Strategic Transparency and Electoral Pressure*

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Abstract

This paper investigates how an office-motivated incumbent can use transparency enhancement on public spending to signal his budgetary management ability and win re-election. We show that, when the incumbent faces a popular challenger, transparency policy can be an effective signaling device. It is also shown that electoral pressure can have a non-monotonic effect on transparency, but a higher electoral pressure always increases the informativeness of signaling and the voter's utility.

Keywords: Endogenous Transparency, Electoral Pressure, Signaling
JEL: D72, D82.

1. Introduction

Enhancing fiscal transparency has been a central part of the attempts to reform public sector governance in many countries since the late 1990s. The debate over the importance of transparency is not limited to the policy circles, but it has attracted increasing interest of academic researchers.[1] Even though most of the researches support the benefit of fiscal transparency, it is not obvious whether an office motivated politician has an incentive to enhance transparency. As noted by Alesina and Perotti (1996), politicians benefit from lack of transparency because it helps to create confusion and ambiguity on the real state of public finance. Moreover, fiscal transparency is costly for politicians since it forces them to restrain unproductive spending that favors themselves.

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[1]See Ferejohn (1999), Milesi-Ferretti (2004), Gavazza and Lizzeri (2009, 2011) and Prat (2005) for a theoretical analysis; Alt and Lassen (2006a, 2006b), Alt *et al.* (2002 and 2006) for an empirical investigation of the beneficial effects of transparency.

One benefit of fiscal transparency for politicians is to enhance their credibility by making them accountable and self-disciplined. However, it is not clear whether this can be a sufficient incentive. In fact, to resolve a fiscal problem, a politician needs to have an ability to mange spending in addition to be accountable and self-disciplined. In other words, even if an incumbent enhances transparency, he would not be reelected if voters think that the incumbent has a poor budgetary management ability. Then, the incumbent with a low management ability might have no incentive to introduce the costly transparency policy as Alesina and Perotti (1996) claim. On the other hand, the incumbent who has confidence to manage fiscal problems, might introduce the costly transparency policy to signal his budgetary management ability. This paper analyzes whether an enhancement of transparency on public spending could be explained by a politician's intention to signal his budgetary management ability in order to win re-election.

To investigate our question, we study the following signaling model. There is an incumbent who wishes to be reelected. Each candidate is characterized by two elements. The first is his budgetary management ability which is the candidate's private information. A politician with a higher budgetary management ability is able to spend less to provide the public services that voters expect. The second element is the other political abilities, a diverse set of complementary political abilities such as mediation. Voters have different tastes over two abilities and each voter's taste is characterized by a parameter which measures the importance of the budgetary management ability relative to other ability. Thus, the distribution of tastes reflects the importance of fiscal problems given the state of the economy. The model consists of two periods. In the first period, the incumbent has to decide whether to introduce the transparency policy that credibly commits the disclosure of spending at the beginning of the next period. The transparency policy is costly for him since it restrains unproductive spending that only benefits him. The level of spending depends not only on the incumbent's budgetary management ability, but also on unobservable economic shocks. Thus, the incumbent cannot prove his budgetary management ability by simply disclosing public spending. We then model public spending as a random variable which is correlated with his budgetary management ability. In the second period, after observing the incumbent's policy choice and spending (if it is disclosed), each voter updates her belief about the incumbent's budgetary management ability and casts her vote for either the incumbent or the challenger. The incumbent wins if he gets the majority of the votes.

First, we analyze the condition under which the transparency policy can be an effective signaling device, i.e., the existence of an "informative equilibrium." We show that a high level of electoral pressure is the key determinant to make the transparency policy an effective signaling device. Suppose the incumbent with a high budgetary management ability introduces the transparency policy. When the incumbent faces an unpopular challenger, the incumbent with a low ability has an incentive to imitate the high type by taking advantage of the noisiness of the spending level. On the other hand, when the incumbent faces a popular challenger, the incumbent can win the election only when the disclosed spending level impresses voters. Thus, the incumbent with a low ability has no incentive to introduce the costly policy by imitating the high ability type.

Our main interest is to analyze how higher electoral pressure, i.e., the presence of a more popular challenger, affects the probability to enhance transparency and the equilibrium payoff of voters. First, when we focus on the informative equilibrium, higher level of electoral pressure decreases the probability to enhance transparency in the informative equilibrium. Intuitively, when the incumbent faces a more popular challenger, the incumbent needs to have a higher budgetary management ability to justify the cost of disclosure. Second, the effect on the median voter's payoff is somewhat counter-intuitive: even though higher electoral pressure decreases the probability to enhance transparency, it increases the median voter's payoff in the informative equilibrium. The basic idea is the following. Higher electoral pressure reduces the probability to enhance transparency by discouraging the incumbent whose ability is lower than the challenger. Consequently, the policy choice becomes a more informative signaling about the ability when the challenger is more popular.

The comparative statics focuses on the informative equilibrium but it can fail to exist under a weak electoral pressure. On the other hand, since the N-pooling equilibrium always exists, we need to deal with the equilibrium selection to understand the general effect of electoral pressure. Since the disclosure cost is independent of the type and "dominance based refinements" are not effective, we employ perfect sequential equilibrium (PSE) by Grossman and Perry (1986). It is shown that when the spending level is sufficiently sensitive to an exogenous economic shock, PSE provides a unique prediction given any level of electoral pressure. Concretely, when the challenger is less popular than the incumbent, the N-pooling equilibrium is the only PSE. On the other hand, when the challenger becomes more popular than the incumbent, the informative equilibrium is the only PSE whenever it exists. In other words, the probability that the incumbent enhances transparency in PSE is non-monotonic in the electoral pressure: the probability is zero when the electoral pressure is low, whereas the probability jumps to a strictly positive level when the pressure reaches a certain level. On the other hand, the probability decreases if the challenger becomes even more popular. Note that since the N-pooling equilibrium reveals no information, this is the worst equilibrium for voters. Thus, from the result of the earlier comparative statics, a higher electoral pressure always increases the median voter's expected payoff despite that the effect of higher electoral pressure on transparency is non-monotonic.

1.1. Related Literature

In most existing theoretical studies, (fiscal) transparency is an exogenous structure and the analysis focuses on how it influences economic activities and welfare. For example, Milesi-Ferretti (2004) shows that, with a lack of transparency, fiscal rules can lead to creative accounting. Gavazza and Lizzeri (2009) analyze a model of electoral competition in which transfer policies are imperfectly observable, and compare the equilibrium outcomes under different transparency structures. They show that transparency of spending is beneficial, while transparency of revenues can be harmful because it leads to an increase of wasteful spending. Prat (2005) shows that transparency of "outcome" is always beneficial to voters because it induces the politician to use information efficiently. However, transparency of "action" can be detrimental because it induces the politician to behave in a conformist manner and to disregard useful private information. Thus, one common message of these papers is that transparency of outcome or spending is always desirable. Our paper studies whether the incumbent has an incentive to introduce such a socially desirable fiscal transparency. Thus, we treat disclosure on public spending as a strategic variable chosen by an office motivated politician and analyze whether equilibria exist in which the politician enhances transparency in a simple election game.

Ferejohn (1999) is the only paper, to our knowledge, that treats the level of transparency as an endogenous variable. He formulates the problem as moral hazard and shows that voters induce an office-motivated politician to take more "transparent" actions. On the other hand, we formulate the problem as adverse selection and explain the enhancement of transparency as a signaling equilibrium. In our model, unlike the "uniform" prediction of Ferejohn (1999), whether an office-motivated politician enhances transparency depends on many factors such as the electoral competitive pressure, and the degree of public interest in fiscal issues.

The idea that voters learn the incumbent's ability from a fiscal variable is similar to Beviá and Llavador (2009). However, since their purpose is to analyze the pure effect of the incumbent's informational advantage, they focus on the case in which the incumbent always discloses the fiscal variable. On the contrary, since the purpose of the current paper is to analyze how electoral pressure can affect fiscal transparency and voters' welfare, we treat the incumbent's disclosure decision as a strategic variable.[2]

From a game theoretical perspective, this paper belongs to the literature on signaling games. In particular, since the sender chooses whether to disclose private information, the game shares some character with persuasion games by Milgrom (1981) and Grossman (1981). However, our model departs from the standard persuasion game in two aspects. First, the sender can disclose a private signal which is correlated with his private information, while the private information itself cannot be disclosed. Second, the sender has to make a disclosure decision before the realization of information. Since the cost of disclosure plays an important role, the model also has an aspect of Spencian signaling game. Unlike the standard costly signaling model, the cost function is independent of the type in our model. However, since the stochastic "performance" is correlated with the sender's type, our model can be interpreted as a costly signaling game in the interim stage, i.e., after observing the type but before observing the performance.[3]

The cost of disclosure plays a crucial role in our signaling model. The effect of "costly disclosure" is also studied in different contexts. For example, in accounting/corporate finance literature, Verrecchia (1983) studies how the cost of disclosure affects the firm's decision to release private information. In industrial organization, there are also some papers that study how firms communicate the product quality when disclosure is costly, e.g., Jovanovic (1982), Daughety and Reinganum (2008). The effect of the disclosure cost on the equilibrium strategy is analogous to these papers. Unlike in costless disclosure models, the sender could conceal information in equilibrium since the receiver knows that the benefit from disclosure needs to be sufficiently high to cover the cost. Consequently, the ex ante probability of concealing information is positive in the costly disclosure models. Even though the equilibrium property of our model is similar to these models, the main result of this paper, i.e., the effect of electoral pressure on transparency, is unique to our model.

The rest of the paper is organized as follows: Section 2 introduces the model; Section 3 analyzes the equilibria; Section 4 provides comparative statics of the informative equilibrium; the set of equilibria is refined in Section 5; Section 6 discusses the results and Section 7 concludes.

[2]We would like to thank the associate editor for this suggestion.
[3]We appreciate a referee for pointing this out.

2. Model

The model consists of two periods. There is a continuum of voters who have to choose between two candidates, an incumbent and a challenger, in an election scheduled for the second period. The election is based on majority rule.

Each candidate is characterized by his budgetary management ability $\theta \in \Theta = [0, 1]$, which is private information, and his political ability $\omega \in [0, 1]$, which is observable for the sake of the analysis.[4] In the model, his budgetary management ability θ refers to the ability of managing public spending efficiently, while his political skill ω refers to a diverse set of complementary political abilities such as mediation, both in domestic and foreign affairs.

In the first period, the incumbent has to decide whether to introduce a transparency policy to disclose public spending $s \in S = [0, \infty)$, which is not realized yet. After the policy choice, the spending level is determined by his budgetary management ability and unobservable economic shocks. Concretely, suppose that Nature draws s given θ according to the conditional probability density $f(s|\theta)$ where $supp f(.|\theta) = S$ for any θ.[5] We assume that the joint probability density $f(s, \theta)$ is continuous in each argument and has strictly monotone likelihood property.

Assumption 1. $\frac{f(s|\theta'')}{f(s|\theta')}$ *is strictly decreasing in* $s \in S$ *for any* $\theta' < \theta''$.

Intuitively, this assumption states that with a higher level of spending, it is more likely that the budgetary management ability is low. As in other models of information economics, this assumption restricts our attention to "monotonic environments" and helps us to provide clear insights to the problem. Note that $f(s, \theta)$ reflects the state of the economy in period 1. For example, during a recession, the level of spending in social programs might need to be increased in order to manage the economy. Thus, the level of spending s could be high even if the incumbent has a high budgetary management ability. Hence, when the economy is in a recession, $f(s|\theta)$ may have a high value for a large s even if θ is high. On the other hand, during booms it might be easier to manage the economy with lower spending even if the incumbent has a low budgetary management ability. Thus, when the economy is booming, $f(s|\theta)$ may have a low value for high s even if θ is low.

If the incumbent introduces the transparency policy, i.e., $a = Y$, spending s will be disclosed in the next period, while he incurs the cost $c \in (0, 1)$. On the other hand, if he does not introduce the policy in period 1, $a = N$, he incurs no cost and public spending cannot be disclosed next period. We assume that the incumbent can credibly commit to the announced transparency policy.

As we explained in the literature review, the cost of the transparency policy plays a crucial role in our model. There are two interpretations of the cost. First, transparency forces the incumbent to restrain unproductive spending that only benefits himself or his political party. That is, the cost can be interpreted as a reduced "political rent." Hence, in societies in which politicians enjoy personal benefits from their position, the level of c is

[4]The results of this paper are preserved even if ω is private inforamtion as long as there is no effective signaling device for ω.

[5]The setting can be justified by the standard logic in producer theory. Suppose that the government tries to provide public service that satisfies voters, while minimizing the expenditure. Then, the spending level reflects the incumbent's budgetary management ability.

very high, while in societies in which politicians are committed to the common good, the cost might be relatively low. Another interpretation of c is the set-up and implementation costs of the policy. In order to introduce a transparency policy, the incumbent might need to build a system and employ workers who organize and disseminate information.[6]

In period 2, voters evaluate the incumbent's budgetary management ability θ based on the level of spending s whenever it is available. However, since public spending s depends not only on the ability θ, but also on some unobservable economic and political shocks, voters cannot pin down the budgetary management ability only from observing spending s. Thus, based on the updated belief conditional on a policy choice and disclosed information (if available), each voter makes a decision.

Turning to the payoff functions, the incumbent is office motivated and his payoff depends on the outcome of the election and his policy choice. Let $c(a)$ be the cost of his policy choice a, that is, $c(Y) = c$ and $c(N) = 0$. Then, the incumbent's payoff from a is $1 - c(a)$ if he is re-elected, while his payoff is $-c(a)$ if he loses the election. Each voter's payoff from electing a candidate is a linear combination of the elected politician's budgetary management ability θ and his political ability ω with relative weights α and $(1-\alpha)$ respectively.[7] Hence, given (θ, ω), a voter's payoff from selecting a candidate is $\alpha\theta + (1-\alpha)\omega$ where $\alpha \in [0, 1]$. α is a taste parameter which characterizes each voter's preference for a politician's budgetary management skill. Thus, a voter characterized by a higher α cares more about the efficiency in government spending than about the candidate's political abilities. The median voter's α captures the economic/political environment. For example, the median α might be quite high when the government suffers from a serious fiscal problem, whereas the median α could be small in good economic conditions.

Finally, we clarify the timeline of our game and define the strategies. In period 1, the incumbent chooses his action a that is either Y or N. In period 2, if the incumbent chooses $a = Y$ in period 1, voters observe public spending s, while s cannot be observed if the incumbent chooses $a = N$. Each voter then chooses whether to vote for the incumbent "I" or the challenger "C" given available information. Thus, the incumbent's strategy[8] is defined as a mapping $\sigma : \Theta \to A$. On the other hand, the voter's strategy is defined as a mapping $r : (A \times Z)\backslash\{(Y, \varnothing)\} \to \{I, C\}$ where $Z = S \cup \{\varnothing\}$ is disclosed information and $\varnothing$ denotes "no available information."[9] For simplicity, we assume that the challenger has no effective signaling device and no effective action to take. It is assumed that the expected value of the challenger's budgetary management ability, $\theta_0 \in (0, 1)$, and his political ability, $\omega_0 \in (0, 1)$, are both common knowledge between the incumbent and voters. Thus, essentially, our model is a signaling game between the incumbent and voters. We employ *perfect Bayesian equilibrium* to analyze the game.

[6]For example, the Congressional Budget Office in US estimated that the cost of the implementation of the Federal Funding Accountability and Transparency Act would be around $20 million over the 2007-2011 period.

[7]We can interpret the voter's payoff as her future consumption given the politicians' abilities. Then α could depend on her belief about the effect of the politician's budgetary management ability on her future consumption.

[8]We focus on pure strategies since the set of types which use a mixed strategy in any equilibrium is measure zero.

[9]If $a = Y$, s is always available. Thus, the voter never has $(Y, \varnothing)$.

3. Equilibrium analysis

3.1. Preliminary analysis

Since this is a two-stage game, we start with each voter's optimal decision given a strategy and available information. The difference between a voter's expected payoff from electing the incumbent and that from electing the challenger conditional on (a, z) is

$$\alpha(E[\theta|a, z] - \theta_0) + (1 - \alpha)(\omega - \omega_0). \tag{1}$$

If $E[\theta|a, z] - \theta_0 > \omega - \omega_0$, then, whenever a voter with α prefers the incumbent to the challenger, a voter with $\alpha' > \alpha$ also prefers the incumbent. On the other hand, if $E[\theta|a, z] - \theta_0 < \omega - \omega_0$, then, whenever a voter with α prefers the challenger to the incumbent, a voter with $\alpha' > \alpha$ also prefers the challenger. Then, since the preferences are order-restricted, the median voter determines the outcome of the election. Let α^* be α of the median voter.

When the median voter observes the incumbent's choice a and disclosed information z, she updates her belief about the incumbent's ability. Concretely, let $\Theta_\sigma(a) = \{\theta : \sigma(\theta) = a\}$. Then, when the incumbent uses strategy σ and his action a is such that $\Theta_\sigma(a) \neq \emptyset$, the consistent posterior belief conditional on (a, z) is

$$\mu(\theta|a, z; \sigma) = \begin{cases} \frac{f(\theta,s)}{\int_{\theta' \in \Theta_\sigma(a)} f(\theta',s)d\theta'} & \text{if } \theta \in \Theta_\sigma(a) \text{and } z = s \\ \frac{f_\theta(\theta)}{\int_{\theta' \in \Theta_\sigma(a)} f_\theta(\theta')d\theta'} & \text{if } \theta \in \Theta_\sigma(a) \text{and } z = \varnothing \\ 0 & \text{if } \theta \notin \Theta_\sigma(a) \end{cases} \tag{2}$$

The median voter chooses a candidate whose expected value is higher. Let $v(\alpha^*, \theta, \omega)$ be the payoff of the median voter from electing the incumbent, while $v(\alpha^*, \theta_0, \omega_0)$ be the payoff of the median voter from electing the challenger. The median voter's optimal reaction is then

$$r(a, z; \alpha^*, \sigma) = \begin{cases} I & \text{if } \int_{\theta \in \Theta_\sigma(a)} v(\alpha^*, \theta, \omega)\mu(\theta|a, z; \sigma)d\theta \geq v(\alpha^*, \theta_0, \omega_0) \\ C & \text{if } \int_{\theta \in \Theta_\sigma(a)} v(\alpha^*, \theta, \omega)\mu(\theta|a, z; \sigma)d\theta < v(\alpha^*, \theta_0, \omega_0) \end{cases}. \tag{3}$$

From the strict monotone likelihood ratio property, i.e., Assumption 1, the optimal voting rule can be characterized by cutoff signal $s(\alpha^*, \sigma) \in [0, \infty)$ such that[10]

$$\begin{cases} r(Y, s; \alpha^*, \sigma) = I & \text{if } s < s(\alpha^*, \sigma) \\ r(Y, s; \alpha^*, \sigma) = C & \text{if } s > s(\alpha^*, \sigma) \end{cases}. \tag{4}$$

Turning to the incumbent's problem, given σ, we can compute the probability of re-

[10]If the voter chooses C for any s, then $s(\alpha^*, \sigma) = \infty$. If the voter chooses I for any s, $s(\alpha^*, \sigma) = 0$.

election conditional on (a, θ) as follows

$$Q_a(\theta;\sigma) = \begin{cases} F(s(\alpha^*,\sigma)|\theta) & \text{if } a = Y \\ 1 & \text{if } a = N \text{ and } \int_{\theta\in\Theta_\sigma(N)} v(\alpha^*,\theta,\omega)\mu(\theta|N,\varnothing;\sigma)d\theta \geq v(\alpha^*,\theta_0,\omega_0) \\ 0 & \text{if } a = N \text{ and } \int_{\theta\in\Theta_\sigma(N)} v(\alpha^*,\theta,\omega)\mu(\theta|N,\varnothing;\sigma)d\theta < v(\alpha^*,\theta_0,\omega_0) \end{cases} \quad (5)$$

where $F(s|\theta)$ is the cumulative distribution of $f(s|\theta)$.

Thus, type θ incumbent's expected payoff from a given σ is

$$\begin{cases} Q_Y(\theta;\sigma) - c & \text{if } a = Y \\ Q_N(\theta;\sigma) & \text{if } a = N \end{cases}. \quad (6)$$

3.2. Characterization of Equilibria

Our signaling game can have both pooling and informative equilibria. In a pooling equilibrium, the incumbent's action is constant in θ and voters have to make their decision based only on disclosed information. On the other hand, in an informative equilibrium, the incumbent's policy choice depends on θ. Thus, voters can learn about θ not only from the disclosed information but also from the policy choice. We then analyze under which circumstances the transparency policy can be an effective signaling device.

3.2.1. Pooling Equilibria

Since there are two possible actions for the incumbent, there are two kinds of pooling strategies. A pooling strategy is **Y-pooling** if all types choose Y, while a pooling strategy is **N-pooling** if all types choose N. Note that in every pooling equilibrium, the policy choice does not reveal any information. In the Y-pooling equilibrium, public spending s is the only available information about θ. On the other hand, in the N-pooling equilibrium voters have to make a decision based only on their priors.

First, it is easy to see that the N-pooling equilibrium always exists when voters interpret off-equilibrium action Y as a "negative signal" about θ. Second, the Y-pooling equilibrium exists if and only if $c \leq F(s(\alpha^*,\sigma_p)|0)$, where σ_p is the Y-pooling strategy. Observe that type θ incumbent's expected payoff from Y given the Y-pooling strategy is $F(s(\alpha^*,\sigma_p)|\theta) - c$. When the expected payoff is positive for the worst type, i.e., $\theta = 0$, and voters interpret off-equilibrium action N as a "negative signal" about θ, no type has incentive to deviate from Y. Since off-equilibrium beliefs of pooling equilibria do not seem always "reasonable," we refine pooling equilibria in Section 5.

3.2.2. Informative Equilibria

When an equilibrium strategy is informative, voters can learn about the incumbent's ability θ not only from the level of spending s, but also from the incumbent's action a. Since voters can make decisions based on additional information, voters' ex ante expected payoffs in an informative equilibrium are always higher than in any pooling equilibrium.

First, we introduce a class of strategies which plays a key role in our paper. An incumbent's strategy is a **cutoff strategy** if there exists $\hat{\theta} \in [0,1]$ such that whenever $\theta > \hat{\theta}$, the incumbent chooses Y, while whenever $\theta < \hat{\theta}$, the incumbent chooses N. An equilibrium is a **cutoff equilibrium** if the incumbent uses a cutoff strategy in the equilibrium.

The first lemma states that, in any equilibrium, the incumbent introduces the transparency policy whenever a lower type incumbent introduces the policy.

Lemma 1. *Any equilibrium is a cutoff equilibrium.*[11]

Proof. See appendix. □

The intuition of the result is as follows. Suppose there exists an equilibrium in which a higher type chooses N, while a lower type chooses Y. Note that by Assumption 1, the expected payoff from Y is higher for the higher type. However, since the expected payoff from N is constant in the type, the higher type always has an incentive to choose Y.

The next lemma provides another property of informative equilibrium.

Lemma 2. *In any informative equilibrium, the incumbent's expected payoff from N is 0.*

Proof. See appendix. □

Intuitively, if the incumbent does not disclose spending, there is no stochastic element in his payoff. Thus the outcome has to be either "win" or "lose" for sure. If he can win with certainty without disclosure, every type prefers not to disclose spending. Hence, whenever the incumbent does not disclose in an informative equilibrium, the probability of winning has to be zero.

Lemma 3. *An informative equilibrium exists only if* $\alpha^* > \max\left\{\frac{\omega_0-\omega}{\omega_0-\omega+1-\theta_0}, \frac{\omega-\omega_0}{\omega-\omega_0+\theta_0}\right\}$.

Proof. See appendix. □

This lemma says that the majority of voters have to be sufficiently interested in fiscal issues in order to have an informative equilibrium. This result is straightforward: when the incumbent cannot win the election even if the median voter believes he has the highest possible θ, he never uses the expensive transparency policy in equilibrium. On the other hand, when the incumbent can win even if the median voter believes that he has the lowest budgetary management ability, he has no reason to enhance transparency.

To state the next lemma, let $\theta(\alpha^*, \theta_0, \omega_0) = \theta_0 + \frac{1-\alpha^*}{\alpha^*}(\omega_0 - \omega)$. Intuitively, suppose the median voter can observe θ. Then, the voter chooses the incumbent (challenger) if $\theta > (<)\theta(\alpha^*, \theta_0, \omega_0)$.

Lemma 4. *Suppose α^* satisfies the inequality of Lemma 3. Then, the equilibrium cutoff type in any informative equilibrium is strictly lower than $\theta(\alpha^*, \theta_0, \omega_0)$.*

[11]Note that a pooling strategy is a cutoff strategy whose cutoff type is 0 or ∞.

Proof. See appendix. □

To see the idea of Lemma 4, observe that if the incumbent uses a cutoff strategy in which the cutoff type is higher or equal to $\theta(\alpha^*, \theta_0, \omega_0)$, Y reveals that his type is at least as good as $\theta(\alpha^*, \theta_0, \omega_0)$. Then, by the definition of $\theta(\alpha^*, \theta_0, \omega_0)$, the voter chooses the incumbent with probability 1 irrespective of the level of spending s. Then, a lower type has an incentive to imitate higher types.

Now we are ready to characterize the economic environment under which the transparency policy can be an effective signaling device.

Proposition 1. *Suppose* $\alpha^* > \max\left\{\frac{\omega_0-\omega}{\omega_0-\omega+1-\theta_0}, \frac{\omega-\omega_0}{\omega-\omega_0+\theta_0}\right\}$.

(i) There exists an informative equilibrium if and only if $c \in (F(s(\alpha^*, \sigma_p)|0), 1)$.

(ii) Whenever an informative equilibrium exists, there exists a unique informative equilibrium.

Proof. See appendix. □

Recall the Y-pooling equilibrium exists if and only if $F(s(\alpha^*, \sigma_p)|0) \geq c$. Hence, an informative equilibrium exists only if there is no Y-pooling equilibrium. The intuition is that when the incumbent faces a popular challenger, only high types, who are confident about their future performance s, can introduce the costly transparency policy. Low types, expecting a poor future performance, avoid the commitment to disclose s.

Proposition 1 is rather straightforward but there are a couple of insightful implications. To state these implications, we define a new term. Candidate A is **more popular** than B if the majority of voters prefer candidate A to B in period 1. Concretely, the incumbent is more (less) popular than the challenger if

$$\int v(\alpha^*, \theta, \omega) f_\theta(\theta) d\theta > (<) v(\alpha^*, \theta_0, \omega_0). \tag{7}$$

To state the first one, let $v_0 = v(\alpha^*, \theta_0, \omega_0)$ be the median voter's payoff from selecting the challenger. The following corollary of Proposition 1-(i) states that an informative equilibrium exists under a reasonably strong "electoral pressure."

Corollary 1. *If* v_0 *is smaller than* $\alpha^* + (1-\alpha^*)\omega$ *but sufficiently close to* $\alpha^* + (1-\alpha^*)\omega$, *there exists an informative equilibrium.*

The spending level has to be sufficiently low to win the election given the Y-pooling strategy. Thus, by choosing a large v_0, we can make $F(s(\alpha^*, \sigma_p)|0)$ strictly lower than c. Observe if $v_0 > \alpha^* + (1-\alpha^*)\omega$, then $\alpha^* < \frac{\omega_0-\omega}{\omega_0-\omega+1-\theta_0}$ and, from Lemma 3, no informative equilibrium exists.

To state the next corollary, we need to introduce a proxy of the informativeness of s about θ. Let

$$\rho = \int_s \{E_\theta[\theta] - E_\theta[\theta|s]\} dF(s|\theta = 0). \tag{8}$$

Intuitively, suppose that the incumbent discloses s following the Y-pooling strategy. Even if the incumbent is the worst type, the expected difference between the unconditional mean of θ and the conditional mean of θ given s should be small if s is noisy. Thus, ρ is small if s is noisy.[12]

Corollary 2. *If ρ is sufficiently small, an informative equilibrium exists only if the challenger is more popular than the incumbent.*

Note that if the incumbent uses Y-pooling strategy, noisier s changes the voter's posterior belief about θ only in a smaller degree. Thus, if the incumbent is more popular than the challenger, the voter selects the incumbent even if s is high, that is, $F(s(\alpha^*, \sigma_p)|0)$ is large. Thus, if ρ is sufficiently small, $F(s(\alpha^*, \sigma_p)|0) > c$. On the other hand, if the challenger is more popular than the incumbent, the voter selects the challenger unless s is sufficiently low, that is, $F(s(\alpha^*, \sigma_p)|0)$ is small. Thus, if ρ is sufficiently small, $F(s(\alpha^*, \sigma_p)|0) < c$.

To provide intuition, observe that when the incumbent is less popular, he has to impress voters to win the election. However, if s is very noisy, even the highest ability type loses the election with a high probability if all types introduce the transparency. Thus, in equilibrium, only some high types introduce the costly transparency. On the other hand, when the incumbent is more popular than the challenger, he can win the election unless he hurts his popularity to a great extent. In fact, when some high types introduce the costly transparency policy, low types can take advantage of the noisiness of s and the popularity by imitating high types.

4. Comparative statics

This section provides comparative statics of the informative equilibrium. Concretely, we analyze how a higher electoral competition affects (i) the probability to enhance transparency and (ii) the median voter's equilibrium payoff. Let $v_0 := v(\alpha^*, \theta_0, \omega_0)$.

Proposition 2. *Suppose there exists an informative equilibrium under each v_0 and v_0' where $v_0' > v_0$.*

(i) The ex ante probability of adopting the transparency policy under v_0 is higher than that under v_0'.

(ii) The median voter's equilibrium payoff under v_0' is higher than that under v_0.

Proof. See appendix. □

Proposition 2 says that more competition reduces the ex ante probability of adopting the transparency policy, while it increases the median voter's payoff. The effect of competition on the probability of the policy adoption is rather straightforward. If the challenger is more popular, the probability of winning with the signaling becomes lower given a strategy. Hence, only higher types can justify the cost of the transparency policy as signaling. Hence, the

[12]There can be other ways to define the informativeness of s. However, since whether an informative equilibrium exists or not depends on $F(s|\theta = 0)$ (see Proposition 1), this is a simple way to define relevant "informativeness."

equilibrium cutoff becomes higher and the ex ante probability of the policy adoption gets lower when the incumbent faces a more popular challenger.

At first glance, higher electoral pressure seems to decrease the voter's payoff since it reduces the ex ante probability of disclosure. However, note that the voter obtains information through two channels in our model: the spending level and the signaling, i.e., a policy choice. Thus, the basic idea of Proposition 2-(ii) is that even though more competition decreases the probability to disclose spending, it increases the informativeness of signaling and the positive effect dominates the negative effect. An intuition for the result is as follows. As we showed in Lemma 4, the equilibrium cutoff level is always smaller than the type that makes the voter indifferent between the incumbent and the challenger. Hence, whenever the incumbent chooses not to adopt the policy, it reveals that selecting the challenger is the optimal choice. On the other hand, since the incumbent who introduces the policy is not always a better candidate than the challenger, the voter's choice depends on the realization of the spending level when the incumbent adopts the policy. As a result, the voter could choose an inferior candidate. Then, since a higher equilibrium cutoff level reduces the probability of the policy adoption and of such a suboptimal voting decision, it increases the voter's payoff.

Remark 1. The effect of higher c on the informative equilibrium is analogous to the effect of higher electoral pressure. If c gets higher, the incumbent needs a higher budgetary management ability to compensate the cost. Thus, the equilibrium cutoff type becomes higher if the incumbent faces a higher cost. The higher cutoff decreases the probability of adopting the transparency policy, whereas the signaling becomes more informative. The net effect is then analogous to that in Proposition 2: higher cost increases the median voter's payoff as long as the cost is not too high to support an informative equilibrium.

5. Refinement

As we showed in the last section, our game has always two equilibria given parameters. If there is no Y-pooling equilibrium, there exists the N-pooling and the informative equilibrium. On the other hand, if there is the Y-pooling equilibrium, it always co-exists with the N-pooling equilibrium. Thus, in order to provide a prediction about how electoral pressure affects transparency, we need to refine the equilibria.

The key to refine equilibria is to check whether each pooling equilibrium is reasonable since they often rely on counter-intuitive off-equilibrium beliefs. For instance, in the N-pooling equilibrium, voters believe that the incumbent has a low budgetary management ability when the transparency policy is introduced. On the other hand, in the Y-pooling equilibrium, voters interpret "no disclosure" as a signal of incompetence even if the incumbent has a good reputation about his budgetary management ability.

To eliminate "unreasonable" pooling equilibria, we employ **perfect sequential equilibrium (PSE)** introduced by Grossman and Perry (1986). The essence of PSE is refining perfect Bayesian equilibria (PBE) by restricting off-equilibrium beliefs to be "credible." Concretely, once a deviation has occurred, the voter tries to rationalize the deviation by trying to find a set of types $T \subset \Theta$ that would benefit from the deviation if and only if he is believed to be in T. More precisely, suppose the incumbent chooses an off-equilibrium action. Voters then try to find $T \subset \Theta$ such that, if voters choose the optimal action believing the incumbent's type is in T, the set of types whose expected payoffs are strictly higher than the equilibrium payoff is exactly T. If such T exists, the **credible updating rule** given off-equilibrium action a is

$$\mu(\theta|a,z) = \begin{cases} \frac{f(\theta,s)}{\int_{\theta'\in T} f(\theta',s)d\theta'} & \text{if } \theta \in T \text{ and } a = Y \\ \frac{f_{\theta'}(\theta)}{\int_{\theta'\in T\setminus\Theta} f_{\theta'}(\theta')d\theta'} & \text{if } \theta \in T\setminus\Theta\text{and } a = N \\ 0 & \text{otherwise} \end{cases} \tag{9}$$

Unlike PBE, PSE consists of "meta-strategies" and a credible updating rule.[13] However, since we already have perfect Bayesian equilibria (PBE) and it is known that any PSE-play is also PBE-play, there is no benefit of constructing PSE with meta-strategies. Thus, in this paper, we say a PBE (or equilibrium) is PSE if the incumbent has no incentive to deviate from the equilibrium strategy when the voter follows the credible updating rule for off-equilibrium actions. Note that since there is no off-equilibrium action in informative equilibria, they are always PSE.

The next result states that when the incumbent is less popular than the challenger in period 1, there is a unique PSE.

Proposition 3. *Suppose $\int_\theta v(\alpha^*,\theta,\omega)f_\theta(\theta)d\theta < v(\alpha^*,\theta_0,\omega_0)$ and there exists an informative equilibrium. Then, the informative equilibrium is the unique PSE.*

Proof. See appendix.

□

Note that there is no Y-pooling equilibrium when an informative equilibrium exists. Thus, to show Proposition 3, we need to prove that the N-pooling is not a PSE when the incumbent is less popular than the challenger. To provide an intuition, suppose that the incumbent has a bad reputation about his budgetary management ability. Then, in the N-pooling equilibrium, when voters observe deviation Y, voters might interpret it as an "attempt to demonstrate his budgetary management ability." In other words, voters might think that the incumbent that deviates could have a high budgetary management ability. In fact, if the informative equilibrium with cutoff type $\hat{\theta}^*$ exists and voters believe that the deviated incumbent belongs to the set $[\hat{\theta}^*, 1]$, the incumbent has an incentive to deviate only if his type belongs to the set $[\hat{\theta}^*, 1]$. That is, the deviation can credibly signal that his type is higher than $\hat{\theta}^*$.

The next proposition states that when the incumbent is more popular than the challenger, the Y-pooling is not a PSE.

Proposition 4. *Suppose $\int_\theta v(\alpha^*,\theta,\omega)f_\theta(\theta)d\theta > v(\alpha^*,\theta_0,\omega_0)$. Then, any PSE is either the N-pooling or an informative equilibrium. Moreover, if ρ is sufficiently small, the N-pooling is the only PSE.*

[13] In a meta-strategy, the voter must specify her action for each possible history and each possible belief. As a result, if the incumbent plays an off-equilibrium action, the voter's response is based on the meta-strategy given a belief computed by the credible updating rule. That is, the combination of a meta-strategy and a credible updating rule effectively restricts some off-equilibrium plays to be "reasonable."

Proof. See appendix. □

To see the result, suppose the incumbent deviates from the Y-pooling equilibrium. When the incumbent has a good reputation about his budgetary management ability, voters might think that the incumbent has nothing to prove and the purpose of the deviation is to save the cost of the transparency policy. Note that if voters believe that the deviated incumbent can be any type in Θ, all types have an incentive to deviate.

Based on our refinement, we can provide a sharper implication on how electoral pressure effects transparency. In practice, the spending level seems quite sensitive to exogenous shocks and tends to be a very noisy signal about θ, i.e., ρ is small. From Proposition 4, if ρ is small and the incumbent is more popular than the challenger, the only PSE is the N-pooling. On the other hand, from Proposition 3 and Corollary 2, the informative equilibrium is the unique PSE if the challenger is more popular than the incumbent and ρ is sufficiently small. Then, the effect of electoral pressure on transparency can be summarized as follows. Let $P^*(v_0)$ be the ex ante probability of adopting the transparency policy in PSE. That is,

$$P^*(v_0) = \begin{cases} 0 & \text{if } v_0 < \int_\theta v(\alpha^*, \theta, \omega) f_\theta(\theta) d\theta \\ 1 - F_\theta(\hat{\theta}^*(v_0)) & \text{if } v_0 > \int_\theta v(\alpha^*, \theta, \omega) f_\theta(\theta) d\theta \end{cases} \tag{10}$$

Recall that as we showed in Proposition 2, $P^*(v_0)$ is decreasing in v_0 if $v_0 > \int_\theta v(\alpha^*, \theta, \omega) f_\theta(\theta) d\theta$. Thus, $P^*(v_0)$ is a non monotonic in v_0: if the challenger becomes more popular than the incumbent, it could dramatically enhance transparency as a jump from the N-pooling to the informative equilibrium, whereas having even more popular challenger decreases the probability to enhance transparency.

6. Discussion

6.1. Does political competition increase transparency?

In Section 5, we show that higher electoral pressure can have a non-monotonic effect: having a challenger who is more popular than the incumbent enhances transparency, while having an even more popular challenger reduces the probability of transparency enhancement. However, there is a caveat when we consider the empirical implication of this theoretical result. Since having a challenger who is more popular than the incumbent induces a "jump" from the N-pooling to an informative equilibria, while having an even more popular challenger induces just a continuous change between informative equilibria, the first effect should be empirically more pronounced. Thus, if the current level of transparency is a consequence of the accumulation of the past transparency enhancements, the transparency level of a country should be essentially determined by the number of past challengers who were more popular than incumbents. As a result, the level of transparency of a country with a low level of political competition should be lower than that of a country with a high level of political competition in general.

This implication of our model is consistent with the empirical evidence of a positive relationship between political competition and fiscal transparency presented in Alt and Lassen

(2006a), using a sample of 19 OECD countries, and in Alt *et al.* (2006), using data on American states. In their study, the level of political competition is measured as turnover. Since a high v_0 always increases the probability of turnover, their measure of political competition is a good proxy of "electoral pressure" in our model.

6.2. Should transparency be rule-based?

It is tempting to impose transparency as a rule, believing it improves welfare. However, our results suggest that rule-based transparency can be optimal only in some circumstances. In fact, when transparency becomes a rule, voters receive the same level of information as in the Y-pooling equilibrium. Instead, when the incumbent enhances transparency voluntarily, voters obtain information not only from the disclosed reports (spending s), but also from the signaling.

On the other hand, as our intuition suggests, "voluntary transparency" is not always more desirable than "rule-based transparency." In fact, our analysis suggests that whether transparency should be rule based or not depends on the situation. When the challenger is more popular than the incumbent, the informative equilibrium can be the only PSE. Thus, voters can be better off by leaving the choice of the transparency policy to the incumbent. On the other hand, when the incumbent is more popular than the challenger, the N-pooling equilibrium can be the most reasonable prediction from Proposition 4. Consequently, voters may be better off by rule-based transparency that guarantees disclosure.

6.3. Repeated elections

In order to focus on the basic idea, there is only one election in this model. Thus, the model describes the incumbent's problem at the end of the first term when the term limit of office is two.[14] On the other hand, our model also provides some insight into the case without term limit.

To see the idea, suppose that our two-period model is repeated indefinitely. The incumbent, who discounts the future payoff, decides whether to disclose public spending just before each election. The challenger is randomly drawn from a distribution in each period and the game ends when a challenger defeats the incumbent. Even though there are multiple equilibria,[15] the most natural equilibrium has the following property: (i) the incumbent introduces the transparency policy at some point and continues the policy in the later terms, (ii) the voters interpret the discontinuation of the policy as a "negative signal." Note that, in this equilibrium, the continuation of the policy does not reveal new information as a signaling. In other words, after introducing the policy, the only informative signal the incumbent can send is the negative signal by the discontinuation of the policy.[16]

Even though the incumbent loses his "positive signaling device" after introducing the policy, our model still provides an insight into the incumbent's decision to introduce the transparency policy. When we focus on the most natural equilibrium, the repeated setting

[14]For example, the term limit of the US president is two four-year terms. Some states in US have a limit of two consecutive terms. France has a semi-presidential system with two five-year terms in office.

[15]Note that the N-pooling is always an equilibrium.

[16]We appreciate a referee for this insightful observation.

only affects the level of the equilibrium cutoff type. Observe that the payoff from introducing the policy needs to incorporate the benefit from future terms. Then, the equilibrium cutoff type, who finds the payoff from disclosure is zero, should decrease since the stake becomes higher. Consequently, under the repeated setting, the equilibrium signaling becomes less informative analogous to the effect of lower c in our basic model.

7. Conclusions

This paper has analyzed how fiscal transparency can emerge in equilibrium when the incumbent uses a costly transparency policy to signal his budgetary management ability to win re-election. We show that the transparency policy can be an effective signaling device when the majority of voters is sufficiently interested in fiscal issues and the incumbent faces a sufficiently popular challenger. Electoral pressure can have a non-monotonic effect on the probability to enhance transparency, whereas the effect on the voter's utility is turned out be always positive.

8. Appendix

This appendix provides the omitted mathematical proofs.

8.1. Proof of Lemma 1

Suppose there exists an equilibrium in which $\sigma(\theta') = Y$ and $\sigma(\theta'') = N$ for $\theta' < \theta''$. Then, $Q_Y(\theta';\sigma) - c \geq Q_N(\theta';\sigma)$ and $Q_Y(\theta'';\sigma) - c \leq Q_N(\theta'';\sigma)$. Note that $Q_N(\theta';\sigma) = Q_N(\theta'';\sigma)$. On the other hand, by Assumption 1, $Q_Y(\theta';\sigma) < Q_Y(\theta'';\sigma)$. This contradicts the hypothesis.

8.2. Proof of Lemma 2

Note that given cutoff strategy $\sigma_{\hat{\theta}}$, N reveals that the incumbent's type is lower than $\hat{\theta}$. The probability of re-election conditional on N is then

$$Q_N(\theta, \sigma_{\hat{\theta}}) = \begin{cases} 1 & \text{if } \int_{\theta<\hat{\theta}} v(\alpha^*, \theta, \omega) \frac{f_\theta(\theta)}{F_\theta(\hat{\theta})} d\theta \geq v(\alpha^*, \theta_0, \omega_0) \\ 0 & \text{if } \int_{\theta<\hat{\theta}} v(\alpha^*, \theta, \omega) \frac{f_\theta(\theta)}{F_\theta(\hat{\theta})} d\theta < v(\alpha^*, \theta_0, \omega_0) \end{cases}. \tag{A1}$$

Thus, the expected payoff from N has to be either 0 or 1 in any informative equilibrium. Since any informative equilibrium is a cutoff equilibrium, given equilibrium cutoff $\hat{\theta}^*$, $Q_Y(\theta, \sigma_{\hat{\theta}^*}) - c > (<)\ Q_N(\theta, \sigma_{\hat{\theta}^*})$ for any $\theta > (<)\ \hat{\theta}^*$. Then, since $Q_Y(\theta, \sigma_{\hat{\theta}}) \leq 1$, the inequality can be satisfied only if $Q_N(\theta, \sigma_{\hat{\theta}^*}) = 0$.

8.3. Proof of Lemma 3

When the incumbent cannot win the election even if the median voters believe that $\theta = 1$ with probability 1, then N is the dominant choice. Thus, we need

$$\alpha^* + (1 - \alpha^*)\omega > \alpha^*\theta_0 + (1 - \alpha^*)\omega_0, \tag{A2}$$

or $\alpha^* > \frac{\omega_0 - \omega}{\omega_0 - \omega + 1 - \theta_0}$. On the other hand, when the incumbent can win even if voters believe that $\theta = 0$ with probability 1, N is the dominant choice. Hence, we need

$$(1 - \alpha^*)\omega < \alpha^*\theta_0 + (1 - \alpha^*)\omega_0, \tag{A3}$$

or $\alpha^* > \frac{\omega - \omega_0}{\omega - \omega_0 + \theta_0}$.

8.4. Proof of Lemma 4

Suppose that the incumbent uses a cutoff strategy in which the cutoff type is higher or equal to $\theta(\alpha^*, \theta_0, \omega_0)$ in an equilibrium. Note that $\alpha^*\theta(\alpha^*, \theta_0, \omega_0) + (1 - \alpha^*)\omega = \alpha^*\theta_0 + (1 - \alpha^*)\omega_0$. Then, when the incumbent chooses Y, it perfectly reveals that his type is at least as good as $\theta(\alpha^*, \theta_0, \omega_0)$. As a result, the voter chooses the incumbent with probability 1 irrespective of the level of spending s. However, then, $\theta < \theta(\alpha^*, \theta_0, \omega_0)$ has an incentive to choose Y pretending his type is higher than $\theta(\alpha^*, \theta_0, \omega_0)$. Thus, such an equilibrium never exists.

8.5. Proof of Proposition 1

Consider the following two cases.

Case 1: $\int v(\alpha^*, \theta, \omega) f_\theta(\theta) d\theta < v(\alpha^*, \theta_0, \omega_0)$.

Note that, in this case, the voter's payoff from selecting the incumbent conditional on N is always lower than $\int v(\alpha^*, \theta, \omega) f_\theta(\theta) d\theta$. Thus, $Q_N(\hat{\theta}; \sigma_{\hat{\theta}}) = 0$ for any $\hat{\theta} \in \Theta$. On the other hand, note that $Q_Y(\hat{\theta}; \sigma_{\hat{\theta}})$ is strictly increasing in $\hat{\theta}$. Moreover, if $\alpha^* > \frac{\omega_0 - \omega}{\omega_0 - \omega + 1 - \theta_0}$, $Q_Y(\hat{\theta}; \sigma_{\hat{\theta}}) > c$ for sufficiently large $\hat{\theta}$. Then, since $Q_Y(\hat{\theta}; \sigma_{\hat{\theta}})$ is continuous and strictly increasing, there exists a unique $\hat{\theta}^*$ such that $F(s(\alpha^*, \sigma_{\hat{\theta}^*})|\hat{\theta}^*) - c = 0$ if and only if $Q_Y(0; \sigma_p) < c$ or equivalently $F(s(\alpha^*, \sigma_p)|0) < c$ where σ_p is the Y-pooling strategy.

To show that the cutoff strategy with $\hat{\theta}^*$, denoted by $\sigma_{\hat{\theta}^*}$, is an equilibrium strategy, note that by Assumption 1, $Q_Y(\theta; \sigma_{\hat{\theta}^*}) - c - Q_N(\theta; \sigma_{\hat{\theta}^*})$ is strictly increasing in θ given the strategy. Thus, given the strategy, any θ has no incentive to deviate. From Lemma 1, since any informative equilibrium is a cutoff equilibrium, this is the only informative equilibrium.

Case 2: $\int v(\alpha^*, \theta, \omega) f_\theta(\theta) d\theta > v(\alpha^*, \theta_0, \omega_0)$

Let $\tilde{\theta}$ be θ' such that $\int_{\theta < \theta'} v(\alpha^*, \theta, \omega) \frac{f_\theta(\theta)}{F_\theta(\theta')} d\theta = v(\alpha^*, \theta_0, \omega_0)$. Obviously, $\tilde{\theta}$ exists in Case 2 and $\alpha^* > \frac{\omega - \omega_0}{\omega - \omega_0 + \theta_0}$. Then, by construction of $\tilde{\theta}$, $Q_N(\hat{\theta}; \sigma_{\hat{\theta}}) = 0$ if $\hat{\theta} \leq \tilde{\theta}$, while $Q_N(\hat{\theta}; \sigma_{\hat{\theta}}) = 1$ if $\hat{\theta} > \tilde{\theta}$. Moreover, observe that, from the definition of $\tilde{\theta}$ and $v(\alpha^*, \theta, \omega)$ is increasing in θ, clearly $v(\alpha^*, \tilde{\theta}, \omega) > v(\alpha^*, \theta_0, \omega_0)$. Thus, when the voter observes Y given the cutoff strategy with $\tilde{\theta}$, it reveals that $\theta > \tilde{\theta}$, thus $Q_Y(\tilde{\theta}; \sigma_{\tilde{\theta}}) = 1$. Moreover, $Q_Y(\hat{\theta}; \sigma_{\hat{\theta}}) = F(s(\alpha^*, \sigma_p)|0)$ at $\hat{\theta} = 0$. Since $Q_Y(\hat{\theta}, \sigma_{\hat{\theta}})$ is continuous and strictly increasing in $\hat{\theta}$ and $c \in (0, 1)$, there exists a unique $\hat{\theta}' < \tilde{\theta}$ such that $Q_Y(\hat{\theta}', \sigma_{\hat{\theta}'}) - c = Q_N(\hat{\theta}', \sigma_{\hat{\theta}'}) = 0$ if and only if $Q_Y(0; \sigma_p) < c$ or equivalently $F(s(\alpha^*, \sigma_p)|0) < c$.

Now, we claim that the cutoff strategy with $\hat{\theta}'$ is an equilibrium strategy. Note that $Q_Y(\theta, \sigma_{\hat{\theta}'}) - c$ is strictly increasing in θ, while $Q_N(\theta, \sigma_{\hat{\theta}'}) = 0$ for all θ. Hence, $Q_Y(\theta, \sigma_{\hat{\theta}'}) > (<) c$ if $\theta > (<) \hat{\theta}'$, that is, any θ has no incentive to deviate.

8.6. Proof of Proposition 2

First, to show (i), suppose the incumbent uses a cutoff strategy $\sigma_{\hat{\theta}}$. Let $s(\alpha^*, \sigma_{\hat{\theta}}; v_0)$ be s such that

$$\int_{\theta > \hat{\theta}} v(\alpha^*, \theta, \omega) \mu(\theta | Y, s; \sigma_{\hat{\theta}}) d\theta = v_0. \tag{A4}$$

Assumption 1 guarantees the existence of such a cutoff signal s. When the challenger gets more popular, the spending level has to be lower to impress the voter. Thus, $s(\alpha^*, \sigma_{\hat{\theta}}; v_0') < s(\alpha^*, \sigma_{\hat{\theta}}; v_0)$ if $v_0' > v_0$. Thus, $F(s(\alpha^*, \sigma_{\hat{\theta}}; v_0')|\hat{\theta}) < F(s(\alpha^*, \sigma_{\hat{\theta}}; v_0)|\hat{\theta})$ for any $\hat{\theta} \in (0, 1)$. Now let $\hat{\theta}_{v_0}$ and $\hat{\theta}_{v_0'}$ be the equilibrium cutoffs given v_0 and v_0' respectively. That is, these are the solutions of $F(s(\alpha^*, \sigma_{\hat{\theta}}; v_0)|\hat{\theta}) = c$ and $F(s(\alpha^*, \sigma_{\hat{\theta}'}; v_0')|\hat{\theta}) = c$ respectively. Then, since $F(s(\alpha^*, \sigma_{\hat{\theta}}; v_0)|\hat{\theta})$ and $F(s(\alpha^*, \sigma_{\hat{\theta}}; v_0')|\hat{\theta})$ are both increasing in $\hat{\theta}$, we obtain $\hat{\theta}_{v_0} < \hat{\theta}_{v_0'}$.

Turning to (ii), to compare the median voter's expected payoffs under v_0 and v_0', consider the following three cases.

Case 1: The incumbent's type is $\theta < \hat{\theta}_{v_0}$.

By the definition of the cutoff strategy, the incumbent's policy choice is $a = N$ under both v_0 and v_0'. From Lemma 4, $\alpha^*\hat{\theta}_{v_0} + (1-\alpha^*)\omega_0 < v_0$ and $\alpha^*\hat{\theta}_{v_0'} + (1-\alpha^*)\omega_0 < v_0'$. Thus, the voter always chooses the challenger if she observes the policy choice of $a = N$. Then, the voter's payoff is higher under v_0'.

Case 2: The incumbent's type is $\theta \in (\hat{\theta}_{v_0}, \hat{\theta}_{v_0'})$.

Given the cutoff strategy, the incumbent's policy choice is $a = N$ under v_0' and the voter chooses the challenger as we explained earlier. Thus, the voter's payoff is v_0' under v_0'. On the other hand, by the definition of the cutoff strategy, the policy choice is $a = Y$ under v_0. Then, the voter's decision depends on the realization of s. If the voter chooses the incumbent, the payoff is $\alpha^*\theta + (1-\alpha^*)\omega_0$ which is strictly lower than v_0' since $\theta < \hat{\theta}_{v_0'}$ and $\alpha^*\hat{\theta}_{v_0'} + (1-\alpha^*)\omega_0 < v_0'$ from Lemma 4. If the voter chooses the challenger, the payoff is v_0 which is also lower than v_0'. Thus, the voter's payoff is higher under v_0' if the incumbent's type is $\theta \in (\hat{\theta}_{v_0}, \hat{\theta}_{v_0'})$

Case 3: The incumbent's type is $\theta > \hat{\theta}_{v_0'}$.

Given the strategy, the policy choice is $a = Y$ under both v_0 and v_0'. Let $s(\alpha^*, \sigma_{\hat{\theta}_{v_0}}; v_0)$ be the voter's optimal cutoff signal under v_0 which is the solution of the following equation with respect to s:

$$\int_{\theta > \hat{\theta}_{v_0}} v(\alpha^*, \theta, \omega)\mu(\theta|Y, s; \sigma_{\hat{\theta}_{v_0}})d\theta = v_0. \tag{A5}$$

Note that Assumption 1 guarantees a unique interior solution of the above equation. Now consider the following hypothetical situation: the voter uses the cutoff signal $s(\alpha^*, \sigma_{\hat{\theta}_{v_0}}; v_0)$ under both v_0 and v_0'. That is, the voter best-responses to (Y, s) under v_0 but it is suboptimal under v_0'. Then, if $s > s(\alpha^*, \sigma_{\hat{\theta}_{v_0}}; v_0)$ and the voter chooses the challenger, the voter's payoff is v_0' under v_0' and v_0 under v_0. Thus, the voter's payoff is higher under v_0'. On the other hand, if $s \leq s(\alpha^*, \sigma_{\hat{\theta}_{v_0}}; v_0)$ and the voter chooses the incumbent, the voter's payoff is $\alpha^*\theta + (1-\alpha^*)\omega_0$ under both v_0 and v_0'. Then, since the probability of having $s > s(\alpha^*, \sigma_{\hat{\theta}_{v_0}}; v_0)$ is always positive in the informative equilibrium, the voter's expected payoff from the response with cutoff signal $s(\alpha^*, \sigma_{\hat{\theta}_{v_0}}; v_0)$ conditional on θ is higher under v_0' if $\theta > \hat{\theta}_{v_0'}$. Now, suppose the voter also best-responses under v_0' instead of the suboptimal response, that is, selecting the incumbent if and only if $s \leq s(\alpha^*, \sigma_{\hat{\theta}_{v_0'}}; v_0')$. Since this is the best response, this improves the voter's payoff under v_0'. Thus, in equilibrium, the voter's expected payoff under v_0' has to be higher than under v_0 if $\theta > \hat{\theta}_{v_0'}$.

Since we showed that the voter's expected payoff is higher under v_0' for any θ, the voter's expected payoff is higher under v_0'.

8.7. Proof of Proposition 3

Consider the N-pooling equilibrium. Let $\hat{\theta}^*$ be the cutoff type in the informative equilibrium. We claim that if voters believe that the set of types who could deviate to Y is $(\hat{\theta}^*, 1]$, this is a credible updating rule. Observe that if $\int_\theta v(\alpha^*, \theta, \omega)f_\theta(\theta)d\theta < v(\alpha^*, \theta_0, \omega_0)$, the incumbent's payoff in the N-pooling equilibrium is 0. On the other hand, by Lemma 2, we know that the expected payoff from N in the cutoff equilibrium is also 0. On the other hand, from the property of $\hat{\theta}^*$ and Assumption 1, the expected payoff from Y if the voter believes that $\theta > \hat{\theta}^*$ is strictly positive. Hence, if the voter believes that $\theta \in (\hat{\theta}^*, 1]$ given Y, the incumbent has incentive to choose Y if and only if $\theta \in (\hat{\theta}^*, 1]$. That is, the N-pooling is not a PSE.

8.8. Proof of Proposition 4

Consider the Y-pooling equilibrium. In this equilibrium, type θ incumbent's expected payoff is $F(s(\alpha, \sigma_p)|\theta) - c$. Suppose that voters believe that the incumbent's type is in Θ when he deviates to N. Then, if $\int v(\alpha^*, \theta, \omega) f_\theta(\theta) d\theta > v(\alpha^*, \theta_0, \omega_0)$, the incumbent's expected payoff is strictly higher for all types since the probability of re-election is 1, while there is no cost from N. Then, if $T = \Theta$, it is profitable for all types to deviate. That is, the updating rule with $T = \Theta$ is credible. Finally, since the expected payoff in the N-pooling equilibrium is the highest possible payoff, this is obviously a PSE. Then, from Corollary 2, the N-pooling is the only PSE if ρ is sufficiently small.

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