidates react to such preference shocks.

The introduction of a minimal level of attention  $\xi_0 > 0$  is useful to simplify the discussion of the example in Section 4.2. If  $\xi_0 = 0$ , voters would pay no attention at all to some policy instruments within some range of their level, and there would be multiple equilibria with similar properties. Any positive  $\xi_0$  pins down the solution uniquely. The minimal level of attention  $\xi_0 > 0$  could be derived (with more complicated notation) from the plausible assumption that all voters receive a costless signal about policy (such as when they turn on the radio or open their internet browser).

*2.3.2. Voters' Objectives.* Why do individuals bother to vote and pay costly attention? With a continuum of voters, the probability of being pivotal is zero, and selfish voters should not be willing to pay any positive cost of information or of voting. Even with a finite number of voters, in a large election the probability of being

14. The interpretation is that candidates have to commit to nonstate-contingent platforms before the state of nature is fully revealed to voters, and candidates have different views about the state of nature (or equivalently about the welfare consequences of alternative policies).

pivotal is so small that it cannot be taken as the main motivation for voting or paying costly attention. This is the same issue faced by many papers in the field of political economy, and we do not aspire to solve it.

Although a large literature has sought to explain why individuals vote in large elections, the question of why they bother to acquire political information in large elections has been neglected. The standard approach views political information as a by-product of other activities (Downs 1957). Although there is no doubt that political information is also acquired in this indirect way, it is also obvious that political information is sought purposefully from the media or from political sources.

As mentioned previously, we assume that voters seek information because they are intrinsically motivated to cast a meaningful vote. An alternative and more ambitious formulation would have been to derive both turnout and information acquisition from a group-utilitarian model of voters' behavior, adapting the approach of Coate and Conlin (2004) to our setting. In this alternative formulation, the demand of political information would continue to reflect the importance of the policy stakes for the group, as in our setting, but the closeness of the election could also matter (in Coate and Conlin (2004), a closer election induces more people to vote). This aspect of the demand of political information is missing from our model.

The cost of information need not be entropy-based. We just use this form because it is standard in the literature. However, almost any function that is globally convex, and increasing in elements of  $\xi^J$ , would generate qualitatively the same results; see a footnote under Proposition 2 in what follows.<sup>15</sup> There would exist a unique solution to the voter's attention problem, and attention would be increasing in both stakes and uncertainty. Also, the cost of information should be interpreted as net of its entertainment value, which can explain why petty news often receives more attention than important issues.<sup>16</sup>

We also assume that the cost of information does not depend on whether the candidate announces a policy that is close to or far away from the voter's bliss point. This makes sense with opportunistic candidates who choose similar policies. But with partisan candidates, voters may face lower cost to acquire information about the closer candidate (social media could have this effect). A previous version discussed how this could increase policy divergence in equilibrium.

Finally, we assume throughout that voters' utility is strictly concave. This is important, because it implies that individual welfare is more sensitive to policy changes when the candidate is further away from the voter's bliss point. Although this assumption is reasonable in many contexts, it need not always hold. If voters' utility was linear or convex in some component of the policy vector, some of the specific predictions of the model would be different. We discuss this point in Section 4 with regard to specific

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15. "Almost any" here denotes functions with sufficient regularity and symmetry across its arguments.

16. In surveys run by Carpini and Keeter (1996), during the Bush versus Clinton campaign, 85% of respondents knew that the President Bush had a dog named Millie, whereas only 15% knew that both candidates supported the death penalty. Deriving the entertainment value of information from the primitive assumption of voters' behavior goes beyond the scope of this paper.

applications. Note, however, that if the utility function was strictly convex, existence of the equilibrium could be problematic or it could entail corner solutions.

### 3. Preliminary Results

In this section, we first describe how the equilibrium policy is influenced by voters' attention, and then we describe the equilibrium attention strategies. The equilibrium policy can be usefully compared to the solution of a modified social welfare function, to highlight similarities and differences with probabilistic voting models under full information. If noise in candidates' policies and thus in voters' prior uncertainty is small, the equilibrium can be approximated by a convenient first-order condition. This result is useful when discussing particular examples and applications of the general model.

#### 3.1. Full Information Equilibrium

Suppose first that the cost of information is 0,  $\lambda_{C,i}^J = 0$ . Then our model boils down to standard probabilistic voting with full information (Persson and Tabellini 2000). Let  $p_A$  be the probability that A wins the elections. The distributional assumptions and the additivity of the preference shocks  $x^v = \tilde{x} + \tilde{x}^v$  then imply:

$$p_A = \frac{1}{2} + \psi \left( \sum_J m^J [U^J(q_A) - U^J(q_B)] \right). \tag{5}$$

The probability that A wins is increasing in the utilitarian social welfare

$$\sum_J m^J U^J(q_A) \tag{6}$$

that A provides. Obviously,  $p_B = 1 - p_A$ . In a Nash equilibrium, each candidate takes the policy vector announced by his opponent as given. Thus, both candidates maximize equation (6), and under full information, the equilibrium policies of both candidates correspond to the solution of the utilitarian optimum.

#### 3.2. A "Perceived" Social Welfare Function

In our model, however, voters do not base their voting decisions on the true utilities they derive from policies, but on expected utilities only. Online Appendix A.1 shows that with inattentive voters and  $\lambda_{C,i}^J > 0$ , the probability that candidate A wins is:

$$p_A = \frac{1}{2} + \psi \left( \sum_J m^J E_{\varepsilon, q_A, q_B}^J \left[ E[U^J(q_A)|s_A^{v,J}] - E[U^J(q_B)|s_B^{v,J}] \right] \right) \tag{7}$$

where the outer expectations operator is indexed by  $J$  because voters' attention differs across groups. For a particular realization of policies, in our model the probability of winning is analogous to equation (5), except that the voting decision is not based

on  $U^J(q_C)$ , but on  $E[U^J(q_A)|s_A^{v,J}]$ . The overall probability of winning is then an expectation of this quantity over all realizations of policies and of noise in signals.

In deriving equation (7), we have assumed that the support of the shocks  $\tilde{x}$  and  $\tilde{x}^v$  are sufficiently large, so that in a neighborhood of the equilibrium all voters have a positive probability of voting for either candidate. Specifically, we assume throughout that, if an equilibrium exists, then in a neighborhood of the equilibrium policies the following condition is satisfied:

$$\left| E_{\varepsilon, q_A, q_B}^J \left[ E[U^J(q_A)|s_A^{v,J}] - E[U^J(q_B)|s_B^{v,J}] \right] \right| < \min \left( \frac{1}{2\psi}, \frac{1}{2\varphi} \right) \tag{8}$$

This assumption requires the variance of the implementation shocks  $\sigma_{C,i}^2$ , to be sufficiently small, and it is more restrictive in the equilibria where there is policy divergence—see Section 4.1. Note that a similar assumption is also needed under full information: In standard probabilistic voting models, preference shocks need to be sufficiently large so that all groups include voters that in equilibrium vote for either candidate. The assumption that noise in beliefs is small is consistent with the approach taken in what follows. Throughout the rest of the paper, we thus assume that condition (8) holds.

Given an attention strategy, candidate  $A$  cannot affect  $E[U^J(q_B)|s_B^{v,J}]$ , and vice versa for candidate  $B$ . Thus we have the following lemma.

LEMMA 1. *In equilibrium, each candidate  $C$  solves the following maximization problem.*

$$\max_{\hat{q}_C \in \mathbb{R}^L} \sum_J m^J E_{\varepsilon, e}^J \left[ E[U^J(q_C)|s_C^{v,J}] \hat{q}_C \right] \tag{9}$$

In equilibrium, candidate  $C$  maximizes the “perceived social welfare” provided by his policies. This is the weighted average of utilities from policy  $q_C$  expected by voters in each group (weighted by the mass of voters, and p.d.f of realizations of errors  $e$  in announced policies and observation noise  $\varepsilon$ ). Under full information, this quantity equals the social welfare provided by  $q_C$ , equation (6). Here instead different groups will generally select different attention strategies, resulting in perceptions of welfare that also differ between groups or across policy issues.

Lemma 1 thus reveals the main difference between this framework and standard probabilistic voting models. For instance, if some voters pay more attention to some policy deviations, then their expected utilities vary more with such policy changes compared to other voters. Therefore, perceived welfare can systematically differ from actual welfare, and rational inattention can lead politicians to select policies that differ from the utilitarian optimum and, in the case of multiple policy instruments, that may even be Pareto inefficient (i.e., that do not maximize a modified social welfare function).

Finally, note that the candidates’ objective (9) is a concave function of the realized policy vector  $q_C$ . Thus, the equilibrium can be characterized by the first-order

conditions of the objective function (9), because they are necessary and sufficient for an optimum.<sup>17</sup>

### 3.3. Small Noise Approximations or Quadratic Utility

In this subsection, we introduce an approach that can be used to determine the exact form of the equilibrium. This can be done if the utility function is quadratic, in which case the approximation is exact, or if prior uncertainty in beliefs is small, in which case we can use a local first order approximation to the utility function.

To formalize the approximations, let us recall the notion of “Big O,” which is one of the common ways to describe limiting behavior.

DEFINITION 2.  $f(x) = O(g(x))$  as  $x \rightarrow 0$  if there exist  $\delta, M > 0$  such that

$$|f(x)| \leq M g(x) \quad \text{when} \quad 0 < |x| < \delta$$

A function  $f(x)$  is a Big O of  $g(x)$  as  $x$  approaches zero if for small enough  $x$ ,  $f$  can be bounded above by a fixed multiple of  $g$ . Therefore, if  $g$  goes to zero as  $x$  does, so does  $f$ .

The distinctive feature of our model is that it studies implications of endogenous imperfect information for outcomes of electoral competition. The approximations emphasize that these effects can be highly relevant even if information imperfections are small.

Let us denote by

$$u_{C,i}^J = \left( \frac{\partial U^J(q_{C,i})}{\partial q_{C,i}} \right) \Big|_{q_C = \bar{q}_C}$$

the marginal utility of a change in the  $i^{\text{th}}$  component of the policy vector for a voter in group  $J$ , evaluated at the expected policies. Thus,  $u_{C,i}^J$  measures intensity of preferences about  $q_{C,i}$  in a neighborhood of the equilibrium.

#### 3.3.1. Candidates’ Problem.

PROPOSITION 1. Suppose that equation (8) holds. For quadratic utility functions the first-order conditions that define equilibrium policies are:

$$\sum_{J=1}^N m^J \xi_{C,i}^J u_{C,i}^J = 0 \quad \forall i, \tag{10}$$

17. Concavity is implied by the following arguments: (i) For Gaussian beliefs and signals, posterior means depend linearly on the target policy  $\hat{q}_C$  set by each candidate, and their variance as well as variances of posterior beliefs are independent of  $\hat{q}_C$ . Variance of posterior belief can be expressed in terms of prior variance and the attention vector:  $\rho_{J,i} = (1 - \xi_i^J) \sigma_i^2$ . Upon acquisition of a signal  $s_{C,i}^{v,J}$ , the posterior mean is:  $\check{q}_{C,i} = \xi_{C,i}^J s_{C,i}^{v,J} + (1 - \xi_{C,i}^J) \bar{q}_{C,i}$ , where  $s_{C,i}^{v,J} = q_{C,i} + \varepsilon_{C,i}^{v,J}$  and  $\bar{q}_{C,i}$  denotes the prior mean. Thus,  $\check{q}_{C,i} = \xi_{C,i}^J (\hat{q}_{C,i} + e_{C,i} + \varepsilon_{C,i}^{v,J}) + (1 - \xi_{C,i}^J) \bar{q}_{C,i}$ . (ii) For a given vector of posterior variances, the term  $E[U^J(q_C) | s_{C,i}^{v,J}]$  is a concave function of the vector of posterior means of the belief about the policy vector  $q_C$ .



otherwise as  $\sigma_C^2 \rightarrow 0$ , they are:

$$\sum_{J=1}^N m^J \xi_{C,i}^J \left( u_{C,i}^J + O(\sigma_C^2) \right) = 0 \quad \forall i. \quad (11)$$

The contribution of the higher order terms is a function of the higher-order derivatives of  $U$  and scales with variance  $\sigma_C^2$ . These terms thus vanish if  $\sigma_C^2$  approaches zero or if the higher derivatives of  $U$  are equal to zero.

**COROLLARY 1** (of Proposition 1). *For quadratic utility or for small noise  $\sigma_C^2$ , the first-order conditions (11) are equal to or well approximated by equation (10).*

From now on, we suppose that the noise  $\sigma_C^2$  is sufficiently small so that equilibrium policies are implicitly defined by equation (10).

This finding emphasizes the main forces in electoral competition with inattentive voters. For a policy change to have an effect on voting, it needs to be paid attention to and observed. If  $q_{C,i}$  changes by an infinitesimal  $\Delta$ , then the expected posterior mean about  $q_{C,i}$  in group  $J$  changes by  $\xi_{C,i}^J \Delta$  only. Thus, although the effect on voters' utility is  $\Delta u_{C,i}^J$ , the effect on expected, that is, perceived, utility is only  $\xi_{C,i}^J \Delta u_{C,i}^J$ .

Several remarks are in order. First, with only one policy instrument, equation (10) is the first-order condition for the maximum of a modified social planner's problem, where each group  $J$  is weighted by its attention,  $\xi_{C,i}^J$ . Thus, if all voters paid the same attention, so that  $\xi_{C,i}^J = \xi$  for all  $J, C, i$ , then the equilibrium coincides with that under full information and hence with the utilitarian optimum (i.e., with maximization of equation (6)). If some groups pay more attention, however, then they are assigned a greater weight by both candidates. That is, more attentive voters are more influential, because they are more responsive to any policy change. This implication is similar to those found in the literature that has studied exogenous informational asymmetries between groups, such as Grossman and Helpman (2001).

Second, if policy is multi-dimensional, the attention weights  $\xi_{C,i}^J$  in equation (10) generally also vary by policy instrument  $i$ . In this case, equation (10) does not correspond to the first-order condition for the maximum of a modified social planner problem. Hence, the equilibrium is not even Pareto efficient. The public good example in Section 4.2 illustrates this point.

Third, if attention weights also differ by candidate  $C$  (besides differing by group  $J$ ), that is if different voters pay more attention to one candidate and less to the other, then in general the two candidates choose different equilibrium policies. We discuss this case in Section 4.1.

We summarize this discussion in the following corollary.

**COROLLARY 2** (of Proposition 1). (i) *If  $\xi_{C,i}^J$ 's are the same for all voters and candidates, that is,  $\xi_{C,i}^J = \xi_i$ , then the equilibrium corresponds to the utilitarian optimum.* (ii) *If  $\xi_{C,i}^J$ 's vary only across voters, that is  $\xi_{C,i}^J = \xi^J$ , then the equilibrium is*

*Pareto efficient but it does not correspond to the utilitarian optimum. (iii) If  $\xi_{C,i}^J$ 's vary across  $J$  and  $i$ , that is  $\xi_{C,i}^J = \xi_i^J$ , then the equilibrium is not Pareto efficient. (iv) If  $\xi_{C,i}^J$ 's vary across  $J$  and  $C$ , then in equilibrium the two candidates choose different policies.*

These results hold for any attention weights, and not just for those that are optimal from the voters' perspectives. In other words, Proposition 1 and Corollary 2 characterize equilibrium policy with imperfectly attentive voters, irrespective of how voters' attention is determined.

**3.3.2. Voters' Problem.** Let us now focus on the voter's problem. How should costly attention be allocated to alternative components of the policy vector?

**LEMMA 2.** *Suppose that equation (8) holds. As  $\sigma_i^2 \rightarrow 0$ , voters choose attention vectors  $\xi^J \in [\xi_0, 1]^L$  to maximize the following (approximated) objective function:*

$$\left( \sum_{C \in \{A,B\}, i=1}^L \xi_{C,i}^J \sigma_{C,i}^2 ((u_{C,i}^J)^2 + O(\sigma_{C,i}^2)) \right) + \sum_{C \in \{A,B\}, i \leq L} \hat{\lambda}_{C,i}^J \log(1 - \xi_{C,i}^J), \tag{12}$$

where

$$\hat{\lambda}_{C,i}^J = 2\lambda_{C,i}^J / \text{Min}(\psi, \varphi).$$

The immediate implication of Lemma 2 is that, if the prior uncertainty  $\sigma_C^2$  is small, then  $(u_{C,i}^J)^2 + O(\sigma_{C,i}^2)$  in equation (12) approaches  $(u_{C,i}^J)^2$ , and thus the objective (12) is well approximated by

$$\left( \sum_{C \in \{A,B\}, i=1}^L \xi_{C,i}^J (u_{C,i}^J)^2 \sigma_{C,i}^2 \right) + \sum_{C \in \{A,B\}, i \leq L} \hat{\lambda}_{C,i}^J \log(1 - \xi_{C,i}^J). \tag{13}$$

The benefit of information for voters reflects the expected difference in utilities from the two candidates. If both candidates provide the same expected utility, then there is no gain from information. Specifically, the term  $\sum_{C \in \{A,B\}, i=1}^L \xi_{C,i}^J (u_{C,i}^J)^2 \sigma_{C,i}^2$  is (an approximation of) the variance of the difference in expected utilities under each of the two candidates, conditional on posterior beliefs. The larger is the discovered difference in utilities, the larger is the gain, because then the voter can choose the candidate that provides higher utility. In the proof, we use condition (8) mentioned previously, saying that the noise  $\sigma_C^2$  and potential a priori divergence between equilibrium policies  $q_A$  and  $q_B$  are small relative to the support of preference shocks  $x$ .

Note also that  $\xi_{C,i}^J \sigma_{C,i}^2 = (\sigma_{C,i}^2 - \rho_{C,i})$  measures the reduction of uncertainty between prior and posterior beliefs. Thus, net of the cost of attention, the voter maximizes a weighted average of the reduction in uncertainty, where the weights correspond to the (squared) marginal utilities from deviations in  $q_{C,i}$ . That is, the voter aims to achieve a greater reduction in uncertainty where the instrument-specific stakes are higher.

3.3.3. *Implications.* From now on, we suppose that the noise  $\sigma_C^2$  is sufficiently small so that the voter’s objective is given by equation (13).

PROPOSITION 2. *The solution to the voter’s attention allocation problem is:*

$$\xi_{C,i}^J = \max \left( \xi_0, 1 - \frac{\hat{\lambda}_{C,i}^J}{(u_{C,i}^J)^2 \sigma_{C,i}^2} \right). \tag{14}$$

Thus, the voter pays weakly more attention to those elements  $q_{C,i}$  for which the unit cost of information  $\lambda_{C,i}^J$  is lower, that is, are more transparent, prior uncertainty  $\sigma_{C,i}^2$  is higher, and which have higher utility-stakes  $|u_{C,i}^J|$  from changes in  $q_{C,i}$ . Strict monotonicity holds for any positive cost  $\hat{\lambda}_{C,i}^J$ , that is sufficiently large that the constraint  $\xi_{C,i}^J \geq \xi_0$  does not bind.<sup>18</sup>

This also implies that the attention weights  $\xi_{C,i}^J$  may differ across candidates, because the cost of information  $\lambda_{C,i}^J$  or prior uncertainty  $\sigma_{C,i}^2$  could differ between the two candidates. If so, the two candidates in equilibrium may end up choosing different policy vectors. Thus, rational inattention can lead to policy divergence if candidates differ in their informational attributes, even though both candidates only care about winning the elections. This contrasts with other existing models of electoral competition, which lead to policy divergence in pure strategies only if candidates have policy preferences themselves (see Persson and Tabellini 2000). Section 4.1 in what follows, illustrates this result with an example.

Finally, Lemma 2 also implies that prior knowledge about one candidate does not affect the choice of attention to the other ( $\xi_{A,i}^J$  does not depend on the voter’s belief about what  $B$  does in equilibrium, and vice versa). More generally, the voter’s prior belief about his ranking of the two candidates has no influence on how he allocates attention. The reason is that the marginal value of better information about the policy shocks  $e_{C,i}$  does not depend on the prior probability of voting for one candidate or the other. This in turn follows from our assumption that shocks to preferences over candidates,  $\tilde{x}$  and  $\tilde{x}^v$ , have a uniform distribution and with a sufficiently large support (so that condition (8) mentioned previously holds).<sup>19</sup> Also recall that the cost of attention is additively separable.

We summarize this discussion in the following.

18. Note that for any convex information-cost function  $\Gamma(\xi^J)$ , the objective (13) would be concave, and thus there would exist a unique maximum, which would solve  $\partial \Gamma(\xi^J) / \partial \xi_{C,i}^J = \text{Min}(\psi, \varphi)(u_{C,i}^J)^2 \sigma_{C,i}^2 / 2$ . The effect of stakes and uncertainty also holds more generally. For instance, the effects hold for any cost function that is symmetric across policy elements, that is, invariant to permutations in  $\xi^J$ .

19. Uniformity of the shocks is a standard assumption in models of probabilistic voting. If the shocks were nonuniform, then although attention to both candidates would be the same, it would depend on the expected distance between their platforms.

COROLLARY 3 (of Proposition 2). *The attention weights  $\xi_{C,i}^J$  that voters in group  $J$  give to the policy instrument  $q_{C,i}$  set by candidate  $C$  have the following properties:*

- (i)  $\xi_{C,i}^J$  is weakly increasing in voters' stakes  $|u_{C,i}^J|$  and decreasing in their unit cost of information  $\hat{\lambda}_{C,i}^J$ .
- (ii)  $\xi_{C,i}^J$  does not depend on the policies set by the other candidate  $C' \neq C$ .

Combining this result with Proposition 1, voters with higher stakes on policy instrument  $q_{C,i}$  (or lower cost of observing  $q_{C,i}$ ) are more attentive, and hence more responsive to changes in this policy instrument. As a consequence, in setting  $q_{C,i}$ , candidate  $C$  has stronger incentives to provide policy favors to these high-stake (or low information cost) voters, compared to less attentive voters. In the next section we explore the implications of these insights for equilibrium policy.

The Online Appendix also sheds light on the implications of risk-aversion. It solves a second-order (rather than first-order) approximation of the voters' optimization problem, see Online Appendix A.20. The benefit from information acquisition is  $\sum_{i=1, C \in \{A, B\}}^L \left( \xi_{C,i}^J \sigma_{C,i}^2 (u_{C,i}^J)^2 + 2(\xi_{C,i}^J)^2 (\sigma_{C,i}^2)^2 (u_{C,i,i}^J)^2 \right)$ . The new addition to the first-order approximation in equation (13) is the second term, which drops out for risk-neutral voters ( $u_{C,i,i}^J = 0$ ). When voters are not risk-neutral, then the benefit from increasing attention  $\xi_{C,i}^J$  increases because  $(\sigma_{C,i}^2)^2 (u_{C,i,i}^J)^2$  is positive. This implies that more risk-averse voters are relatively more attentive. In Section 4.1, we show how more attentive voters have more influence on the equilibrium policies. Hence, risk-averse voters would in those cases also be relatively more influential than under perfect information, the more so the greater is the prior uncertainty and their risk aversion, that is, the higher  $(\sigma_{C,i}^2)^2 (u_{C,i,i}^J)^2$  is.

The additional term in Online Appendix A.20 is the benefit from decreasing variance of realized utility. Voters cannot decrease variance of realized utility from a given candidate, but they can decrease variance of utility from the selected candidate. Paying more attention decreases the likelihood of mistakes in the choice and thus also of selecting a candidate that provides a very low utility.

#### 4. Applications

In this section, we present two examples to illustrate some basic implications of inattentive voters. Besides explaining what voters know and don't know and predicting specific policy distortions relative to the full information equilibrium, rational inattention also sheds light on other issues. In particular, these examples illustrate why an increase in the granularity of information can be welfare deteriorating, and why new and lesser known candidates often cater to minorities or political extremists.

We start with electoral competition on a one-dimensional policy. Here the focus is on how different voters allocate attention to the same policy issue, with resulting differences in political influence. Then we turn to multi-dimensional policies, in a

symmetric model. Here the focus is on how voters allocate attention to different policy issues and the resulting policy distortions.

#### 4.1. One Dimensional Conflict

This example explores the effects of rational inattention on equilibrium policy outcomes in a simple setting. We study how electoral competition resolves heterogeneity in preferences regarding a single policy dimension. Rational inattention amplifies the effects of preference intensity and dampens the effects of group size. The reason is that voters with higher stakes pay more attention and hence are more influential (Corollary 3). Who has the higher stakes is endogenous, however, because it depends on expected policy platforms. This leads to equilibrium policies that favor smaller and more extremist groups, relative to full information.

Let voters differ in their preferences for a one dimensional policy  $q$ . Voters in group  $J$  have a bliss-point  $t^J$  and their marginal cost of information is  $\hat{\lambda}^J$ , for now assumed to be the same for all candidates  $C$ . The voters' utility function is

$$U^J(q) = U(q - t^J),$$

$q \in R$  and  $U(\cdot)$  is concave and symmetric about its maximum at 0. With a one-dimensional policy, by equation (10), the equilibrium with rational inattention can be computed as the solution to a modified social planning problem, where each candidate  $C$  maximizes  $\sum_J m^J \xi_C^J U^J(q_C)$ .

*4.1.1. Who is more Attentive and Influential?* By equation (14), voters' attention increases with the distance  $|\hat{q}^* - t^J|$ , where  $\hat{q}^*$  denotes the equilibrium policy target. The reason is that the utility stakes,  $|u^J(q_C)|$ , increase in this distance, due to concavity of  $U^J$ . The distance  $|\hat{q}^* - t^J|$ , in turn, reflects two features of a group: its size  $m^J$  and the location of its bliss point  $t^J$  in the overall distribution of voters' preference. Clearly groups with extreme preferences tend to have high stakes, because the equilibrium policy is generally far away from their bliss point. Smaller groups also have higher stakes, because the equilibrium policy treats them less favorably than larger groups. Hence, if the cost of collecting information  $\hat{\lambda}^J$  is the same for all groups of voters, then groups with extreme policy preferences and of small size pay more attention to  $q_C$  and are politically more influential (i.e., they receive a higher weight  $\xi_C^J$  in the modified planner's problem). The specific implications for how the equilibrium differs from that with full information depend on the shape of the distribution of bliss-points  $t^J$ . If the distribution is asymmetric, then voters in the longer tail pay relatively more attention, and thus the equilibrium under rational inattention is closer to them relative to the perfect information equilibrium. These features of the equilibrium become more relevant the higher the cost of attention is. Moreover, groups with a lower cost  $\hat{\lambda}^J$  also receive a greater weight, for the same reason.

These properties of the equilibrium can be illustrated with two examples. Suppose first that there are three groups of the same size, and with a distribution of bliss points skewed to the right, for instance  $t^1 < t^2 < t^3$  and  $t^2 - t^1 < t^3 - t^2$ . Thus, group 3 has

more extreme policy preferences than the other groups. The cost of information is the same for all groups. Then, the following holds.

**COROLLARY 4** (of Propositions 1 and 2). *Let  $t^1 < t^2 < t^3$  such that  $t^2 - t^1 < t^3 - t^2$ . There exist  $\lambda_2 > \lambda_1 > \lambda_0 > 0$  such that:*

*For all  $\hat{\lambda} \in (0, \lambda_0)$ , the equilibrium policy  $\hat{q}^*$  is strictly increasing in  $\hat{\lambda}$ . That is, as the cost of attention rises, the equilibrium moves closer to the bliss point of the group with more extreme preferences (here group 3).*

*For all  $\hat{\lambda} \in (\lambda_1, \lambda_2)$ , the equilibrium policy  $\hat{q}^*$  is strictly decreasing in  $\hat{\lambda}$ . As the cost of attention rises, the equilibrium moves away from  $t^3$ .*

Voters with more extreme preferences, that is, location of their bliss-points, pay more attention. This is an immediate implication of equation (14) and the concavity of  $U^J(q)$ . The stakes are increasing in  $|\hat{q}^* - t^J|$ , which in turn drives the attention level up for the more extreme voters.

The effect on the location of equilibrium policy is monotone for low costs of information. This is true anytime the minimal level of attention is not binding, that is, when the selective attention applies and the levels of attention of all groups respond to changes in the cost of information. In this range, an increase in the cost of information makes the extreme group relatively more influential. For higher costs of information, however, if the cost is further increased, the equilibrium can instead move away from the extreme groups. In fact, there exists an interval of cost for which this occurs. The reason is that for such higher costs of information the attention of the less extreme groups is at the minimal bound  $\xi_0$ . Attention of these groups thus does not further decrease with the cost, whereas attention of the extreme group would decrease, and the extreme group would thus become relatively less influential. The effect of the cost of information on the equilibrium policy is nonmonotonic due to the lower bound on the level of attention, but it is monotonic for all interior solutions.

Group size has a similar effect, because it also implies that in equilibrium some groups are further away from their bliss points than others. To show this, consider an example with two groups. Now group 2 is the smaller group. Here in equilibrium group 2 is further away from the equilibrium policy and thus pays more attention. Specifically, we have the following.

**COROLLARY 5** (of Propositions 1 and 2). *Let  $J \in \{1, 2\}$ ,  $m^1 > m^2$ , and  $\hat{\lambda}$  be the cost of information of both groups. Then the distance between equilibrium policy and bliss-point of the smaller group  $|\hat{q}^* - t^2|$  is weakly lower for  $\hat{\lambda} > 0$  than under perfect information.*

*Moreover, there exist  $\lambda_2 > \lambda_1 > \lambda_0 > 0$  such that:  $|\hat{q}^* - t^2|$  is strictly decreasing in  $\hat{\lambda}$  for all  $\hat{\lambda} \in (0, \lambda_0)$  and strictly increasing for  $\hat{\lambda} \in (\lambda_1, \lambda_2)$ .*

Unless voters are constrained by the lower bound on attention  $\xi_0$ , increases in  $\hat{\lambda}$  imply that the small group becomes even more influential, because attention of the larger group decreases by more. Again, strict monotonicity of the location of

the equilibrium policy applies anytime the cost of information is sufficiently low that the minimal level of attention is not binding. If the minimal level of attention is binding only for the larger group, then an increase in the cost of information moves the equilibrium policy towards this group.

More generally, rational inattention, when limits on attention are not binding, amplifies the effect of preference intensity (i.e., the intensive margin) and dampens the effect of group size (the extensive margin) on the equilibrium policy. Consider a group with a bliss point above the equilibrium policy target:  $t^J > \hat{q}^*$ . If  $t^J$  increases further, then both the policy stakes  $u^J$  and attention  $\xi_C^J$  increase, and thus the overall effect of higher stakes is super-proportional. On the other hand, the effect of an increase in group size is less than proportional. If the mass of voters  $m^J$  increases, then for given attention the weight of group  $J$  increases proportionately. However, larger groups pay less attention ( $\xi_C^J$  drops as  $m^J$  rises), with a partially offsetting effect on the equilibrium policy.

This implication of rational inattention, that smaller groups are more informed and hence more influential compared to full information, contrasts with the opposite result in the literature on the political effects of the media. Profit maximizing media typically target larger groups, who are thus predicted to be better informed and more influential (Stromberg 2015, Prat and Stromberg 2013). If one interprets the cost  $\hat{\lambda}^J$  as influenced by the media, then the media literature predicts that larger groups have smaller  $\hat{\lambda}^J$ , whereas rational inattention predicts that smaller groups have higher stakes  $u^J$ . Which effects prevail on attention  $\xi_C^J$  is a priori ambiguous. Nevertheless, the evidence in Carpinì and Keeter (1996) quoted in the introduction suggests that minorities are generally more informed about the issues that are relevant to them, compared to the rest of the population.

Clearly, these results reflect the assumption that utility is strictly concave. If preferences were linear, for example,  $U^J(q) = -\alpha^J|q - t^J|$ , then the more attentive groups would still be those with higher stakes, but here these would be the groups with high  $\alpha^J$ , and not necessarily those with extreme bliss points. Nevertheless, the prediction that extremist voters pay more attention is in line with results of some previous empirical studies. Using survey data of US presidential elections held in 1980, Palfrey and Poole (1987) find that voters who are highly informed about the candidate policy location tend to be significantly more polarized in their ideological views compared to uninformed voters. Similarly, Lauderdale (2013) find that citizens who are better informed about policy positions of members of Congress are more polarized in their policy views. Moreover, using data from the 2010 Cooperative Congressional Election Survey and the American National Election Survey, Ortoleva and Snowberg (2015) find that voters with more extreme policy preferences consume more media such as newspapers, TV, radio, and internet blogs. Ortoleva and Snowberg interpret this finding as suggesting that greater media exposure enhances overconfidence and extremism, because of correlation neglect (voters don't take into account that signals are correlated and overestimate the accuracy of the information that they acquired). But an alternative interpretation, consistent with rational inattention, is that voters with more extreme policy preferences deliberately seek more information, because they have greater stakes in political outcomes.

To further explore the empirical validity of the prediction that extremist voters are more attentive, we have analyzed survey data from the ANES. In the 2012 and 2016 waves, respondents are asked how often do they pay attention to what is going on in government and politics; possible answers vary discretely from 1 to 5, and we have rescaled them so that they vary from 0 to 1, increasing in attention. The resulting variable is called *Political Attention*. We consider attitudes towards three policy issues: the desired size of government spending, globalization (captured by the first principal components of attitudes towards immigrants and imports limits) and civil rights (captured by the first principal components of attitudes towards abortion and race relations). We define as extremists on globalization and culture those individuals who fall in the first and last decile of the distribution of views on that issue (separately by issue). Extremists on redistribution are defined as individuals who respond with extreme values on the scale of possible answers on a scale from 1 to 7—these extreme values are close to the first and last deciles of the distribution. Precise definitions are provided in the Online Appendix.

Table 1, column (1), reports the ordinary least squares estimates of a regression of *Political Attention* on dummy variables for being an extremist on each of these three policy dimensions separately, after controlling for observable features of the respondent (age, gender, income, education, and race) and wave fixed effects. Extremists on each of these three issues are significantly more attentive, and the point estimates imply that extremists pay a higher level of attention ranging from 5% to 17% of the average level of attention (0.6), depending on the issue, compared to nonextremists. In column (2), extremists are defined as respondents who hold extreme views on *both* redistribution and globalization, whereas in column (3), they are defined as holding extreme views on *all three* issues (redistribution, globalization, and civil rights). The size of the estimated coefficient on extremism rises; the point estimate of 0.12 in columns (2) and (3) implies that the difference in political attention between extremists on all three issues and the rest of the sample is 20% of the average level of attention.

Individuals who hold extreme views may be more likely to be party activists, and their higher level of attention could reflect lower information costs, rather than higher stakes as predicted by our theory. For this reason, columns (4–6) repeat the same regressions, but adding to the right hand side also two dummy variables for being politically identified with the Democratic Party and with the Republican Party, respectively (the default being politically nonidentified individuals). These control variables are always statistically significant, but the estimated coefficients of extremism remain practically unaffected, suggesting that the higher attention paid by extremists is not due to their political identity. Results are similar if the sample is restricted to politically not identified respondents.

Of course, these estimates only reflect correlations, not causality, and they might be consistent with other possible theoretical mechanisms.<sup>20</sup>

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20. As pointed out by a referee, a more demanding test of the joint hypothesis of rational inattention and concave preferences would be to show that, holding constant the cost of information, voters pay more attention to the policies announced by the more distant candidate (e.g., Democrats pay more attention to the policies of the Republican candidate, and vice versa). This kind of evidence is more difficult to find,



TABLE 1. Regressing *Political Attention* on dummy variables for being an extremist on each of the following policy dimensions: desired size of government spending, globalization, and civil rights.

	<i>Dependent Variable: Political Attention</i>					
	(1)	(2)	(3)	(4)	(5)	(6)
Extremist on redistribution	0.101*** (0.012)			0.101*** (0.013)		
Extremist on globalisation	0.063*** (0.010)			0.062*** (0.010)		
Extremist on civil rights	0.032*** (0.012)			0.027** (0.011)		
Extremist on red. and glo.		0.122*** (0.019)			0.119*** (0.019)	
Extremist on all three issues			0.117*** (0.036)			0.106*** (0.036)
Democrat				0.040*** (0.011)	0.044*** (0.009)	0.043*** (0.009)
Republican				0.041*** (0.011)	0.053*** (0.009)	0.054*** (0.009)
Mean dep.	0.61	0.61	0.61	0.61	0.61	0.61
Observations	5,720	8,245	8,245	5,709	8,222	8,222
Adjusted ( $R^2$ )	0.16	0.15	0.15	0.17	0.16	0.15
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable *Political Attention* ranges from 0 to 1, and 1 indicates full attention of the respondent to what is going on in government and politics. Additional controls include age, age squared, gender, education, and race. Standard errors are robust to heteroskedasticity. Significance levels: \*0.10, \*\*0.05, and \*\*\*0.01.

*4.1.2. Policy Divergence and New Candidates.* If the two candidates differ in how visible they are to voters, we obtain a new implication. Suppose that the cost of collecting information is lower, say, for candidate  $A$ . For instance,  $A$  could be a highly visible incumbent, whereas  $B$  is a less established challenger to which the media pay less attention. Then all voters pay more attention to the incumbent, here  $A$  ( $\xi_A^J > \xi_B^J$  for all  $J$ ). But this effect is not the same across groups of voters. By equation (14), the difference in attention given by voters to the two candidates depends on  $|u^J|$ , and it is higher in the center, that is, for  $t^J$  closer to  $q$ , than at the extremes of the voters' distribution. Specifically, the more extremist voters pay relatively more attention to the less established candidate  $B$ , whereas the centrist voters pay relatively more attention to the more visible candidate  $A$  (this can be seen by evaluating the derivative of  $\xi^J$  with respect to  $\hat{\lambda}$  in equation (14)).<sup>21</sup> This in turn affects the incentives of both candidates and leads to policy divergence if the distribution of bliss points is asymmetric.

This result is best illustrated in the example of Corollary 4 discussed previously. Specifically, suppose that there are three groups of the same size, and group 3 has more extreme preferences:  $t^2 - t^1 < t^3 - t^2$ . We have the following corollary.

**COROLLARY 6.** *of propositions 1 and 2. Let  $\hat{\lambda}_A < \hat{\lambda}_B$ . There exists  $\lambda_0 > 0$  such that, for any  $\hat{\lambda}_B < \lambda_0$ , the equilibrium policy  $\hat{q}_B^*$  is strictly closer to the bliss point of the group with more extreme preferences (here group 3), compared to  $\hat{q}_A^*$ . Moreover, in equilibrium  $A$  has a higher probability of winning the election than  $B$ .*

The more extremist voters pay more attention overall, but they also pay relatively more attention to the less established candidate  $B$ , because their stakes are higher. The centrist voters pay relatively more attention to candidate  $A$ , who has greater media coverage. Thus, more established candidates tend to cater to the average voter, whereas candidates receiving less media coverage go after extremist voters. A similar result applies if one group has higher stakes because it is smaller, as in Corollary 5.

With policy divergence and different attention weights, the probability of victory differs from  $1/2$ . The less established candidate  $B$  (who receives less attention by all voters and by the centrist voters in particular) is less likely to win. Equation (7) shows that the candidate who provides higher perceived social welfare has a higher probability of winning. Perceived social welfare provided by each candidate  $C$  equals social welfare at the expected equilibrium policy  $\bar{q}_C$ , plus terms that depend on the noise in policies.<sup>22</sup> If noise is small, then the sign of the difference in the expectations determines the sign of differences in perceived social welfare. Thus, if  $A$  is closer to the social optimum, then she also has a higher probability of winning. This effect is weaker when the policy

however, because the cost of information may be unobservable, and yet it is an important determinant of the allocation of attention (social interactions or motivated beliefs are likely to reduce the cost of being informed on the closer candidate).

21. The derivative of  $\xi^J$  with respect to  $\hat{\lambda}$  is  $-1/(u^J(q)\sigma^2)$  if and only if  $1 - \hat{\lambda}/((u^J)^2\sigma^2) > \xi_0$ , otherwise it equals zero. Thus, the change in attention when  $\hat{\lambda}$  changes is larger for voters with lower  $|u^J|$ .

22. See for instance the expansion of perceived utility in the Online Appendix A.5.

stakes  $|u^j|$  are scaled up, however. This implies that in unusual times, for example, in a crisis when policy stakes are particularly high, or when a new important issue comes up, then less established candidates have a higher chance of winning the elections. Such situations provide windows of opportunity for new challengers.

Ansolabehere, Snyder, and Stewart (2001) provide evidence consistent with Corollary 6. They show that, in US Congressional elections and controlling for district preferences, challengers choose more extreme positions compared to candidates running in open seats, and the latter choose more extreme positions than incumbents. This finding is confirmed by Stone and Simas (2010), who also show that incumbents tend to be closer to the average position of their districts and receive more attention, compared to their challengers. Stone and Simas (2010) also show that challenger's extremism is rewarded by voters. They suggest that this occurs because, by taking more extreme positions, challengers please party activists and contributors who tend to be policy extremists. Although our model does not allow for campaign contributions, this suggested mechanism is consistent with the idea that attention is an important component of political participation, and that attention is less sensitive to information costs for voters with stronger policy preferences.

Again, the caveat discussed previously with reference to Corollaries 5 and 6 applies here as well. The main general lesson of Corollary 6 is that candidates with less media coverage try to appeal to voters with higher stakes, because their attention is less sensitive to information costs. Concavity adds the implication that more attentive voters also have more extreme policy preferences, and the evidence is consistent with this last step as well. Nevertheless, there may be other reasons, besides concavity, that may induce policy extremists to be both more attentive and less sensitive to information costs.

#### *4.2. Multidimensional Policy: Targeted Transfers and Public Good Provision*

When the policy is multi-dimensional, rational inattention has additional implications, because voters also choose how to allocate attention amongst policy instruments. As discussed previously, equilibrium attention is higher on the policy instruments where the stakes for the voter are more important. Typically these are the most divisive policy issues, on which there is sharp disagreement amongst voters. The reason is that voters realize that the equilibrium will not deliver their preferred policies on the more controversial issues, although they expect to be pleased (and hence have low stakes—i.e., low marginal utility from observing a policy deviation) on the issues where they all have the same preferences.

We illustrate this result in a model of public good provision and targeted redistribution. The model is symmetric and all voters behave identically. The framework is similar to Gavazza and Lizzeri (2009), except that there information is given exogenously. Our agents instead choose what to get informed about. They all choose to pay minimal attention to the public good and to uniform taxes (on which they all agree), and focus their attention on the targeted policy instruments, with highest attention on those instruments that are more relevant for them. As a result

the equilibrium is Pareto inefficient: There is under-provision of the public good and over-reliance on uniform but distorting taxes in order to finance targeted redistribution. Equilibrium distortions are worse if the granularity of information increases.

*4.2.1. A Simple Model.* Consider an economy where  $N > 2$  groups of voters indexed by  $J$  derive utility from private consumption  $c^J$  and a public good  $g$ :

$$U^J = V(c^J) + H(g),$$

where  $V(\cdot)$  and  $H(\cdot)$  are strictly increasing and strictly concave functions. Each group has a unit size. Government spending can be financed through alternative policy instruments: A nondistorting lump sum tax targeted to each group,  $b^J$ , with negative values of  $b^J$  corresponding to targeted transfers; a uniform tax,  $\tau$ , that cannot be targeted and that entails tax distortions; and a nonobservable source of revenue,  $s$  for seigniorage, also distorting and non targetable.<sup>23</sup> Thus, the government and private budget constraints can be written respectively as:

$$g = \sum_J b^J + N\tau + s$$

$$c^J = y - b^J - T(\tau) - S(s)/N.$$

where  $y$  is personal income and the functions  $T(\cdot)$  and  $S(\cdot)$  capture the distorting effects of these two sources of revenues. Specifically, we assume that both  $S(\cdot)$  and  $T(\cdot)$  are increasing, differentiable, and convex functions. Moreover,  $S(0) = T(0) = 0$  and for derivatives  $S'(0) = T'(0) = 1$ . From a technical point of view, the non observable tax has the role of a shock absorber and allows us to retain the assumption of independent noise shocks to all observable policy instruments. Its distorting effects capture the idea that any excess of public spending over tax revenues must be covered through inefficient sources of finance, such as seigniorage or costly borrowing. Putting these pieces together, we get:

$$U^J(q) = V[y - b^J - T(\tau) - S(g - \sum_K b^K - N\tau)/N] + H(g) \quad (15)$$

The observable policy vector is  $q = [b^1, \dots, b^N, g, \tau]$ , and the nonobservable tax can be inferred by voters from information on the observable policy vector. For simplicity, we assume that prior uncertainty is the same for all voters, all candidates and all policy instruments, and all voters have the same information costs:  $\sigma_{C,i}^J = \sigma$  and  $\lambda_{C,i}^J = \lambda$  for all  $C, J, i$ .

*4.2.2. Equilibrium Policy with Rational Inattention.* It is easy to verify that the socially optimal policy vector  $q^\circ$  (i.e, the policy that maximizes  $\sum_J m^J U^J(q)$ ) satisfies  $s^\circ = \tau^\circ = 0$ , that is, distorting taxes are not used, achieves equal consumption for

23. One can think of targeted taxes as a uniform (non-distorting) tax, with tax credits granted to specific groups.

all groups,  $c^J = c^\circ$  for all  $J$ , and sets the public good so as to satisfy Samuelson optimality condition, namely,  $H'(g^\circ) = V'(c^\circ)/N$ . Thus the optimal level of the public good is financed through an equal targeted lump sum tax on all groups. Under full information, electoral competition would deliver this outcome.<sup>24</sup>

However, with rationally inattentive voters, candidates are motivated to distort the policies away from the social optimum. Let  $\xi_g^J, \xi_\tau^J, \xi_J^J, \xi_{-J}^J$  denote the level of attention that voters in group  $J$  devote to  $g, \tau, b^J$ , and  $b^K$  for  $K \neq J$ , respectively (by symmetry, the targeted taxes paid by all other groups receive the same level of attention in equilibrium). The Online Appendix proves:

**PROPOSITION 3.** *Under costly attention the equilibrium policy vector  $\hat{q}^*$  and allocation of attention have the following features: (i) there is under-provision of the public good relative to the social optimum,  $\hat{g}^* \leq g^\circ$ , and the government relies on distorting (observable and unobservable) sources of revenues:  $\hat{s}^*, \hat{\tau}^* \geq 0$ . (ii) All voters pay only the minimal attention to non-divisive issues,  $\xi_g^J = \xi_\tau^J = \xi_0$ , and they pay weakly more attention to their own targeted taxes (or transfers) than to the targeted instruments affecting others,  $\xi_J^J \geq \xi_{-J}^J$ . There exists  $\lambda_0 > 0$  such that for all  $\hat{\lambda} < \hat{\lambda}_0$  all inequalities are strict.*

Strict under-provision and inefficient use of taxes occurs anytime the agent pays higher than minimal attention to his own targeted taxes. If the marginal tax distortions  $T'$  and  $S'$  do not rise too rapidly, it is even possible that the equilibrium entails negative values of  $\hat{b}^J$ . That is, both candidates collect revenue through distorting taxes from all citizens, and then give it back to each group in the form of targeted transfers (i.e., there is fiscal churning).

What drives equilibria away from the social optimum is heterogeneity in  $\xi_i^J$  across different voters. Stakes regarding  $g$  and  $\tau$  are uniform across all voters, and thus all voters pay the same attention to these instruments, which yields the same first order conditions as for the social optimum. However, when it comes to targeted taxes  $b^J$ , stakes differ across voters. Voters of type  $J$  choose to pay more attention to  $b^J$  than other voters do. This incentivizes candidates to decrease  $b^J$  away from the social optimum, so as to please voters who pay most attention to their own group specific taxes. By symmetry, in equilibrium all targeted taxes  $b^J$  are decreased, public goods are underprovided, and uniform distorting taxes are over-used.

Note that in equilibrium, although  $\hat{\tau}^*$  and  $\hat{g}^*$  differ from the social optimum, all groups  $J$  have  $u_\tau^J = 0$  and  $u_g^J = 0$ . That is, the policy instruments that have a uniform effect on all groups are set at the (identical) bliss point of each group. These bliss points differ from the social optimum, because each group wishes to under-provide the public good and raise distorting taxes so as to direct targeted transfers to itself. By equation (14) this in turn implies that  $\xi_g^J = \xi_\tau^J = \xi_0$ . Namely, in equilibrium all voters

24. See the beginning of the proof of Proposition 3, and in particular the note following equation A.25 in the Online Appendix.

pay minimal attention to public goods and to the uniform distorting tax, as if they were nonobservable. This point applies generally, beyond this specific example. If there is no disagreement among voters regarding a policy instrument, then all voters expect both candidates to set these general instruments at their optimal values (from the individual voter's selfish perspective). Marginal utility from policy deviations is then zero, and voters have no incentive to devote costly attention to these items. For issues that are non-divisive, equation (10) implies that the equilibrium attention is at the minimal level  $\xi_0$ . On the other hand, divisive issues are paid more attention to. Because these policy instruments are not set optimally from the perspective of each individual voter, then voters' stakes are positive, and they pay attention to such issues.<sup>25</sup>

The result that in equilibrium voters are inattentive to policies on which everyone agrees (such as  $g$  and  $\tau$  in the model) although they pay attention to divisive issues (such as targeted instruments) can also shed light on existing evidence on the content of Congressional debates and on the focus of US electoral campaigns. Ash Morelli, and van Weelden (2015) construct indicators of divisiveness in the floor speeches of US congressmen. Exploiting within-legislator variation, they show that the speeches of US senators become more divisive during election years, consistent with the idea that voters' attention is greater on the more divisive issues. Moreover, Hillygus and Shields (2008) show that divisive issues figure prominently in US presidential campaigns, contrary to the expectation that candidates instead try to avoid divisive policy positions in order to win more widespread support.

Finally, the result that the equilibrium policy is distorted towards excessive targeted benefits reflects an (endogenous) asymmetric allocation of attention: Each group is more attentive to the targeted taxes it pays than to those paid by others. This in turn reflects the assumption that there are more than two groups. If  $N = 2$ , then each group would pay the same attention to targeted taxes paid by themselves and by others, because they would be equally important for individual welfare. Attention would still be higher on the more controversial targeted taxes than on the uniform policy instruments, but politicians would no longer have any incentive to provide targeted benefits, and the equilibrium policy would be efficient. Thus, political incentives to over-provide controversial policies presuppose an asymmetry in the allocation of attention between beneficiaries and opponents of such policies. In this model, this is due to asymmetric stakes of controversial policies across groups. But asymmetries could also be due to differences in the cost of attention, with beneficiaries of a controversial policy having a lower cost of information compared to opponents. Note, however, that in equilibrium both candidates over-provide the same controversial policies. Hence this model cannot explain why opposite candidates might over-provide different controversial policies.

25. For any  $\xi_0 > 0$  the equilibrium is unique. However, when  $\xi_0 = 0$ , there is an interval of equilibria about the unique equilibrium for a positive  $\xi_0$ . This is because, when attention to  $g$  and  $\tau$  is zero, then the first-order conditions (10) with respect to these instruments are satisfied trivially. At the social optimum,  $u_g^J$  and  $u_\tau^J$  equal zero, and thus attention is zero, and it is zero in its neighborhood as well.

4.2.3. *The Effects of Fiscal Transparency.* We distinguish between two types of transparency. One that affects the cost of information, and the other that affects the flexibility of choice over what information to gather. The diffusion of the Internet is a case in point. The Internet provides not only very cheap information, but also information on very fine issues. Agents can now choose to be informed on very narrow issues of their choice, and also what information to avoid. Such granular information was not available before as agents had to get information on broader issues presented by TV, for instance. The Online Appendix proves the following.

COROLLARY 7 (of Proposition 3). *The equilibrium becomes less distorted, that is,  $\hat{b}^{J*}$  and  $\hat{g}^*$  increase whereas  $\hat{\tau}^*$  and  $\hat{s}^*$  fall, if*

- (i) *the cost of information on instruments targeted at others ( $\lambda_{-J}^J$ ) falls or if*
- (ii) *the cost of information on instruments targeted at themselves ( $\lambda_J^J$ ) increases.*

The potential inefficiencies are driven by too much attention to instruments targeted at themselves relative to those targeted at others. Intuitively, inducing voters to pay more attention to benefits targeted at other groups, raises the political costs of targeting.<sup>26</sup> On the other hand, although Proposition 3 mentioned previously states that welfare is weakly lower under rational inattention than under perfect information, lowering the cost of information  $\hat{\lambda}$  uniformly on all instruments has a nonmonotonic effect. If voters pay higher than minimal attention to both  $b^J$  and  $b^{-J}$ , then efficiency increases, whereas if the cost is sufficiently high that voters pay the minimal attention to  $b^{-J}$ , then the effect is the opposite.

Now we illustrate the second point that transparency in the form of packaging of information can also affect welfare. Suppose that agents cannot choose attention to each targeted transfer independently, but that information about several such targetable instruments is packaged together in  $K$  information bins. Specifically, the number  $N$  of targetable instruments is decomposed as:  $N = kK$ , where  $k$  and  $K$  are both integers and  $k$  denotes the size of each information bin (all bins are of equal size to preserve symmetry). Voters are constrained to pay uniform attention to the objects inside each bin. That is, they observe independent noisy signals of each policy instrument including  $b^J$  and  $b^I$ , for  $J \neq I$ . But voters can only vary attention (i.e., the precision of these signals) across the  $L$  information bins, not across the  $N$  targetable instruments, because any informational message on the size of  $b^J$  provides exactly the same information on  $b^I$  for all  $I$  in the same bin. Thus  $k$  is a measure of how information is packaged (not of more or less information): Lower  $k$  means a more granular packaging, such that it is easier to be informed only about the transfers received by a specific group, without also being exposed to information about other groups.

26. Of course, there is a limit to how much these costs can be exogenously changed by the government, because the cost of observing instruments targeted at oneself will generally be lower than the cost of instruments targeted at others (see Ponzetto (2011) for a specific example of this point with regard to trade policy). Moreover, transparency is also a policy choice, and it is not clear that politicians would always benefit from it.

**COROLLARY 8** (of Proposition 3). *As  $k$  increases (i.e., granularity of packaging decreases) the equilibrium becomes less distorted, that is,  $\hat{b}^{J*}$  and  $\hat{g}^*$  increase whereas  $\hat{\tau}^*$  and  $\hat{s}^*$  fall. The equilibrium reaches the social optimum when  $k = N$  (i.e., information is the least granular).*

In other words, more granular packaging of information leads to more distorted policies and is welfare deteriorating. An important implication of the model is that being able to collect more information only on subsets of the policy instruments can have adverse effects on social welfare, because it can enhance endogenous informational asymmetries.

Another welfare improving information repackaging would be to also give voters information on the net taxes that they pay,  $b^j + \tau$ , besides on  $b^j$  and  $\tau$  separately. Then voters would pay some attention to it, and candidates would be less tempted to raise  $\tau$  and reduce  $b^j$ , because voters would be less likely to detect a direct welfare improvement. If information is separately provided on  $b^j$  and  $\tau$ , instead, such a deviation would be more profitable for the candidates, because voters would be attentive to  $b^j$  whereas paying only minimal attention to  $\tau$ .<sup>27</sup>

The more general normative lesson is that more information is not necessarily better, but information should be packaged so that the value of attention is similar across policy dimensions and groups of voters. This is different from Gavazza and Lizzeri (2009), who emphasize the distorting effects of asymmetric information in a setting where voters' information is exogenous. They argue that more information on aggregate spending is welfare improving, whereas information on aggregate taxes is counter-productive in an intertemporal setting. Our model instead highlights the distinction between targeted versus general instruments. Changing the cost of information on general taxation ( $\tau$ ) or general public goods ( $g$ ) has no effect in our framework, because voters choose to pay no attention irrespective of the cost. What matters instead is the cost of collecting information on instruments targeted at them versus those targeted at others.

Finally, and almost trivially, the model could be extended to capture the evidence in Cabral and Hoxby (2012), or Bordignon, Grembi, and Piazza (2010). These empirical papers find that policymakers tend to charge lower tax rates when the visibility of taxation is higher, shifting the tax burden on less visible sources of revenue. This prediction would follow almost immediately from a modified version of this example, where the cost of information  $\lambda^j$  varies across policy instruments. From a normative perspective, this implies that more transparency of taxation is not always unambiguously welfare improving. Suppose, in particular, that there are differences

27. Note that the incentive to under-provide the public good would not be affected by this repackaging of information, because candidates would still have the possibility of reducing  $g$  (to which voters only pay minimal attention) so as to reduce targeted taxes on all groups. For this reason, it would not be optimal to *only* provide information on  $b^j + \tau$ , because the attention paid to targeted taxes paid by others dampens the incentive to under-provide  $g$ . Deriving these results formally would entail additional complications, because now the error terms would be correlated across observable variables, and the expressions in Propositions 1 and 2 and in Lemma 2 would have to be modified accordingly.



in transparency across policy instruments, and for technological reasons some policy instruments cannot become more transparent (for instance because income tax withholding is preferable due to economies of scale or for other administrative reasons). Then, it may be optimal to reduce the transparency of other sources of revenues, so as to put them on an even footing in terms of political costs.<sup>28</sup>

## 5. Concluding Remarks

Digital technologies provide an almost unlimited and easily accessible supply of very detailed information. Yet, because of limited attention, information remains costly to absorb and process. This has raised the relevance of informational asymmetries between voters and across policy issues. Such asymmetries are not random or unexplainable, however. What we know and don't know about the political process is largely determined by information that we purposefully seek of our own initiative, or to which we are exposed through social media. This paper has studied how voters allocate costly attention to political information, and how this interacts with the behavior of office seeking politicians.

Our analysis delivers two general and intuitive insights. First, voters pay more attention to policy issues where they have higher stakes. Second, the political process rewards attention with policy favors. In equilibrium, attention and policy are jointly determined, because policy stakes are endogenous. We have then illustrated the implications of these general insights with two examples. If policy is one-dimensional, endogenous attention acts as an amplifier of preference intensity, and can lead to policy divergence even if politicians only care about winning the election. If policy is multi-dimensional, attention is devoted to the more controversial policy issues. As a result, the equilibrium is generally Pareto inefficient and policies that provide uniform benefits to all are under-provided. These results have normative implications for how to structure the cost of acquiring information over public policies (e.g., distortions get worse if the granularity of information increases).

The model is highly portable across applications, because attention allocation is derived from first principles, that is, directly from preferences in a general setup. It can thus be applied to study a large variety of questions. A previous version of this paper showed that our results extend to a setting where politicians have partisan policy preferences that are unknown to voters. This framework yields an additional insight. Equilibrium policy divergence between the two candidates reflects the cost of attention by voters. A uniform drop in the cost of attention leads to more policy convergence, because voters are more responsive and candidates are less free to pursue their preferred policies. But compositional effects also matter. If the cost of information drops only for the more extremist voters, then this has the opposite effect

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28. Inattention also changes the behavioral implications of how economic agents respond to tax policy or other instruments, including the deadweight losses of taxation. Here we neglect these issues, discussed at length for instance in Congdon, Kling, and Mullainathan (2011).

and policy divergence increases in equilibrium. This clarifies some of the mechanisms through which the new media technologies may lead to increased political polarization by elected representatives. The Internet can lead to more polarization to the extent that it reduces the cost of information for voters with extreme partisan views, but not if it brings about a generalized and uniform improvement in political information.

In future research, it would be fruitful to integrate our political demand for information in a framework where the cost of information is affected by equilibrium behavior of others, such as media, interest groups, or politicians. This would entail studying the incentives of whoever provides this information, and how this interacts with rational inattention. The literature on lobbying has studied the role of organized groups in providing information to voters, but much of this literature makes demanding assumptions on the voters' ability to process information (e.g., Coate 2004, Prat 2006). Perego and Yuksel (2016) show that competition may induce media to differentiate from each other by specializing on different policy dimensions, and the more granular information that they provide has counterproductive effects on voters' behavior. This insight is related to our results in Section 4.2, but they only consider the supply side of the media market, and policy platforms are taken as given. Studying how individuals choose to pay attention to information provided by others (media, lobbies, or political parties), how the suppliers of information compete for attention, and how this interacts with electoral competition, is an important area for future research.

In this paper, we have focused on forward-looking voting, in the course of electoral campaigns. Voters also vote retrospectively; however, reacting *ex post* to the incumbent's behavior. A large theoretical and empirical literature on electoral accountability has focused on this aspect of elections (see Persson and Tabellini 2000, Besley 2007). These contributions generally assume that voters' information, although incomplete, is exogenous. Endogenizing what voters pay attention to, in a framework of retrospective voting and where policy is manipulated by the incumbent so as to hide or attract attention, is likely to yield other novel insights. More generally, rational inattention could shed light on when voters behave retrospectively, when they pay attention to proposed new policies, and when to candidates' valence. This could help integrate several strands of literature in political economy.<sup>29</sup>

Finally, in this paper, attention influences policy but the reverse channel (from policy to attention) only occurs through voters' expectations. A previous version considered a setting where implemented policies influence attention by changing the opportunity cost of time. In particular, poverty alleviation programs allow the poor to engage in activities other than mere survival. This makes the poor more attentive and hence more influential, which increases the likelihood of pro-poor policies. This complementarity is consistent with empirical findings about the consequences of welfare programs in Latin America (e.g., Manacorda et al. 2009), and can give rise to multiple equilibria.

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29. Diermeier and Li (2015) study electoral control by behavioral and nonstrategic voters. Prato and Wolton (2017) study a signalling model where voters' attention can endogenously be high or low. Bandyopadhyay, Chatterjee, and Roy (2018) study under what conditions a challenger chooses an extremist policy in order to attract the attention of a profit maximizing media.

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## Supplementary Data

Supplementary data are available at [JEEA](#) online.